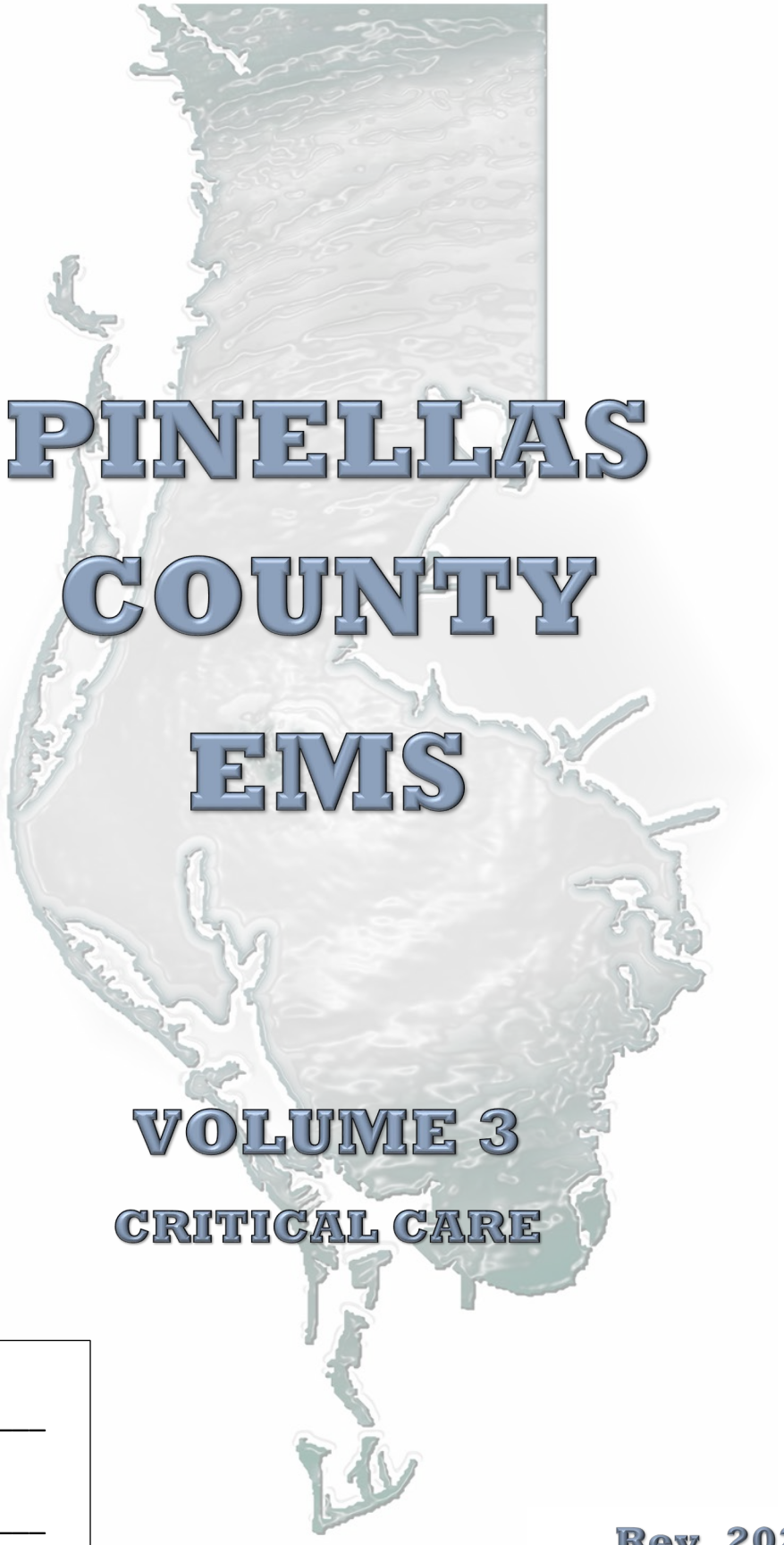
MEDICAL OPERATIONS MANUAL



PINELLAS COUNTY EMS

VOLUME 3

CRITICAL CARE

Issued To:

_____

EMS ID:

_____

Rev. 2024.1

CRISIS RESOURCES

988 Suicide and Crisis Lifeline – DIAL 988 or https://988lifeline.org/talk-to-someone-now/ offers free, confidential crisis counseling 24/7/365 – and you don't have to be in crisis to call or text

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Crisis Text Line also offers free 24/7 mental health support. Text "SCRUBS" to 741741 for help

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NAMI HelpLine can be reached Monday through Friday, 10 a.m. - 10 p.m., ET.
Call 1-800-950-NAMI (6264), text "HelpLine" to 62640 or email us at helpline@nami.org

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Code Green Campaign - https://www.codegreencampaign.org/

Responder Strong - https://responderstrong.org/ We all struggle at times. If you are experiencing any crisis – work-related, substance use, depression, romantic, financial or any other – reach out by texting "BADGE" to 741741

American Addiction Centers or 888-300-3332: Provides first responders and their families with a toll-free, confidential phone line for immediate assistance with issues like substance abuse, stress, relationship problems, work-related concerns, and virtually anything disrupting a member's work life and overall wellness.

IAFF Recovery Center - https://www.iaffrecoverycenter.com/

Last To Ask - https://www.lasttoask.com/

Hero Helpline – DIAL 211 or https://211tampabay.org/programs/hero-helpline/

All Clear Foundation - https://allclearfoundation.org/about/

REVISION HISTORY LOG

Revision Date	Section	Protocol	Revision

FOREWORD

The Sunstar Critical Care Team is a dedicated group of highly trained individuals that transport some of the sickest patients in Pinellas County. This document represents the delegation of specialized medical practices to these clinicians. It is crafted to address common conditions seen during critical care transports. This document provides guidance to the Critical Care Paramedic as well as the full Critical Care team.

In addition to this volume, clinicians are expected to familiarize themselves with all volumes of the Medical Operations Manual as foundational clinical and administrative information from other volumes applies to the Critical Care Team. Additionally, each treatment protocol in this volume is color coded to match the main system Medical Operations Manual and utilizes references to that document when applicable. Individual protocols incorporate sections including CCP, CCT and OLMC recommendations as well as pearls for advancing care. Additionally – photos, flowcharts, and diagrams are utilized when necessary to reinforce stepwise treatments and care plans. This is a living document and updates will be made as necessary and disseminated accordingly.

The instructions in this document provide a generalized framework to address common critical care issues. At no time is it to supersede direct orders from the sending or receiving physicians. The Critical Care Team will operate under the assumption that all sending/receiving clinician recommendations are in the best interest of the patient and tailored to their physiology. The recommendations in this document are to be used to guide changes, adjust therapy as clinical status evolves, and manage new conditions as they arise.

This document cannot cover the myriad of clinical conditions encountered and clinicians are encouraged to contact the On-Line Medical Control physician as needed. As explained in Volume 1 of the Medical Operation Manual – In the absence of specific guidance, clinicians who cultivate a strong foundation of medical knowledge, operate within the framework of this manual, use critical thinking skills, apply the principles of Crew Resource Management, and advocate for their patients will always be supported.

Thank you for your ongoing commitment to training and your dedication to providing excellent care for the sickest patients in Pinellas County. We look forward to continuing to evolve and grow our care as we integrate best medical practices for Sunstar Critical Care Transport.

Andrew Franklin Smith MD
Associate EMS Medical Director
Pinellas County

AUTHORIZATION

These protocols are granted under the authority of Chapter 401 of the Florida Statutes and 64J-1.004 of the Florida Administrative Code.

The EMS Medical Director for the following agencies under the umbrella of Pinellas County Emergency Medical Services shall be the only one authorized to make changes to these protocols.

Provider Name	License Number
Pinellas County EMS DBA Sunstar	ALS5220

Effective Date: June 5, 2024

Dr. Angus M. Jameson

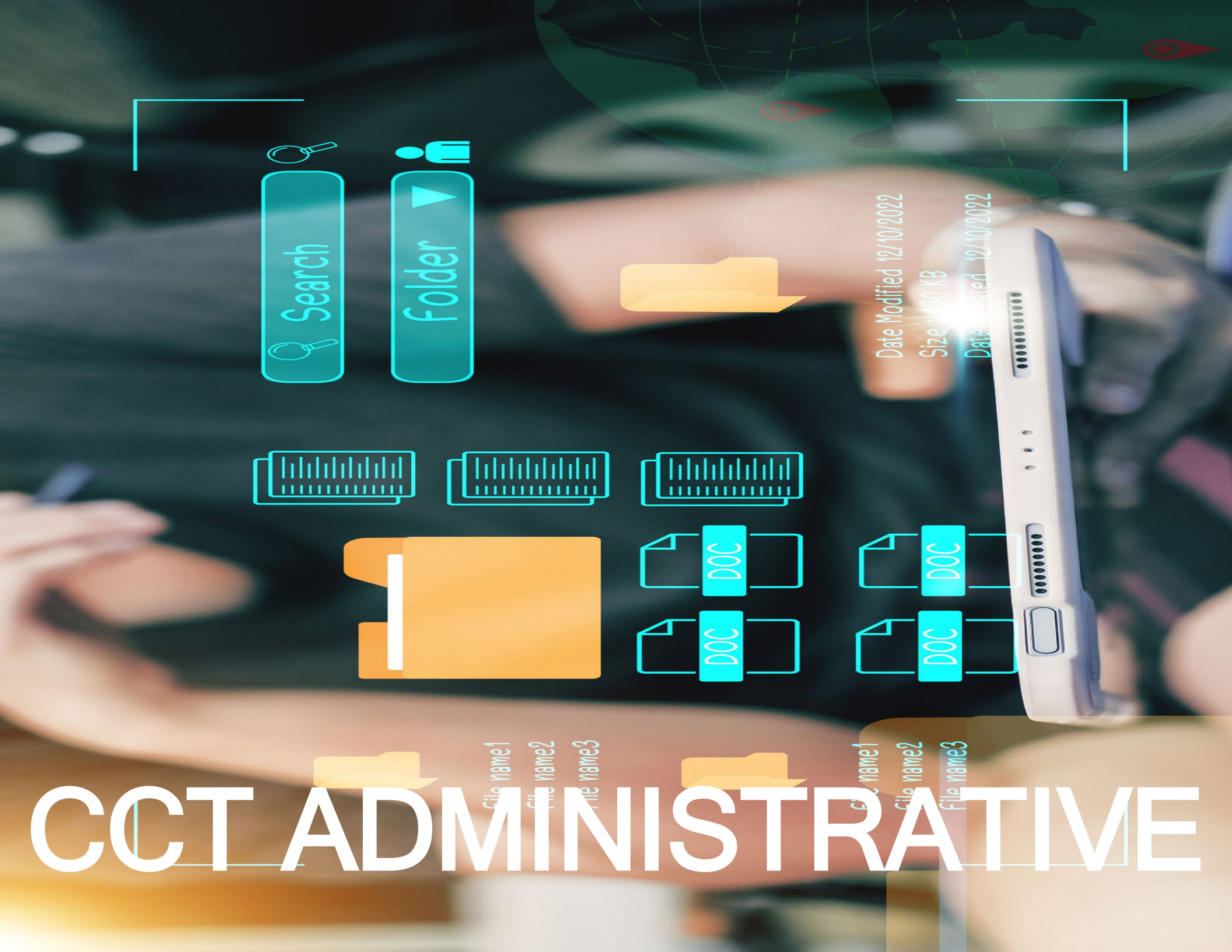
Angus M. Jameson MD MPH FAEMS FACEP
EMS Medical Director

CCT - TABLE OF CONTENTS

CCT - TABLE OF CONTENTS

CCT - TABLE OF CONTENTS

CCT ADMINISTRATIVE



CCT ADMINISTRATIVE

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

The Sapphire Infusion Pump Clinical Configuration is the clinical standard for Critical Care Patient transports. It reflects a standard configuration for **ALL** Sapphire Infusion Pump devices utilized as a component of Critical Care Transports under the auspices of Pinellas County EMS. ***This configuration is not to be altered without prior approval of the EMS Medical Director***.

This pump is only to be used in Continuous Mode. Additional modes are disabled/hidden. The following settings apply to the continuous mode. If any other setting is visible, please contact your administrator.

System Settings	
Parameter	**Setting**
New Patient	Off
Calculate Concentration	On
Prime Reminder	Off
Bolus Reminder	Off
Allow Delayed Start	Off
Automatic Patient Lockout	Off
Medium Titration	On
US Format	On
Screen Saver	On
Backlight	Partially dimmed
Keys Volume	Low
Alarm volume	Maximum
Bolus Handle	Always On
Repeat Last Infusion	On
PreProgram	Off
Single Air Detector*	Off
Accumulated air Detector	0.2 mL
Accumulated Threshold	0.5 mL
Prime Volume**	10 mL

Alarms Settings	
Parameter	**Setting**
Occlusion Units	mmHg
Occlusion Pressure	600 mmHg
Pump Unattended	5 minutes
Infusion Near End	5 minutes
Alarm Volume	Maximum

Mode Options	
Parameter	**Setting**
Allow Bolus Continuous	Off
Advance Bolus Continuous	Off
Bolus Rate Continuous	500 mL/h
Bolus Rate Secondary	125 mL/h
Set Secondary	Off

Hard Limits	
Parameter	**Setting**
VTBI Continuous	9999 mL
Rate Continuous	999 mL/h
VTBI Secondary	9999 mL
Rate Secondary	500 mL/h
Minimum Bolus Lockout	00:01 h:min
Maximum Bolus Lockout	24:00 h:min

* If an infusion is running at a rate of 1-4 mL/h or lower, the single air detector will automatically switch to "On" at 0.5 mL. If an infusion is running at a rate lower than 1 mL/h, the single air detector will automatically switch to 0.1 mL

**When able (such as with macro bore tubing), prime the pump by opening the clamp and allowing gravity to prime the tubing.

Regional (All Modes)	
Parameter	**Setting**
Date	MM/DD/YY
Time	12-hour clock
Language	English
US Format	ON

Reset System: Password
The device password is managed by Pinellas County EMS and Sunstar administration. Distribution of the password is only permitted with prior approval of the EMS Medical Director.

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Set Hard Limits; Mode Specific		
Mode	**Parameter**	**Setting**
Continuous	Primary VTBI (Volume to be Infused)	9999 mL
	Primary Rate	999 mL/h
	Secondary VTBI	9999 mL
	Secondary Rate	500 mL/h

Set KVO	
Mode	**Setting**
Continuous	3 mL/h

Delivery Mode	
Mode	**Visibility**
Continuous	Visible
Intermittent	Hidden
TPN	Hidden
PCA	Hidden
Multi-step	Hidden
Epidural Intermittent	Hidden
PCEA	Hidden

Configurable Units			
Units	**Visibility**	**Units**	**Visibility**
mL/h	Visible	nanog/kg/min	Visible
mL/min	Visible	mmol/h	Visible
mL/kg/h	Visible	mmol/min	Visible
mL/kg/min	Visible	mmol/kg/h	Visible
grams/h	Visible	mmol/kg/min	Visible
grams/min	Visible	Million Units/h	Hidden
grams/kg/h	Visible	Units/h	Visible
grams/kg/min	Visible	Units/min	Visible
mg/h	Visible	Units/kg/h	Visible
mg/min	Visible	Units/kg/min	Visible
mg/kg/h	Visible	mUnits/h	Visible
mg/kg/min	Visible	mUnits/min	Visible
mcg/h	Visible	mUnits/kg/h	Visible
mcg/kg/h	Visible	mUnits/kg/min	Visible
mcg/kg/min	Visible	mEq/h	Visible
nanog/h	Visible	mEq/min	Visible
nanog/min	Visible	mEq/kg/h	Visible
nanog/kg/h	Visible	mEq/kg/min	Visible

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	DOBUTamine		
Displayed Name	DOBUTamine (Dobutrex)	Concentration	500 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.5	40

Generic Name	DOBUTamine		
Displayed Name	DOBUTamine (Dobutrex)	Concentration	1000 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.5	40

Generic Name	DOPamine		
Displayed Name	DOPamine (Intropin)	Concentration	400 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	2	50

Generic Name	DOPamine		
Displayed Name	DOPamine (Intropin)	Concentration	800 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	2	50

Generic Name	EPINEPHrine		
Displayed Name	EPINEPHrine	Concentration	4 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	1	20

Generic Name	EPINEPHrine		
Displayed Name	EPINEPHrine	Concentration	8 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	1	20

Generic Name	IV Fluid		
Displayed Name	IV Fluid 0.9% Sodium Chloride	Concentration	___mL/___mL
RULE	DOSING UNIT	LHL	UHL
Bolus Options	Simple	n/a	n/a
Dose Rate	mL/h	1	999
Bolus Amount	mL	1	999

Generic Name	IV Fluid		
Displayed Name	IV Fluid Lactated Ringers	Concentration	___mL/___mL
RULE	DOSING UNIT	LHL	UHL
Bolus Options	Simple	n/a	n/a
Dose Rate	mL/h	1	999
Bolus Amount	mL	1	999

Generic Name	IV Fluid		
Displayed Name	IV Fluid (3% Saline Wt.)	Concentration	___mL/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mL/kg/h	0.1	1

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	IV Fluid		
Displayed Name	IV Fluid 3% Saline	Concentration	___mL/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mL/h	10	200

Generic Name	LORazepam		
Displayed Name	LORazepam (Ativan)	Concentration	40 mg/40 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	1	10

Generic Name	LORazepam		
Displayed Name	LORazepam (Ativan)	Concentration	50 mg/50 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	1	10

Generic Name	LORazepam		
Displayed Name	LORazepam (Ativan)	Concentration	100 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	1	10

Generic Name	sodium bicarbonate		
Displayed Name	sodium bicarbonate	Concentration	___mEq/1000 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mL/h	1	250

Generic Name	Total Parenteral Nutrition (TPN)		
Displayed Name	Total Parenteral Nutrition (TPN)	Concentration	___mL/___mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mL/h	1	200

Generic Name	tranexamic acid (TXA)		
Displayed Name	tranexamic acid (TXA)	Concentration	1 gram/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	grams/h	0.124	0.125

Generic Name	alteplase		
Displayed Name	alteplase (t-PA)	Concentration	100 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.1	100

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	amiodarone		
Displayed Name	amiodarone	Concentration	360 mg/200 mL

RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	mg/min	0.5	1
Bolus Amount	mg	n/a	150
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	n/a	500
Bolus Time	h:min	0:10	0:11

Generic Name	amiodarone		
Displayed Name	amiodarone	Concentration	450 mg/250 mL

RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	mg/min	0.5	1
Bolus Amount	mg	n/a	150
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	n/a	500
Bolus Time	h:min	0:10	0:11

Generic Name	amiodarone		
Displayed Name	amiodarone	Concentration	900 mg/500 mL

RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	mg/min	0.5	1
Bolus Amount	mg	n/a	150
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	n/a	500
Bolus Time	h:min	0:10	0:11

Generic Name	amiodarone bolus		
Displayed Name	amiodarone bolus	Concentration	150 mg/100 mL

RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	mg/min	n/a	n/a
Bolus Amount	mL	100	n/a
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	600	n/a
Bolus Time	h:min	0:10	0:11

Generic Name	argatroban		
Displayed Name	argatroban	Concentration	250 mg/250 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.5	10

Generic Name	bivalirudin		
Displayed Name	bivalirudin (Angiomax)	Concentration	250 mg/500 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/kg/h	0.25	1.75

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	bivalirudin		
Displayed Name	bivalirudin (Angiomax)	Concentration	250 mg/50 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/kg/h	0.25	1.75

Generic Name	cisatracurium		
Displayed Name	cisatracurium (Nimbex)	Concentration	200 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.5	10

Generic Name	cisatracurium		
Displayed Name	cisatracurium (Nimbex)	Concentration	100 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.5	10

Generic Name	dexmede**TOMID**ine		
Displayed Name	dexmede**TOMID**ine (Precedex)	Concentration	200 mcg/50 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/h	0.1	1.5

Generic Name	dexmede**TOMID**ine		
Displayed Name	dexmede**TOMID**ine (Precedex)	Concentration	400 mcg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/h	0.1	1.5

Generic Name	dil**TIAZ**em		
Displayed Name	dil**TIAZ**em (Cardizem)	Concentration	100 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	2.5	15

Generic Name	dil**TIAZ**em		
Displayed Name	dil**TIAZ**em (Cardizem)	Concentration	125 mg/125 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	2.5	15

Generic Name	esmolol		
Displayed Name	esmolol (Brevibloc)	Concentration	2500 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	50	300

Generic Name	fenta**NYL**		
Displayed Name	fenta**NYL**	Concentration	1000 mcg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/h	1	200

Generic Name	fenta**NYL**		
Displayed Name	fenta**NYL**	Concentration	2000 mcg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/h	2	200

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	fentaNYL		
Displayed Name	fentaNYL	Concentration	2500 mcg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/h	1	200

Generic Name	heparin		
Displayed Name	heparin (Heparin Sodium)	Concentration	25000 Units/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/h	100	1800

Generic Name	heparin		
Displayed Name	heparin (Heparin Sodium)	Concentration	25000 Units/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/h	100	1800

Generic Name	heparin Wt.		
Displayed Name	heparin Wt. (Heparin Sodium Wt.)	Concentration	25000 Units/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/kg/h	10	18

Generic Name	heparin Wt.		
Displayed Name	heparin Wt. (Heparin Sodium Wt.)	Concentration	25000 Units/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/kg/h	10	18

Generic Name	insulin		
Displayed Name	insulin (Regular Insulin)	Concentration	100 Units/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/h	0.1	15

Generic Name	insulin Wt.		
Displayed Name	insulin Wt. (Regular Insulin Wt.)	Concentration	100 Units/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/kg/h	0.01	1

Generic Name	ketamine		
Displayed Name	ketamine (Ketalar)	Concentration	500 mg/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/kg/h	0.1	3

Generic Name	ketamine		
Displayed Name	ketamine (Ketalar)	Concentration	___ mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/kg/h	0.1	3

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	labetalol		
Displayed Name	labetalol	Concentration	200 mg/200 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/min	1	6

Generic Name	labetalol		
Displayed Name	labetalol	Concentration	___mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/kg/h	0.4	3

Generic Name	lidocaine		
Displayed Name	lidocaine (Xylocaine)	Concentration	2000 mg/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/min	1	4

Generic Name	lidocaine		
Displayed Name	lidocaine (Xylocaine)	Concentration	2000 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/min	1	4

Generic Name	magnesium sulfate		
Displayed Name	magnesium sulfate (Mag Sulfate)	Concentration	20 grams/500 mL
RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	grams/h	1	3
Bolus Amount	grams	2	6
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	100	300
Bolus Time	h:min	0:10	0:30

Generic Name	magnesium sulfate		
Displayed Name	magnesium sulfate (Mag Sulfate)	Concentration	40 grams/1000 mL
RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	grams/h	1	3
Bolus Amount	grams	2	6
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	100	300
Bolus Time	h:min	0:10	0:30

Generic Name	magnesium sulfate		
Displayed Name	magnesium sulfate (Mag Sulfate)	Concentration	10 grams/250 mL
RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Dose Rate	grams/h	1	3
Bolus Amount	grams	2	6
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	100	300
Bolus Time	h:min	0:10	0:30

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	mannitol 20%		
Displayed Name	mannitol (Osmitrol)	Concentration	100 grams/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	grams/h	1	199

Generic Name	midazolam		
Displayed Name	midazolam (Versed)	Concentration	100 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.5	20

Generic Name	midazolam		
Displayed Name	midazolam (Versed)	Concentration	50 mg/50 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.5	20

Generic Name	milrinone		
Displayed Name	milrinone (Primacor)	Concentration	20 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.1	0.75

Generic Name	morphine		
Displayed Name	morphine sulfate (Morphine)	Concentration	50 mg/50 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.5	20

Generic Name	morphine		
Displayed Name	morphine sulfate (Morphine)	Concentration	100 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.5	20

Generic Name	narcan		
Displayed Name	narcan (Naloxone)	Concentration	___mg/500 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.1	10

Generic Name	narcan		
Displayed Name	narcan (Naloxone)	Concentration	___mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	0.1	10

Generic Name	niCARdipine		
Displayed Name	niCARdipine (Cardene)	Concentration	20 mg/200 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	1	15

Generic Name	niCARdipine		
Displayed Name	niCARdipine (Cardene)	Concentration	25 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	1	15

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	niCARdipine		
Displayed Name	niCARdipine (Cardene)	Concentration	40 mg/200 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	1	15

Generic Name	nitroglycerin		
Displayed Name	nitroglycerin (Tridil)	Concentration	50 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	2.5	300

Generic Name	nitroglycerin		
Displayed Name	nitroglycerin (Tridil)	Concentration	25 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	2.5	300

Generic Name	nitroglycerin		
Displayed Name	nitroglycerin Wt (Tridil Wt)	Concentration	___mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.05	5

Generic Name	nitroprusside		
Displayed Name	nitroprusside (Nipride)	Concentration	50 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.1	10

Generic Name	norepinephrine Wt.		
Displayed Name	norepinephrine Wt. (Levophed Wt.)	Concentration	4 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.01	3

Generic Name	norepinephrine Wt.		
Displayed Name	norepinephrine Wt. (Levophed Wt.)	Concentration	8 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.01	3

Generic Name	norepinephrine Wt.		
Displayed Name	norepinephrine Wt. (Levophed Wt.)	Concentration	16 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.01	3

Generic Name	norepinephrine Wt.		
Displayed Name	norepinephrine Wt. (Levophed Wt.)	Concentration	___mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.01	3

Generic Name	norepinephrine		
Displayed Name	norepinephrine (Levophed)	Concentration	4 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	0.25	30

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	norepinephrine		
Displayed Name	norepinephrine (Levophed)	Concentration	8 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	0.25	30

Generic Name	norepinephrine		
Displayed Name	norepinephrine (Levophed)	Concentration	16 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	0.25	30

Generic Name	octreotide		
Displayed Name	octreotide (Sandostatin)	Concentration	1000 mcg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/h	25	50

Generic Name	oxytocin		
Displayed Name	oxytocin (Pitocin)	Concentration	___Units/1000 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mUnits/min	2	42

Generic Name	pantoprazole		
Displayed Name	pantoprazole (Protonix)	Concentration	40 mg/50 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	7	8

Generic Name	pantoprazole		
Displayed Name	pantoprazole (Protonix)	Concentration	80 mg/100 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/h	7	8

Generic Name	phenylephrine		
Displayed Name	phenylephrine (Neosynephrine)	Concentration	10 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	50	200

Generic Name	phenylephrine		
Displayed Name	phenylephrine (Neosynephrine)	Concentration	50 mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	50	200

Generic Name	phenylephrine		
Displayed Name	phenylephrine (Neosynephrine)	Concentration	___mg/250 mL
RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/min	50	200

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	potassium chloride		
Displayed Name	potassium chloride (KCL Maintenance)	Concentration	___mEq/1000 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mL/h	1	200

Generic Name	potassium chloride		
Displayed Name	potassium chloride (K Rider Peripheral)	Concentration	___mEq/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mEq/h	1	10

Generic Name	potassium chloride		
Displayed Name	potassium chloride (K Rider Central)	Concentration	___mEq/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mEq/h	1	40

Generic Name	procainamide		
Displayed Name	procainamide (Pronestyl)	Concentration	1000 mg/250 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/min	1	6

Generic Name	procainamide		
Displayed Name	procainamide (Pronestyl)	Concentration	2000 mg/250 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mg/min	1	6

Generic Name	propofol		
Displayed Name	propofol (Diprivan)	Concentration	500 mg/50 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	5	100

Generic Name	propofol		
Displayed Name	propofol (Diprivan)	Concentration	1000 mg/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	5	100

Generic Name	rocuronium		
Displayed Name	rocuronium (Zemuron)	Concentration	100 mg/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	4	16

Generic Name	tirofiban		
Displayed Name	tirofiban (Aggrastat)	Concentration	12.5 mg/250 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.075	0.15

CCT-AD1 SAPPHIRE INFUSION PUMP CONFIGURATION

Generic Name	tranexamic acid		
Displayed Name	tranexamic acid (TXA Bolus)	Concentration	1 gram/100 mL

RULE	DOSING UNIT	LHL	UHL
Bolus Options	Advanced	n/a	n/a
Bolus Amount	mL	99.9	100
Max Bolus Amount	n/a	n/a	n/a
Bolus Rate	mL/h	n/a	600
Bolus Time	h:min	0:10	0:11

Generic Name	vasopressin		
Displayed Name	vasopressin (Vasostrict)	Concentration	40 Units/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/min	0.01	0.1

Generic Name	vasopressin		
Displayed Name	vasopressin (Vasostrict)	Concentration	100 Units/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	Units/min	0.01	0.1

Generic Name	vecuronium		
Displayed Name	vecuronium (Norcuron)	Concentration	100 mg/100 mL

RULE	DOSING UNIT	LHL	UHL
Dose Rate	mcg/kg/min	0.8	1.2


CCT CLINICAL STANDARDS


CCT CLINICAL STANDARDS

CCT- CS1 CRITICAL CARE TEAM (CCT) MEDICAL OPERATIONS MANUAL (MOM)

The CCT Medical Operations Manual (MOM - Volume 3) is used in conjunction with Volumes 1 and 2 of the current Pinellas County Medical Operations Manual (MOM). The operational standards and protocols contained in this volume have been developed to assist clinicians in delivering high quality care but are not meant to be educational or represent the total body of knowledge, judgement, or skill necessary to accomplish this.

Critical Care Team clinicians shall adhere to the protocols set forth in the Pinellas Medical Operations Manuals, Volumes 1, 2, and 3, at all times while providing patient care within the Pinellas County EMS System. Volume 3 will take precedence in the rare case where a treatment protocol or standard in Volume 3 conflicts with a similar protocol or standard found in Volume 1 or 2.

To ensure continuity of care within the larger Pinellas County healthcare system, CCT clinicians may utilize sending and/or receiving physician's written or verbal orders for specific patient care when applicable and authorized in protocol but will otherwise employ these standing protocols and On-Line Medical Control (OLMC) for clinical guidance. The On-Line Medical Control Physician retains ultimate authority for care decisions during transport.

When operating as a full Critical Care Team (composed of an EMT, Paramedic, and RN) all sections of these protocols may be utilized by the Critical Care Paramedic and RN with the EMT supporting within their scope of care. When operating as a sole Critical Care Paramedic Unit (composed of a Paramedic and EMT) a Critical Care Paramedic may utilize all protocol sections up to and including the "CCP" section, but not the "CCT" sections. CCT-CS3 Critical Care Transport Utilization specifies when a patient may be transported by a sole Critical Care Paramedic versus the full team.

CCT- CS2 ONLINE MEDICAL CONTROL

Real-time clinical support is available to CCT clinicians through On-Line Medical Control (OLMC) as it is for all PCEMS clinicians. However, due to the complex nature of a CCT patient, OLMC for CCT is better accomplished via telephone than radio.

CCT clinicians are reminded that they must comply with OLMC contact requirements in PCEMS MOM Volume 1 Protocol CS10 in addition to any requirements in Volume 3. Clinicians are encouraged to initiate early OLMC contact if concerned that they may need emergency orders later in the call to allow time for familiarization, discussion, and planning prior to decompensation or need for urgent intervention.

- CCT Clinicians **MUST** initiate OLMC contact in the following situations:
  - To request a deviation from standard level of care (CCT, CCP, ALS or BLS)
  - A request to abort a transfer due to the patient condition, inability to provide needed interventions enroute, equipment failure, or any other reason that a patient would not be suitable for transport by the CCT
  - When a CCT intervention, procedure or treatment methodology is challenged by hospital staff
  - When a question or concern exists regarding the appropriateness of a sending or receiving physician's orders
  - When diverting to a closer facility
  - Any blood product transfusion reaction

- CCT clinicians **MAY** initiate OLMC contact in the following situations:
  - Anytime medical advice is needed
  - When there is concern that a significant patient deterioration may occur during transport

CCT Clinicians requesting OLMC consult shall initiate contact in the following manner:

- Call Sunstar Communications at (727) 582-2003 and request a telephone consult on a recorded line with the CCT Medical Director
- Sunstar Communications will contact the CCT Medical Director and patch the call through
- If unable to contact the CCT Medical Director, Sunstar Communications shall contact backup physician coverage in the following order:
  - EMS Medical Director
  - Associate EMS Medical Directors
  - OLMC Physician on duty

CCT - CS3 CRITICAL CARE TRANSPORT UTILIZATION

CCT Response Activation

A call for a CCT response may be received from a healthcare facility or other PCEMS unit. If the request is from a healthcare facility, the call taker will follow applicable protocol(s) from PCEMS MOM Volume 2. A request for a CCT field response from a PCEMS unit must come via an OLMC consult as per PCEMS MOM Volume 1 Protocol CS10.

CCT Response Triage

Upon receipt of an EMERGENCY interfacility transfer request, CCT crew shall initiate immediate response (lights and sirens) and once enroute, the CCT RN shall call the sending facility to obtain report and complete the CCT Triage. If the patient is determined to be appropriate for transport by CCP, ALS, or BLS ambulance, CCT may discontinue response in favor of an available more appropriate unit. If appropriate following triage, CCT may downgrade to "As Soon As Possible" or "Scheduled/Routine" response.

Patient Selection Criteria for CCT (Ref. PCEMS MOM Vol. 1 - CT-24):

<table>
<tr><th colspan="5">Advanced Airway Adjuncts</th></tr>
<tr><td>Mechanical ventilator</td><td colspan="2">Continuous positive airway pressure (CPAP/BiPAP/NPPV) device</td><td>Chest Tube</td><td>Tracheostomy Patient with artificial adjunct or complications</td></tr>
<tr><th colspan="5">Invasive Pressure Lines</th></tr>
<tr><td>Arterial line</td><td colspan="2">arterial/venous sheath</td><td>Swan-Ganz catheter</td><td>intracranial pressure line, CVP's, etc.</td></tr>
<tr><th colspan="5">Adjuncts to Support Circulation</th></tr>
<tr><td>Intra-aortic balloon pump (IABP)</td><td>Extracorporeal membrane oxygenation (ECMO)
Note: Facility perfusionist is required to accompany an ECMO patient for transport</td><td>Internal/external cardiac pacing</td><td>Impella device</td><td>Ventricular assist device (VAD)</td></tr>
<tr><th colspan="5">Medicated Intravenous Lines</th></tr>
<tr><td colspan="5">Intravenous access site(s) requiring accurate mechanical dose regulation such as pressors, antianginal, thrombolytics, antidysrhythmic, anticoagulants, tocolytics, paralytic, volume expanders including blood, plasma, platelets, and colloids</td></tr>
<tr><th colspan="5">Trauma Patient</th></tr>
<tr><td colspan="5">Interfacility transfer to a state approved trauma center</td></tr>
</table>

- **continued next page**

CCT - CS3 CRITICAL CARE TRANSPORT UTILIZATION

Patient Selection Criteria for CCT (Ref. PCEMS MOM Vol. 1 - CT-24 (cont.):

<table>
<tr><th colspan="5">Pediatric Patient</th></tr>
<tr><td colspan="5">Unstable conditions, advanced adjuncts or requiring transport to a specialized pediatric receiving facility
A call involving the transfer of a newborn, 28 days or less, or a child weighing five (5) kilograms or less should go to the CCT RN for appropriate triage. This does not automatically result in CC1 performing the transfer. If deemed appropriate by the CCT RN, the resource determination might be an ALS or BLS unit. All transport units have a car seat that can handle a pediatric patient between the weight of 5-10 pounds
Any call resulting in a transfer to a Level 2 or 3 Neonatal Intensive Care Unit (NICU), must be completed by an appropriate NICU team per Florida Statute 401 and Florida Chapter 64J.</td></tr>
<tr><th colspan="5">Obstetric Patient</th></tr>
<tr><td>High Risk</td><td>Premature labor</td><td>Preterm premature rupture of the membranes (PPROM)</td><td>Pre-eclampsia</td><td>Requiring transport to a Regional Perinatal Intensive Care Center or facility with obstetric services
Note: OLMC consultation is required if labor is advanced (greater than six (6) cm), rapidly progressing/continuing to dilate, or imminent delivery</td></tr>
<tr><th colspan="5">Other Patients</th></tr>
<tr><td colspan="5">May have the need for advanced, and/or specialty care, or there is the high potential for deterioration during transport</td></tr>
</table>

CCT - CS3 CRITICAL CARE TRANSPORT UTILIZATION

The following patients may be transported by a Critical Care Paramedic (CCP - 800 Unit) following a thorough patient report and deemed applicable by the on duty CCT RN:

A patient with any of the following adjuncts	
• Ventilator or NIPPV patients who are stable (e.g., at home/baseline settings or no change in settings in **24 hours**)	Ref. CCT-CP1
• Arterial sheath in place (non-monitored)	Ref. CCT-CP8
• Chest tube in place greater than **48 hours** and set to water seal	Ref. CCT-CP13
A patient on any of the following single medication requiring an infusion pump	
• H2 Blockers infusion • Anticoagulant infusion • Antiplatelet infusion • Maintenance fluid infusion on a pediatric patient under the age of 1 year • Nitroglycerin infusion (ONLY - **hemodynamically stable** EMERGENCY STEMI patient) • Total parental nutrition (TPN) • Calcium channel blocker or beta blocker infusion (stable patient, non-titrating dose) • Antibiotic infusion • Proton pump inhibitor infusion • Tissue Plasminogen Activator (TPA) infusion (without concomitant antihypertensive medications)	
Patient with a valid out of hospital DNR and who is receiving end-of-life care	

• Including adjuncts/support outside standard ALS system protocols or a non-titrating infusion of any single one of the following medications:
  ○ Vasopressor
  ○ Benzodiazepine
  ○ Opioid	

CCT-CS4 STANDARDIZED CRITICAL CARE TEAM (CCT) RESPONSE GEAR AND EQUIPMENT INVENTORY

Required Medical Equipment

This protocol defines the required medical equipment and supplies for the Critical Care Team response units (primary, backup, and CCP) in the Pinellas County EMS System in accordance with Florida rules and state approved local substitutions (Ref. MOM Vol. 2 Protocol AD15). Where equipment has local configuration options, those are established separately in administrative protocol (Ref. CCT-AD1 & MOM Vol. 2 Protocols AD16, AD16.1, AD16.2)

Standardization of Equipment

The CCT units shall utilize PCEMS issued standardized medical bags and inventories to promote patient safety

Unauthorized Equipment

Patient care items (medical devices, medical supplies, pharmaceuticals, monitors, defibrillators, or any other equipment, etc.) may not be carried or employed by Certified Professionals in the Pinellas County EMS System while on duty unless specifically authorized in this protocol

Required Equipment by Unit Type

	CCT Unit - Primary	CCT Unit - Backup	CCP Unit
ALS Airway	✓	✓	✓
Trauma	✓	✓	✓
Medical	✓	✓	✓
Handtevy	✓	✓	✓
Suction	✓	✓	✓
PPE	✓	✓	✓
Documentation	✓	✓	✓
Supplies	✓	✓	✓

CCT – CS5 TEMPERATURE CONTROL – MEDICATION AND SENSITIVE EQUPMENT

This standard establishes guidelines to ensure environmentally sensitive medication, equipment or supplies are appropriately stored and protected from potentially harmful temperatures:

- A list of temperature sensitive pharmaceuticals shall be maintained and stored with medical reference materials on the CCT unit
- Temperature sensitive pharmaceuticals requiring refrigeration will be stored in the vehicle refrigerator
- Non-refrigerated pharmaceuticals will be stored at 59° - 77° F in the temperature-controlled compartment of the vehicle
- Refrigerator temperature will be maintained between 35.6° – 46.4° F (2°- 8° C)
- Refrigerator temperatures will be verified and recorded at least once each shift
- Refrigerator will be locked anytime it contains controlled substances
- When operating in a CCT specific backup unit or regular system ALS vehicle all temperature sensitive pharmaceuticals will be removed and stored in the temperature-controlled compartment of the ALS vehicle.
- Temperature excursions are defined as:
    - Exposure to temperatures outside manufacturer specifications for greater than 24 hrs.
    - Any exposure to extreme temperatures
    - Lack of refrigeration for longer than manufacturers recommended time frame (e.g., 30 days for diltiazem)
- Pharmaceuticals subject to temperature excursions shall be returned to EMS Central Supply or Controlled Substance Central Supply as required for accounting and destruction

CCT-CS6 SAPPHIRE INFUSION PUMP TUBING SELECTION

The Sapphire Infusion Pump is equipped to handle both “Full Set” (AP409-01/12005-000-0003) Primary tubing which includes a spike for accessing medication containers and “Half Set” (AP416-01/12003-000-0012) tubing which does not. Selection of appropriate tubing is important to ensure the safe and accurate administration of a medication.

Full Set:

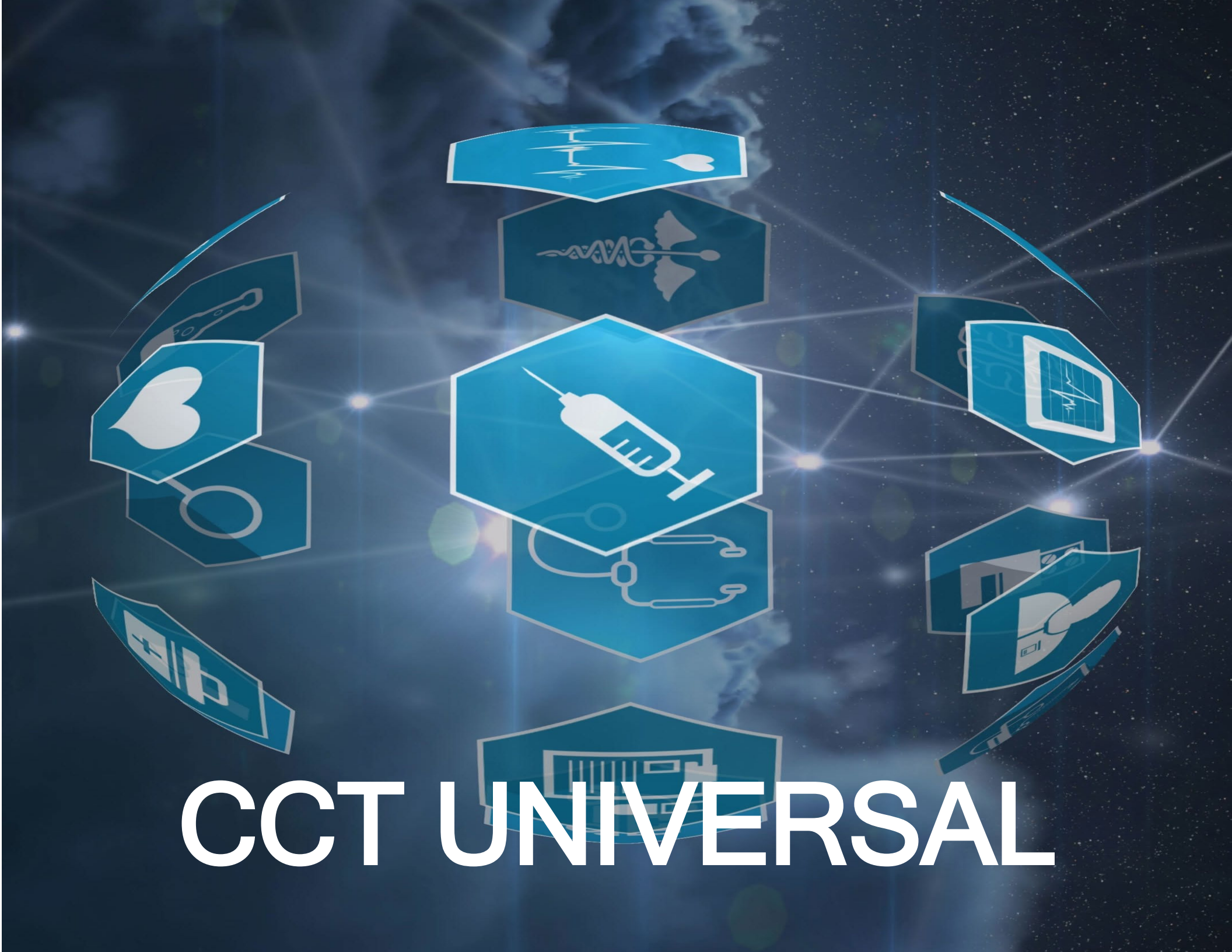
- Full set tubing shall be used as the default tubing for all fluids and medications administered with the Sapphire Infusion pump

Half Set:

- Half set tubing may be used instead of Full Set tubing in the following situations:
  - When there is a small volume (less than or equal to 100 mL) of medication left to be infused upon arrival to patient (e.g., patient has already received most of the medication and small volume is remaining prior to transport)
  - When assuming care during an ongoing infusion of a medication where switching to a Full Set would result in loss of medication (e.g., in the discarded tubing) causing significant alteration of intended dosing or when re-spiking a medication bag or bottle is not possible. Examples include but are not limited to:
    - TPA
    - Propofol
    - Dexmedetomidine
    - Antibiotics – when remaining volume is less than or equal to 100 mL
  - When authorized via specific OLMC order

Reference:

- https://eitanmedical.com/


CCT UNIVERSAL


CCT UNIVERSAL

CCT-U1 UNIVERSAL APPROACH TO PATIENT CARE

	GOALS OF CARE
ADULT and PEDIATRIC	• Treat every patient with courtesy and respect, with appreciation of his or her individual dignity and with protection of his or her need for privacy • Provide every patient with a professional, complete, and accurate assessment, all indicated treatment to your certification level, and transport to an appropriate facility • Maintain a high level of suspicion for injury or illness • Provide expert critical care treatment in support of the needs of a complex interfacility transfer patient • Augment system capabilities by bringing higher level interventions to selected field responses

CCP

When acting independently on a CCP unit, CCP's shall provide all applicable CCP level care in CCT-U1 Universal Approach to Patient Care protocol and all other appropriate treatment protocols and clinical standards. When acting as part of the full CCT crew, CCPs may provide all interventions in the CCP and CCT sections of the protocols.

General Considerations:

- Ensure scene safety and employ "universal precautions" on every patient
- Ensure receipt of verbal report and confirm the identity of the patient via wrist band prior to interfacility transfer
- Bring all required equipment to the patient's bedside
- Perform initial assessment of the patient and transfer the patient to the CCT cardiac monitor, IV pump(s) and/or other equipment as indicated prior to moving the patient
- Transfer and secure the patient to the stretcher utilizing weight/size appropriate restraints and/or immobilization devices (Ref. PCEMS MOM Vol. 1 – CP24) for transport if applicable.
- Secure all equipment properly for transport to ensure patient safety
- Ensure continuous monitoring and re-assessment of the patient and minimize time off support devices until care transferred to receiving facility
- Assure that transfer paperwork is complete and review for the following:
  - Consent to transfer
  - Complete Physician Certification Statement
  - Face sheet with patient demographics and billing information
  - Past medical history
  - Medication list
  - Copies of pertinent diagnostic tests (radiology results, labs, interventions, etc.)
- Confirm any specific physician orders for transport ensuring treatment plan is appropriate to unit type and that the transferring facility can provide any medications not carried by CCT unit.

Patient Assessment:

- All patients transported by a CCP or CCT unit will receive a full assessment including all organ systems and complete vital signs

CCT-U1 UNIVERSAL APPROACH TO PATIENT CARE

CCP (cont.)

Patient Assessment (cont.):

- Vital signs shall be continuously monitored and documented at least every 15 minutes and more frequently as warranted by clinical condition

  Note: During long distance transports (greater than two [2] hrs.) of stable patients, vital signs frequency may be reduced to every 30 minutes

- Utilize the Handtevy pediatric length-based tape for age/weight estimation, confirmation of care giver provided age/weight information, and determination of appropriate equipment sizing and medication dosing of a pediatric patient
- Utilize the Pediatric Assessment Triangle (PAT) to assess a pediatric patient (Ref. PCEMS MOM CT20)

Treatment:

- A patient with an advanced airway shall have continuous EtCO2 waveform capnography and SpO2 monitoring
- A patient receiving opiates, opioids, ketamine, benzodiazepine or any other medication expected to depress respiratory drive will be placed on continuous SpO2 and EtCO2
- Administer oxygen as needed via the most appropriate device based on the clinical scenario (e.g., nasal cannula, non-rebreather mask, trach collar, etc.) for goal SpO2 greater than 94%
- Provide ventilatory assistance (BVM and airway adjunct) as needed (Ref. CCT-CP1, CCT-CP2, CCT-CP4 except RSI, CCT-CP5, and CCT-CP6) and support ventilation and oxygenation with goals appropriate to patient condition (Ref. CCT-T2)
- Position patient in a way that may improve respiratory status or decrease work of breathing (e.g., semi-fowlers or high-fowlers position)
    - If patient presents in respiratory distress or develops inadequate respirations, provide positive pressure ventilation with high flow oxygen and the use of any of the following methods as needed:
        - Head-tilt chin lift if no cervical trauma present or suspected
        - Modified jaw thrust if cervical trauma is present or suspected
        - Insert basic airway adjunct (OPA/NPA)
        - Use BVM as necessary (two-person technique preferred)
- All patients, except for those being transported to a lower level of care facility such as residence or skilled nursing facility, shall have vascular access
- Medications (including fluids) initiated by the sending facility may be titrated according to the patient's condition per protocol and/or physician's orders

  Note: When no specific orders are provided by the transferring or receiving physician, default to dosing listed in protocol

CCT-U1 UNIVERSAL APPROACH TO PATIENT CARE

CCP (cont.)

- Treat specific conditions as indicated in the appropriate protocol

  Note: *if a pediatric specific protocol does not exist, implement the appropriate adult protocol*

Documentation:

- Complete appropriate and accurate patient care documentation per standard PCEMS protocols (Ref. PCEMS MOM CS7, CS9)
- In addition, the following items must be documented:
  - Patient weight
  - Sending and receiving physician
  - Admission date
  - Diagnosis and reason for transport
  - Indication/criteria for CCT or CCP
  - Vascular access sites, medications with mixture and dosage
  - Interventions, invasive pressures with sites and condition
  - Any other patient adjuncts
- Additional documentation as required by protocol or Medical Control Directive

CCT

Certified RNs and Critical Care Paramedics as part of the patient care team, shall ensure completion of all CCP and CCT level care in all appropriate treatment protocols and clinical standards in this volume

- **Patient Report/Triage:**
  - Contact sending facility staff to receive full report and triage according to CCT-CS3
  - Ensure appropriate additional resources/staff (e.g., perfusionist) are available to accompany patient as indicated
  - Discuss any and all team questions with sending facility staff
  - Discuss any treatment or plan of care concerns including requested medications not carried by CCT or interventions not within scope of CCT with sending physician and OLMC prior to departing facility
- **Patient Assessment**
  - Ensure appropriate placement and monitoring of invasive lines
  - Confirm placement of core temperature monitoring when indicated
  - Electronic fetal monitoring shall be initiated at the sending facility bedside for a patient greater than 24 weeks gestation and must be continued until transfer of care is completed at receiving facility

OLMC

- Consult Online Medical Control Physician as needed or required (Ref. CCT-CS2)

CCT-U1 UNIVERSAL APPROACH TO PATIENT CARE

PEARLS

S A F E T Y A L E R T

RESPONDER SAFETY IS PARAMOUNT

- Always maintain situational awareness
- Consider need for enhanced PPE (e.g., eye protection, N95, ballistic gear, etc.)
- It is NOT considered patient abandonment to back out of a dangerous scene
- Utilize the principles of Stress First Aid to support your fellow responders

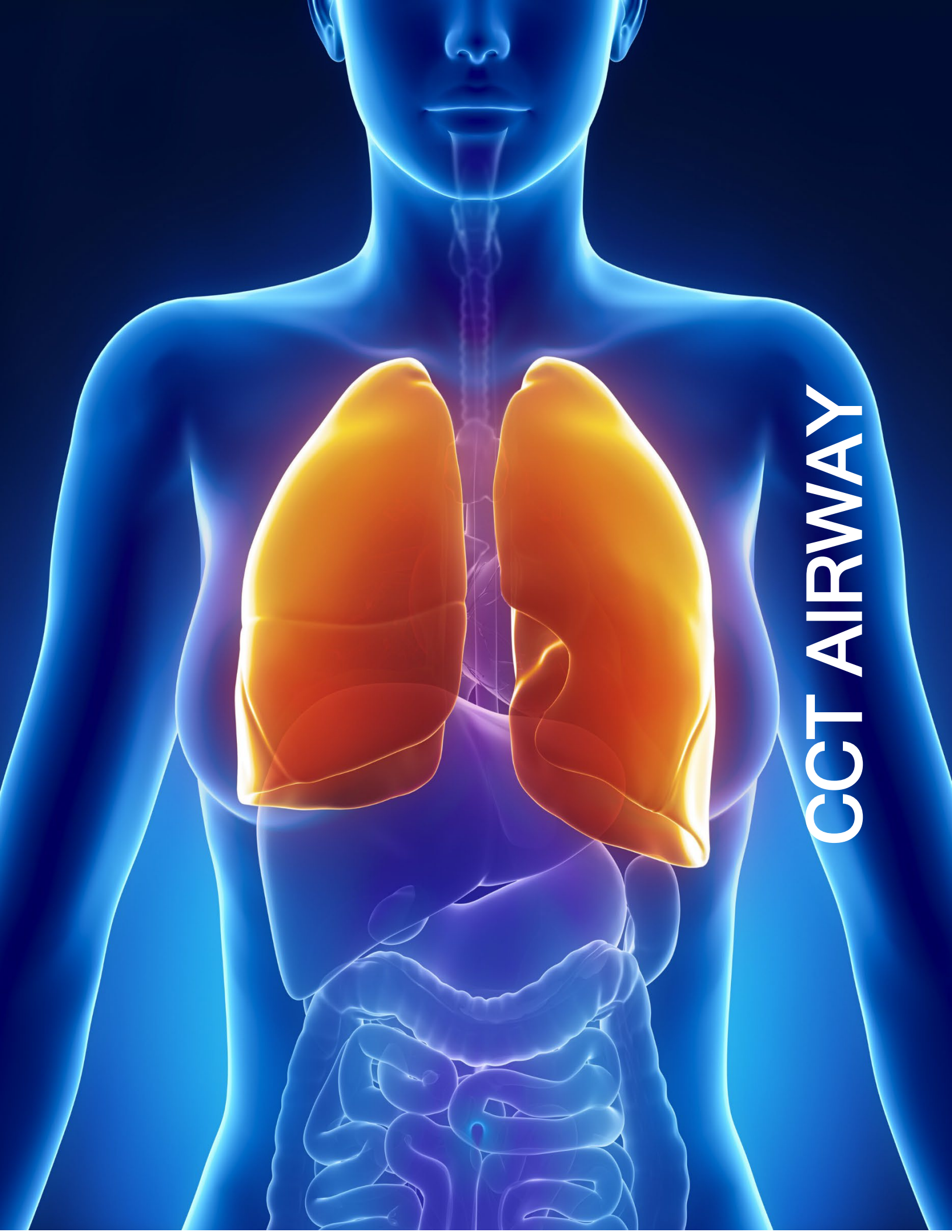
IF YOU SEE SOMETHING, SAY SOMETHING

QUALITY MEASURES

- CCT calls reviewed regularly for quality assurance.

REFERENCES

- None


CCT AIRWAY


CCT AIRWAY

CCT - A1 TRACHEOSTOMY EMERGENCY

ADULT and PEDIATRIC	GOALS OF CARE
	To ensure airway patency, oxygenation, and ventilation of a patient who is tracheostomy dependent

CCP

- Assess respiratory status
- If ventilator-dependent patient is in respiratory distress troubleshoot using DOPE mnemonic (**D**isplacement, **O**bstruction, **P**neumothorax, **E**quipment)
- If suspected tracheostomy obstruction, perform sterile suction as needed:
  - Instill 1-3 mL 0.9% sodium chloride or sterile water into tracheostomy tube
  - Suction tracheostomy tube
- If unable to clear obstruction, assist caretaker with removal and replacement of the tube
- If replacement tube is unavailable or unable to be inserted, and the patient is unable to be ventilated, may remove tube, and insert an endotracheal tube half a size smaller into the stoma and assist ventilations. Tube will need to be manually secured until arrival at hospital
  - If unable to insert an endotracheal tube, ventilate with bag-valve-mask (BVM) over stoma or over patient's mouth while covering the stoma
- Refer to CCT-CT10 Tracheostomy Troubleshooting as necessary

CCT

- Evaluate type of tracheostomy tube to determine if inner cannula is present, re-usable, or disposable.
- If cleaning or changing inner cannula does not clear obstruction, replace tracheostomy tube
  - If tracheostomy is **less than** 7 days old, do NOT attempt to replace due to risk of forming a false tract.
  - Instead, perform supraglottic airway or endotracheal intubation.
- Follow CCT – CP3 for tracheostomy change

OLMC

- Consult OLMC Physician as needed

PEARLS

- Signs of obstruction: increased respiratory rate, heart rate, blood pressure; decreased SpO2; use of accessory muscles; labored breathing; excess secretions; no chest wall movement; distress, anxiety, restlessness
- Potential complications: hemorrhage, subcutaneous emphysema, pneumothorax, infection, aspiration, tracheal damage, tube displacement

QUALITY MEASURES

- Calls reviewed regularly

CCT - A1 TRACHEOSTOMY EMERGENCY

REFERENCES
• https://nasemso.org/projects/model-ems-clinical-guidelines/

CCT - A2 RESPIRATORY FAILURE

ADULT and PEDIATRIC	GOALS OF CARE
	Recognition and management of a patient with respiratory distress and/or failure during transport

CCP

- Assess work of breathing, level of distress, and vital signs including SpO2 and EtCO2 to determine if patient in respiratory distress or respiratory failure
- Administer supplemental oxygen as required to maintain SpO2 greater than 94%
- Assist ventilations as needed to maintain EtCO2 35-45 mmHg or 30-35 mmHg if concern for increasing ICP (Ref. CCT-T2)
- Suction as needed
- Troubleshoot other adjuncts that may be causing respiratory distress/failure:
  - Ventilator (Ref. CCT-CT1)
  - Tracheostomy (Ref. CCT- A1)
  - Chest tube (Ref. CCT-CP13)
- Perform airway management as needed (Ref. PCEMS MOM Vol. 1 - CP1, CP2, CP3, CP4)
- Initiate positive pressure ventilation as needed (Ref. CCT-CP4 & PCEMS MOM Vol. 1 - CP6)
- Assess and treat underlying causes as appropriate:
  - Asthma/COPD (Ref. PCEMS MOM Vol. 1 - A2)
  - CHF/Pulmonary Edema (Ref. PCEMS MOM Vol. 1 - C7)

CCT

- Perform RSI as needed (Ref. CCT-CP1.3 adult & CCP-CP2.2 pediatric)
- Assess and treat underlying causes as appropriate:
  - If CHF/pulmonary edema, consider the addition of nitroglycerin drip (Ref. CCT-C1)
  - Troubleshoot other adjuncts that may be causing respiratory distress/failure
    - Impella device (Ref CCT-CP10) or IABP (CCT-CP11)
    - Transvenous pacer (Ref CCT-CP12)
    - Others
  - Consider other secondary causes such as increasing ICP, amniotic fluid embolism, neuromuscular disease crisis, adrenal insufficiency, and medication reactions/overdose, infection, cystic fibrosis

OLMC

- Consult OLMC Physician as needed

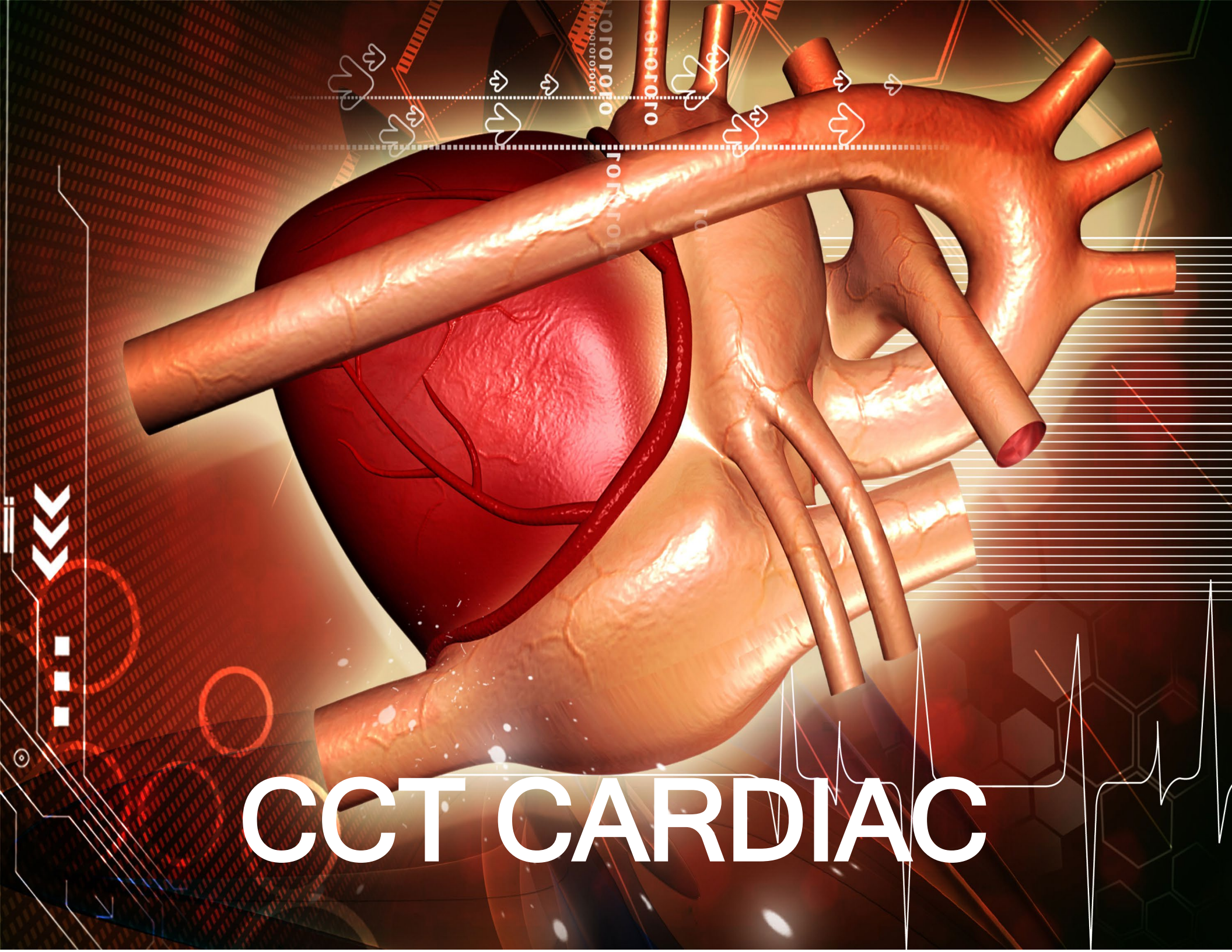
PEARLS

- Maintain a high index of suspicion and watch for signs and symptoms of developing pneumothorax (e.g., worsening respiratory distress, high peak pressures, hypoxia, hemodynamic compromise) when employing positive pressure ventilation.

CCT - A2 RESPIRATORY FAILURE

QUALITY MEASURES
• CCT calls reviewed at regular intervals

REFERENCES
• https://litfl.com/respiratory-distress-in-tracheostomy-patient/


CCT CARDIAC

CCT CARDIAC

CCT - C1 ACUTE CORONARY SYNDROME

ADULT and PEDIATRIC	GOALS OF CARE
	Minimize ischemic progression and myocardial damage while managing hemodynamic instability, and cardiac dysrhythmias

CCP

- Ensure continuous cardiac monitoring and vascular access
- Discuss treatment strategy and medications with sending physician
- Ensure aspirin or other antiplatelet has been administered prior to transfer. If not administered, document reason from sending physician
- Obtain serial 12 lead ECGs to monitor for progression of ischemia.
  - Treat pain as necessary (Ref. CCT-M1 & PCEMS MOM Vol. 1 - M13)
  - Hemodynamic support
  - Fluids: if hypotension occurs (MAP less than 65 mmHg), administer 0.9% sodium chloride or lactated ringers, 500 mL boluses to max of 2L, assessing for signs of fluid overload after each 500 mL
- EMERGENCY STEMI Transfer via CCP Unit may continue any **SINGLE** one of the following medications (one [1] drip max) enroute:
  - Coronary vasodilator:
    - Nitroglycerin Infusion:
      - Maintain infusion rate per sending physician
      - Discontinue if MAP less than 65 mmHg or concern for hemodynamic instability
  - Anticoagulants:
    - Anticoagulant/antiplatelet Infusion:
      - Continue at rate set per sending physician
      - Discontinue if visible external hemorrhage or suspected ICH

CCT

- Coronary vasodilator:
  - Nitroglycerin infusion:
    - If pain/anginal equivalent not improved or worsening, initiate nitroglycerin infusion at 10 mcg/min if not already running and increase rate by 5 mcg/min every 2-3 minutes until pain improves
    - Maximum rate 200 mcg/min
    - If signs of hemodynamic instability - decrease rate or discontinue if MAP less than 65 mmHg and initiate hemodynamic support (Ref. CCT-M5)
- Opioids:
  - Consider fentanyl or morphine for pain management as needed (Ref. CCT-M1)
- Pressors:
  - Continue sending facility pressors and titrate to MAP greater than or equal to 65 mmHg unless given alternate parameters by sending/receiving physician
  - If not initiated prior to transport, initiate pressor support as needed (Ref. CCT-M5)

CCT - C1 ACUTE CORONARY SYNDROME

CCT (cont.)

- Mechanical Circulatory Support
  - Impella – Ref. CCT-CP10
  - Intra-Aortic Balloon Pump – Ref. CCT-CP11
  - ECMO – **Ensure facility perfusionist is accompanying the patient and device**
    - Document the following for all ECMO transports:
      - Cannulating physician name
      - Accompanying Perfusionist name
      - Type of ECMO (V-V or V-A)
      - Cannulation site
      - Venous catheter size
      - Arterial catheter size
      - Distal circulation of cannulated extremity
      - ECMO flow rate
      - Revolutions Per Minute (RPMs)
      - Sweep value
      - Cannulation insertion site
  - LVAD – Ref. PCEMS MOM Vol. 1 - CP26
    - Sunstar communications has additional resources for LVAD care and contact information for the appropriate 24-hour emergency LVAD center. **Ensure early contact with LVAD coordinators to help guide care**.

OLMC

- Consult OLMC Physician as needed

PEARLS

- Use of nitroglycerin is contraindicated in a patient that has received erectile dysfunction medications in the last 12-48 hours (for a list of medications, Ref. PCEMS MOM Vol. 1 - C3)
- Nitroglycerin provides comfort but does not affect mortality
- In the presence of an inferior wall MI, nitrate therapy should proceed with caution as these patients are preload dependent (which may be compromised by nitroglycerin's vasodilatory effects). Consider performing a right sided ECG to evaluate for inferior involvement if not already performed. **DO NOT** administer nitroglycerin if patient has low or borderline blood pressure and concern for right sided MI

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- https://nasemso.org/projects/model-ems-clinical-guidelines/
- Abiomed - https://www.heartrecovery.com/education/education-library
- http://icuecmo.ca/index.htm
- https://www.elso.org/ecmo-resources/elso-ecmo-guidelines.aspx

CCT - C2 AORTIC EMERGENCY

ADULT and PEDIATRIC	GOALS OF CARE
	Control blood pressure and heart rate to prevent progression of aortic pathology while ensuring adequate peripheral perfusion.

CCP

- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- Apply supplemental O2 as necessary to maintain SpO2 equal to or greater than 94%
- Provide pain control as indicated (Ref. CCT-M1)

CCT

BLOOD PRESSURE GOALS IN AORTIC EMERGENCIES

Condition	Goal SBP	Heart Rate Goal
Dissection or Unruptured Aneurysm	90-120 mmHg	less than 60 BPM (Goal 50 - 60)
Confirmed or Suspected Ruptured Aneurysm	80-120 mmHg	less than 60 BPM (Goal 50 - 60)

Maintain lowest SBP and heart rate that provides adequate peripheral perfusion but NOT LESS than 80 mmHg

- Utilize the above blood pressure goals unless alternate specific goals have been provided by the sending and receiving physicians
- Discuss anticipated need for blood products from sending physician and obtain needed products from sending facility
- Utilize intra-arterial blood pressure monitoring, if available, to guide therapy (Ref. CCT-CP8). Intra-arterial monitoring is preferred.
- Initiate hemodynamic management as follows:
  - If SBP is above the set goal, initiate nicardipine infusion at 5 mg/hr and increase by 2.5 mg/hr every 15 minutes to a maximum of 15 mg/hr
  - If nicardipine is unavailable or contraindicated, administer labetalol 20 mg slow intravenous push over two (2) minutes. Repeat every 15 minutes, as needed, to a maximum dose of 300 mg to achieve SBP goals.
  - If prolonged transport, contact OLMC if increased doses or additional doses of medications if still not at SBP goal
- If heart rate remains above the target heart rate (and unless contraindicated) administer labetalol 20 mg slow intravenous push over 2 minutes. Repeat every 15 minutes, as needed, to a maximum dose of 300 mg to achieve HR goals.
  - Closely monitor the blood pressure when using labetalol along with nicardipine

CCT - C2 AORTIC EMERGENCY

CCT (cont.)

- If tachycardia remains, consider use of esmolol from sending facility, as follows, with escalating dose every 4 minutes until goals are achieved:
  - 1mg/kg (max dose 80 mg) + Initiate infusion at 150 mcg/kg/min
  - 1mg/kg (max dose 80 mg) + Initiate infusion at 200 mcg/kg/min
  - 1mg/kg (max dose 80 mg) + Initiate infusion at 250 mcg/kg/min
  - 1mg/kg (max dose 80 mg) + Initiate infusion at 300 mcg/kg/min
- Treat pain, anxiety/agitation as needed per CCT- M1 and CCT-M2
- If MAP less than 60 (or SBP less than 80 mmHg):
  - Administer 0.9% sodium chloride 250 mL bolus
  - Repeat as needed to goal of MAP greater than 60 (or SBP greater than 80 mmHg unless evidence of volume overload
- Initiate blood as indicated (Ref. CCT-CP14)
- If blood pressure is fluid unresponsive after 2000 mL or patient continues to decompensate, initiate norepinephrine infusion at 1 mcg/min and titrate to SBP 80 mmHg, max. dose 10 mcg/min

OLMC

- Consult OLMC if sending facility not providing blood products for transport greater than one (1) hour
- Consult OLMC Physician as needed

PEARLS

- If titrating esmolol, a bolus must be given with each increase in infusion or there will be no effect of the medication.
- Allow for permissive hypotension with aortic emergencies.
- Pain control is critical as this will likely lessen HR and SBP
- When titrating medications for blood pressure control, monitor for reflex tachycardia and need for additional medication.

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- https://www.ahajournals.org/doi/abs/10.1161/cir.0b013e3181d4739e
- Suzuki T, Eagle KA, Bossone E, Ballotta A, Froehlich JB, Isselbacher EM. Medical management in type B aortic dissection. Ann Cardiothorac Surg. 2014 Jul;3(4):413-7. doi: 10.3978/j.issn.2225-319X.2014.07.01. PMID: 25133106; PMCID: PMC4128933

CCT - C3 POST CARDIAC ARREST CARE

ADULT and PEDIATRIC	GOALS OF CARE
	Aggressively manage post-arrest cardiogenic shock to optimize cardiopulmonary function, maintain vital organ perfusion, and mitigate underlying causes

CCP

- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- Ensure continuous cardiac monitoring and perform serial 12-lead ECGs to monitor for development of cardiac dysrhythmias and/or ischemic progression
- Treat dysrhythmias per sending physician orders or in absence of specific orders per PCEMS MOM Vol. 1 - C4 & C5
- Apply supplemental oxygen as required to maintain SpO2 greater than 94%
- Maintain goal MAP greater than 65 mmHg (SBP greater than 90 mmHg)

CCT

- Respiratory Support
  - Ensure adequate oxygenation
  - If intubated, maintain EtCO2 of 35-40 mmHg unless instructed by sending physician

- Hemodynamic Support
  - If hypotensive, consider IV fluid boluses:
    - Assess for signs of volume overload prior to fluid bolus
    - Lactated ringers 20 mL/kg boluses up to 2,000 mL
  - If unresponsive to fluids, initiate/titrate vasopressor therapy:
    - Push dose pressors (Ref. PCEMS MOM Vol. 1 - CT26)
    - Norepinephrine infusion (Ref. CCT-M5)
    - If ineffective, consider additional pressor agents per CCT-M5

- Temperature:
  - If targeted temperature management (TTM) has been initiated, determine if it is to be continued for transport and by what methods (e.g., fluids, Artic Sun, etc.)
    - Sending facility must supply temperature management device for transport
  - If TTM in place, confirm facility placement or place esophageal temperature probe (Ref. CCT-CP21) and record patient temperature and therapeutic temperature goal
    - Goal is 32°-36° Celsius (89.6° - 96.8° Fahrenheit) unless directed by sending/receiving physician.
- Manage underlying etiology as appropriate:
  - Initiate or continue management of acute coronary syndrome/cardiac ischemia (Ref. CCT-C1)
  - Trauma – maintain hemodynamic support, address reversible causes as indicated (e.g., relief of pneumothorax) (Ref. CCT-T1 through CCT-T3)
  - Continue other specific managements as indicated/ordered

CCT - C3 POST CARDIAC ARREST CARE

CCT (cont.)
• Sedation/Pain management: ○ Titrate sedation and pain management cautiously in hypotensive patients (Ref. CCT-M1 & CCT-M3)

OLMC
• Consult OLMC Physician as needed

PEARLS
• Pending

QUALITY MEASURES
• Calls reviewed regularly

REFERENCES
• https://cpr.heart.org/-/media/cpr-files/cpr-guidelines-files/highlights/hghlghts_2020_ecc_guidelines_english.pdf


HEDICAL


HEDICAL

CCT - M1 PAIN MANAGEMENT

ADULT and PEDIATRIC	GOALS OF CARE
	Provide safe and effective pain management to a patient while minimizing risk and adverse side effects

CCP

- Refer to PCEMS MOM Vol. 1 - M13 Acute Pain Management as clinically indicated
- A patient with a valid Florida DNRO who is undergoing END OF LIFE TRANSPORT via a CCP Unit may continue a SINGLE comfort infusion initiated by the sending facility (Ref. CCT-CS3 & PCEMS MOM Vol. 1 – CS16):
  - Continue opioid or benzodiazepine infusion at sending facility rate
  - If need for titration, consult OLMC

CCT

Bolus Dosing

MORPHINE

- Adult:
  - 0.1 mg/kg IV administered over 30-60 seconds
    - May give additional 0.05-0.1 mg/kg every 5 mins. as needed until pain is tolerable to maximum total combined dose of 20 mg
  - Use smaller doses with elderly and use extreme caution with a hypotensive patient
- Pediatric – Refer to PCEMS Handtevy Medication and Equipment Guidebook for dosing

PAIN-DOSE KETAMINE

- Adult:
  - 0.15-0.3 mg/kg IV/intraosseous slow push over 1-2 minutes. Additional doses every 15 minutes as indicated to a maximum total combined of 1 mg/kg
  - If patient has reaction (anxious/nervous), administer midazolam 2.5 mg IV/intraosseous. **DO NOT** administer additional ketamine

Facility Initiated Analgesic Infusion(s)

- Facility initiated analgesic infusions may be maintained at rate as ordered by sending facility.
- Document full set of vital signs every 15 minutes while infusion is running

SAFETY ALERT

Analgesic Infusions May Not Be Initiated by the CCT

- May decrease infusion if patient exhibits signs of opiate overdose toxidrome or develops any hemodynamic instability

CCT - M1 PAIN MANAGEMENT

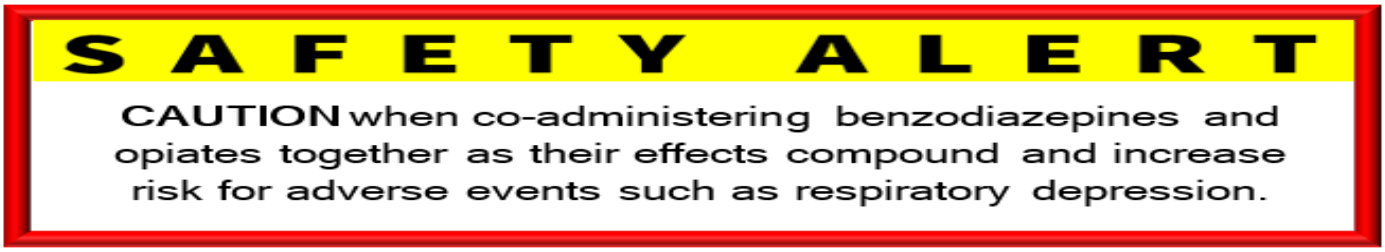
CCT (cont.)

- A mechanically ventilated patient receiving an analgesic infusion as part of their sedation regimen may receive additional boluses as required for comfort:
  - Fentanyl: 1 mcg/kg IV every 60 minutes or 0.5 mcg/kg IV, if hypotensive
  - Morphine: 0.1 mg/kg IV every 60 minutes, unless hypotensive
- **NOTE:** Must document full set of vital signs 5 minutes after bolus

OLMC

- Contact OLMC as needed

PEARLS



- *Ensure proper Ketamine dosing strategy:*
  - PAIN CONTROL (sub-dissociative dose) 0.1 - 0.3 mg/kg (Authorized)
  - PROCEDURAL SEDATION (dissociative dose) 0.5 - 1 mg/kg (Not Authorized For Pain Control)
  - ANESTHESIA (induction dose) - Greater than 1 mg/kg (Not Authorized For Pain Control)
- Ketamine Cautions:
  - Ketamine has a dose rate response. All doses should be given over 1-2 minutes. Rapid pushes increase risk of dissociation and respiratory depression.
  - Patients receiving ketamine may appear awake but will not likely respond appropriately or at all to verbal cues.
  - Nystagmus is often seen in patients receiving ketamine.
  - "Emergence reactions" may occur after dissociative doses and require benzodiazepines for mitigation

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- George Lindbeck, Manish I. Shah, Sabina Braithwaite, Jonathan R. Powell, Ashish R. Panchal, Lorin R. Browne, Eddy S. Lang, Brooke Burton, Jeffrey Coughenour, Remle P. Crowe, Hannah Degn, Mary Hedges, James Gasper, Kyle Guild, Connie Mattera, Sandra Nasca, Peter Taillac & Mark Warth (2022) Evidence-Based Guidelines for Prehospital Pain Management: Recommendations, Prehospital Emergency Care, DOI: 10.1080/10903127.2021.2018073

CCT - M2 ANXIOLYSIS

ADULT and PEDIATRIC	GOALS OF CARE
	Provide safe transportation of the combative, anxious, or restless patient while minimizing treatment interruptions and ensuring crew and patient safety

CCP

- Reference PCEMS MOM Vol. 1 - M3 for administration of benzodiazepines and anxiolysis

CCT

- Obtain baseline and repeat vital signs including pain score
  - May use Wong-Baker Faces scale for patient who is unable to provide a number (Ref. PCEMS MOM Vol. 1 - CT18)
- Provide verbal reassurance and de-escalation
- If unsuccessful, may administer anxiolysis **ensuring minimum anxiolytic dose necessary to achieve patient and crew safety:**
  - Midazolam (short acting):
    - Adult: 2.5 mg IV/intramuscular or 5 mg intranasal every 10 minutes, no maximum dose
    - Pediatric: Refer to PCEMS Handtevy Medication and Equipment Guidebook for dosing
  - Lorazepam (long acting):
    - Adult: 2 mg IV/intramuscular, may repeat every 15 minutes as needed, maximum dose 10 mg
    - Pediatric: 0.05 mg/kg IV; may repeat single dose after 15 minutes; maximum 2 mg per dose
- Obtain complete set of vital signs including EtCO2 and SpO2 and document before and after administration of an anxiolytic medication
- **Monitor for signs of respiratory depression and intervene as clinically indicated**

OLMC

- Contact OLMC as needed or for additional doses beyond maximums listed above

PEARLS

- Lorazepam is not approved for pediatric intramuscular administration

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- George Lindbeck, Manish I. Shah, Sabina Braithwaite, Jonathan R. Powell, Ashish R. Panchal, Lorin R. Browne, Eddy S. Lang, Brooke Burton, Jeffrey Coughenour, Remle P. Crowe, Hannah Degn, Mary Hedges, James Gasper, Kyle Guild, Connie Mattera, Sandra Nasca, Peter Taillac & Mark Warth (2022) Evidence-Based Guidelines for Prehospital Pain Management: Recommendations, Prehospital Emergency Care, DOI: 10.1080/10903127.2021.2018073
- https://www.pediatrics.wisc.edu/education/sedation-program/sedation-education/sedatives
- https://online.epocrates.com/drugs/41602/Ativan/Peds-Dosing

CCT - M3 SEDATION OF THE INTUBATED PATIENT

ADULT and PEDIATRIC	GOALS OF CARE
	Provide adequate sedation of the intubated patient to maximize comfort and improve synchronicity/compliance and outcomes

CCP

- Confirm airway placement and patency prior to and during sedation
- Ensure continuous EtCO2 waveform capnography and monitor vital signs
- Utilize the Richmond Agitation Sedation Scale (RASS – Ref. CCT-CT7) to monitor sedation
- Discuss ongoing sedation plan with sending facility and ensure appropriate medications are available

CCT

- Minimize interruptions in sedation during patient transfer
- *Titrate sedation to a RASS GOAL of -2 to 0 (Ref. CCT-CT7)*
- Use the least number of simultaneous infusions possible to achieve desired results
- Titrate agents to maximize effect prior to administering additional medications
- Use caution when managing multiple sedating infusions with additive effects
- Ketamine ***MAY NOT*** be combined with any other sedative or analgesic agents unless continued from sending facility.

SEDATION MEDICATIONS

- Ketamine **(ADULT ONLY)**:
  - Continuous infusion:
    - Initiate 0.5 mg/kg/hr. IV/intraosseous
      - Titrate by 0.1 mg/kg/hr. every five (5) minutes to maintain sedation
      - Maximum dose 2.5 mg/kg/hr.
  - Additional bolus dosing:
    - 0.5 mg/kg IV/intraosseous, may repeat every ten (10) minutes to a maximum of 1 mg/kg

- Lorazepam (**ADULT ONLY**):
  - Continuous infusion:
    - Initiate at 0.01 mg/kg/hr. IV/intraosseous
      - Titrate by 0.01 mg/kg every 3-5 minutes
      - Maximum dose 0.1 mg/kg/hr.
  - Additional bolus dosing:
    - 2 mg IV/intraosseous, may repeat every 15 minutes as needed to a maximum of 10 mg IV/intraosseous
    - 4 mg intramuscular, may repeat every 15 minutes as needed to a maximum of 20 mg intramuscular

CCT - M3 SEDATION OF THE INTUBATED PATIENT

CCT (cont.)

- Propofol **(ADULT ONLY)**:
  - Continuous infusion:
    - Initiate at 5 mcg/kg/min
      - Titrate by 5 mcg/kg/min every 5-10 minutes
      - Maximum dose 75 mcg/kg/min

      CAUTION: Reduce dose or discontinue if hypotension develops
  - Additional bolus dosing:
    - If MAP greater than 65 mmHg, 1 mg/kg IV/intraosseous every 15 minutes, maximum single bolus of 60 mg

- Midazolam **(Adult and Pediatric)**:
  - Continuous infusion:
    - Initiate at 0.01 mg/kg/hr. IV/intraosseous
      - Titrate by 0.01 mg/kg every 3-5 minutes
      - Maximum dose 0.1 mg/kg/hr
  - Additional bolus dosing:
    - Adult: 2.5 mg IV/intraosseous every ten (10) minutes, no maximum dose
    - Pediatric: 0.05 mg/kg IV/intraosseous, may repeat every 3-5 minutes, maximum of 10 mg

- Fentanyl **(Adult and Pediatric):**
  - Continuous infusion:
    - Adult and pediatric:
      - Initiate at 1 mcg/kg/hr IV/intraosseous
        - Titrate by 0.1 mcg/kg every 3-5 minutes
        - Maximum dose 2 mcg/kg/hr
  - Additional bolus dosing:
    - Adult and pediatric: 1 mcg/kg IV/intraosseous every sixty (60) minutes

- Dexmedetomidine **(Adult and Pediatric):**
  - Continuous infusion:
    - Adult and pediatric:
      - Initiate 0.2 mcg/kg/hr.
        - Titrate by 0.2 mcg/kg/hour every 30 minutes
        - Maximum dose 1.5 mcg/kg/hour
  - Additional bolus dosing: None

OLMC

- For additional medications beyond maximums listed above
- Contact OLMC as needed

CCT - M3 SEDATION OF THE INTUBATED PATIENT

PEARLS

- Intubated patients require constant monitoring and re-evaluation for appropriate sedation and analgesia
- Ketamine has intrinsic anesthetic and sedative properties.
- Sedatives and analgesics may cause or worsen hypotension, especially when used together. Choose sedative and analgesics appropriately based on clinical scenario and a patient's hemodynamics
- Dexmedetomidine has no true maximum dose. However, doses greater than 1.5 mcg/kg/hour have no additional sedative benefits but increase the risk of adverse events
- If a long-acting paralytic is used, high dose sedation must be given to ensure the patient is not awake and aware of the intubation/paralysis. Use the highest dose possible that ensures the patient is hemodynamically stable

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- Riessen R, Pech R, Tränkle P, Blumenstock G, Haap M. Comparison of the RAMSAY score and the Richmond Agitation Sedation Score for the measurement of sedation depth. Crit Care. 2012;16(Suppl 1):P326. doi:10.1186/cc10933
- Vet NJ, Kleiber N, Ista E, de Hoog M, de Wildt SN. Sedation in Critically Ill Children with Respiratory Failure. Front Pediatr. 2016 Aug 24;4:89. doi: 10.3389/fped.2016.00089. PMID: 27606309; PMCID: PMC4995367

CCT - M4 DIABETIC KETOACIDOSIS (DKA)

ADULT and PEDIATRIC	GOALS OF CARE
	Rapid identification or continued management of the patient with diabetic ketoacidosis

CCP

- Determine total volume and type of fluid administered by sending facility
- Review plan of care and any specific orders (e.g., fluid choice, insulin, potassium, etc.) with sending physician and ensure needed fluids and medications are available
- Determine recent glucose levels/trends at sending facility with specific attention to any episodes of hypoglycemia
- Continuously monitor EtCO2 and monitor mental status during transfer
- Measure and document capillary blood glucose at least every thirty (30) minutes or within five (5) minutes of any insulin/dextrose titration
- Treat hypoglycemia per PCEMS MOM Vol. 1 M5
- The following fluids may be administered to a patient with DKA during transfer:

• 0.9% sodium chloride	• 0.45% sodium chloride
• 5% dextrose/0.45% sodium chloride	• 10% dextrose/0.45% sodium chloride
• lactated ringers	• 0.45% sodium chloride + 20 mEq potassium chloride
• 5% dextrose/0.45% sodium chloride + 20 mEq potassium chloride	• 10% dextrose/0.45% sodium chloride + 20 mEq potassium chloride

SAFETY ALERT

ALL IV Fluids Containing Potassium Must Be Administered Via Infusion Pump

- Initiate/continue IV fluid
  - Adults:
    - Initial bolus: 20 mL/kg if not completed prior to transfer
    - Continued infusion: at rate ordered by sending physician or 150 mL/hr. if no rate specified
    - Monitor for signs of volume overload or altered mental status
  - Pediatrics:
    - Ensure initial fluid bolus of 10-20 mL/kg has been completed prior to transfer
    - Continued infusion: at rate ordered by sending physician or refer to PCEMS Handtevy Medication and Equipment Guidebook if no rate specified
    - Monitor for signs of volume overload or altered mental status

CCT - M4 DIABETIC KETOACIDOSIS (DKA)

CCT

- IV insulin infusion:
  - Continue insulin infusion at rate ordered by sending physician or, if no rate specified at 0.1 units/kg/hr.
  - Measure and document capillary blood glucose at least every thirty (30) minutes or within five (5) minutes of any insulin/dextrose titration
  - If glucose drops below 250 mg/dL or more than 100 mg/dL in less than sixty (60) minutes:
    - Decrease insulin infusion by half or to 0.05 units/kg/hr. (whichever is greater)
    - Add 10% dextrose/0.45% sodium chloride or 5% dextrose/0.45% sodium chloride at 150 mL/hr. if available and not already being infused
      - If dextrose containing fluids unavailable or already infusing, administer 10% dextrose in water at 150 mL/hr.
- If glucose continues to drop (below 200 mg/dL) pause insulin infusion and contact OLMC

OLMC

- Contact OLMC for additional infusions or adjustments as above
- Contact OLMC as needed

PEARLS

- Repletion of potassium, fluids, and correction of the acidotic state must proceed deliberately and with due regard for the time interval in which this patient has been experiencing this condition.
- Hyperglycemia from other etiologies other than that of DKA should be ruled out before applying this protocol. The treatment of hyperosmolar hyperglycemic state is the same as DKA. Hyperosmolar hyperglycemic state (HHS) is differentiated (usually) by presence of altered mental status and absence of acidosis.
- Rapid reduction of blood glucose (greater than 100 mg/dL/hr.) may cause cerebral edema
- Insulin is discontinued when the acidosis resolves and the anion gap closes, not when patient is euglycemic. Thus, dextrose is added when serum glucose is less than 250 mg/dL

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- https://www.uptodate.com/contents/diabetic-ketoacidosis-in-children-treatment-and-complications?search=dka&topicRef=1795&source=see_link#H426397146
- https://www.uptodate.com/contents/diabetic-ketoacidosis-and-hyperosmolar-hyperglycemic-state-in-adults

CCT - M5 SHOCK

ADULT and PEDIATRIC	GOALS OF CARE
	Identify signs and symptoms of shock, determine etiology, and provide rapid treatment to optimize patient outcomes and reduce morbidity and mortality

CCP

- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- Unless specific blood pressure goals are specified by sending/receiving physician or the clinical scenario requires altered parameters, **ALL** adult patients will have the following blood pressure goals when being treated for shock (either):
  - SBP equal to or greater than 90 mmHg
  - MAP equal to or greater than 65 mmHg
- Determine shock type and treat as clinically indicated
- If unknown etiology of shock, administer initial bolus of 1000 mL 0.9% sodium chloride or lactated ringers. Monitor for signs of pulmonary edema.
- Discuss treatment plan (e.g., vasopressors, IV fluids, etc.) with the sending physician and ensure needed medications are available.
- May utilize push dose pressors (Ref. PCEMS MOM Vol. 1 - CT26) to maintain adequate perfusion while instituting additional therapies

Distributive shock or shock of unknown etiology (septic shock, anaphylactic shock, neurogenic shock)

- Determine volume and type of IV fluids received
- Add additional fluids to **TOTAL** (including fluids given prior to arrival by sending facility) volume of 30 mL/kg crystalloids
- Add norepinephrine if patient remains hypotensive/in shock (must have administered at least 1000 mL IV fluids)
  - Begin at 0.05 mcg/kg/min. May increase by 0.02 mcg/kg/min every 2 minutes to a maximum dose of 0.5 mcg/kg/min
- If norepinephrine is maximized but patient is still in shock, add:
  - Epinephrine – begin 0.1 mcg/kg/min, titrate by 0.05 mcg/kg every 2 minutes to maximum of 1 mcg/kg/min.
  - If still hypotensive, consider vasopressin – 0.03 units/minute (no titration), if available

CCT - M5 SHOCK

CCT

Cardiogenic Shock

- Assess rhythm and treat underlying arrhythmias
- Administer up to 2000 mL 0.9% sodium chloride total (or 20 mL/kg if less than 100 kg). Reassess patient every 500 mL for adverse effects (pulmonary edema)
- Add norepinephrine if patient remains hypotensive after IV fluids
    - Begin at 0.05 mcg/kg/min. May increase by 0.02 mcg/kg/min every 2 minutes to a max dose of 0.5 mcg/kg/min.
- Add dobutamine if norepinephrine is maximized, but patient is still in shock.
    - Dobutamine – begin 5 mcg/kg/min, titrate 1-2 mcg/kg/min every 3 minutes to maximum dose of 20 mcg/kg/min.
- Add epinephrine if still hypotensive after maximum dobutamine.
    - Epinephrine - 0.1 mcg/kg/min, titrate by 0.05 mcg/kg every 1-2 minutes to maximum of 1 mcg/kg/min

Hypovolemic (hemorrhagic) shock

- Control external hemorrhage - apply tourniquet(s), apply direct pressure, etc. (Ref. PCEMS MOM Vol. 1 - CP16, CP17, CP18)
- Discuss treatment strategies with sending physician including blood products, coagulopathy correction, TXA, permissive hypotension, calcium, etc. and ensure needed medications/products are available for transport
- Continue IV fluids to a total of 2000 mL 0.9% sodium chloride or lactated ringers

Pediatric Shock

- Control external hemorrhage - apply tourniquet(s), apply direct pressure, etc. (Ref. PCEMS MOM Vol. 1 - CP16, CP17, CP18)
- Discuss treatment strategies with sending physician including blood products, coagulopathy correction, TXA, permissive hypotension, calcium, etc. and ensure needed medications/products are available for transport
- Administer IV fluid bolus to a total of 20 mL/kg IV 0.9% sodium chloride. May give additional 10 mL/kg IV crystalloids if still hypotensive
- If unresponsive to fluids, administer vasopressors per PCEMS Handtevy Medication and Equipment Guidebook

OLMC

- Contact OLMC for consideration of vasopressors in hemorrhagic shock
- Contact OLMC for refractory shock despite medical optimization
- Contact OLMC as needed

CCT - M5 SHOCK

PEARLS

- Vasopressors have little to no role in hemorrhagic shock
- Invasive hemodynamic monitoring is preferred (arterial line, CVP). If not in place and patient hypotensive, ask sending facility to consider placing invasive monitoring
- Patient may be fluid sensitive (such as CHF, cirrhosis). Even in this patient, IV fluids are still the cornerstone of therapy. Monitor for signs of fluid overload and need for airway intervention.

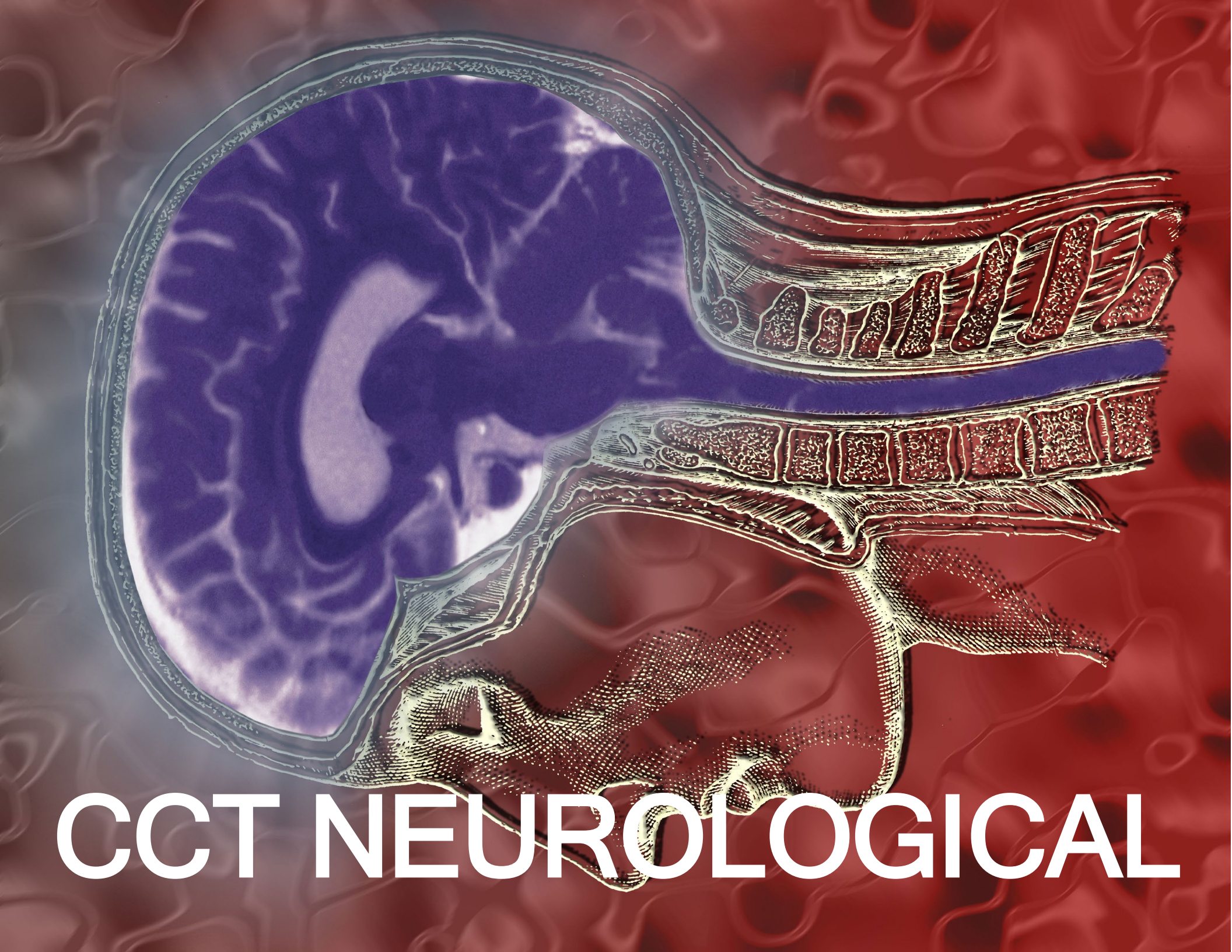
QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- Richards JB, Wilcox SR. Diagnosis And Management Of Shock In The Emergency Department. EB Medicine. https://www.ebmedicine.net/topics/critical-care/management-of-shock . Published March 2, 2014
- UpToDate.com – Definition, classification, etiology, and pathophysiology of shock in adults


CCT NEUROLOGICAL


CCT NEUROLOGICAL

CCT - N1 SEIZURE

ADULT and PEDIATRIC	GOALS OF CARE
	Address reversible causes and minimize seizure activity while ensuring airway protection

CCP

- Discuss treatment plan with sending physician and ensure needed medications are available
- Discuss potential need for airway protection prior to transfer
- Verify and continue any antiepileptic medications initiated by sending facility
- If recurrent seizure activity develops:
  - Ref. PCEMS MOM Vol. 1 - M14 for standard BLS and ALS care of seizure patient
  - Administer additional abortive medications for seizure as needed:
    - Midazolam (adult and pediatric)
      - 0.2 mg/kg IV/intramuscular/intraosseous/intranasal maximum dose 10 mg. May repeat single dose if after 5 minutes if still seizing (intranasal - maximum of 5 mg per nare)
    - Reassess capillary blood glucose level (Ref. PCEMS MOM Vol. 1 - M5) for any new seizure activity and treat if less than 60 mg/dL (Ref. PCEMS MOM Vol. 1 - M5 & P11)

CONSIDER ALTERNATE CAUSES OF SEIZURE		
Eclampsia	Refer to eclampsia protocol	Ref. CCT-OB4 & PCEMS MOM Vol. 1 - M10
Trauma/head injury	Refer to trauma protocol for management of head injuries	Ref. CCT-T2
Electrolyte Abnormalities	Refer to sending facility labs for electrolyte derangements (e.g., hyponatremia, see CCT below) and treat appropriately	N/A
Sympathomimetic overdose	e.g., cocaine, methamphetamine	Treat with benzodiazepines as above (may require higher doses)
Tricyclic antidepressants	Seizure, anticholinergic toxidrome	Give 50 mEq sodium bicarbonate IV/intraosseous. May repeat one (1) time after five (5) minutes if still seizing
Isoniazid toxicity	N/A	Discuss administration of pyridoxine prior to departing referring facility

CCT - N1 SEIZURE

CCT

STATUS EPILEPTICUS

- Ensure active seizure has been adequately addressed prior to departure.

SAFETY ALERT

Patient should not depart referring facility with active seizure unless definitive airway has been established and facility has exhausted all available resources for seizure management

- If status epilepticus develops during transport:
  - Ensure airway is protected (Ref. CCT-CP1-2, CCT-M3)
  - Treat with abortive medications as per CCP.
  - Continue all anti-epileptic infusions began at referring facility and manage hypoglycemia as per CCP
- If evidence of significant hyponatremia (recent sodium level less than 130 mEq/L) and actively seizing:
  - 50 mEq sodium bicarbonate IV/intraosseous. May repeat one (1) time after five (5) minutes if still seizing, **OR**
  - 100 mL 3% sodium chloride (hypertonic saline), if available

OLMC

- Contact OLMC as needed or for additional doses of abortive medications
- Contact if patient needs to be transported with active seizure activity prior to departure from referring facility

PEARLS

- Intubation of a seizure patient is extremely difficult with a high complication rate
- Always monitor the airway when administering benzodiazepines and be prepared to intervene if necessary
- Always consider hypoglycemia in new onset seizure
- Isoniazid can deplete vitamin B6 (pyridoxine) and can lead to refractory seizure. Classic presentation is a child that ingested parent's medication
- Status epilepticus is defined as seizure of greater than five (5) minutes in duration **OR** recurrent seizure activity without recovery to baseline between seizures.

QUALITY MEASURES

- Calls reviewed regularly

CCT - N1 SEIZURE

REFERENCES

- Wylie T, Sandhu DS, Murr N. Status Epilepticus. [Updated 2023 May 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK430686/
- Sirven JI, Waterhouse E. Management of status epilepticus. Am Fam Physician. 2003 Aug 1;68(3):469-76. PMID: 12924830. https://www.aafp.org/afp/2003/0801/p469.html
- Shenoi RP, Timm N; COMMITTEE ON DRUGS; COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE. Drugs Used to Treat Pediatric Emergencies. Pediatrics. 2020 Jan;145(1):e20193450. doi: 10.1542/peds.2019-3450. PMID: 31871244

CCT - N2 ISCHEMIC STROKE

ADULT and PEDIATRIC	GOALS OF CARE
	Provide rapid transport to definitive care while minimizing ongoing ischemia, avoiding enlargement of the ischemic penumbra, and maximizing reperfusion therapies

CCP

- Discuss treatment plan (e.g., thrombolytics, vasopressors, antihypertensives, IV fluids, etc.) with the sending physician and ensure needed medications are available
- Determine and document time interval:
  - **EXACT** time of symptom onset or discovery (hh:mm)
  - Last **KNOWN** Normal Time (hh:mm) (may or may not be same as onset)
  - If symptoms were present upon awakening from sleep
  - Name and phone number of individual who witnessed event
  - Document onset time, contact information for alternate historian
- Document initial and any subsequent NIHSS scores from sending facility
- Keep patient in supine position (head of bed - 0°) unless directed otherwise by sending physician
- Monitor neurological status closely and document any updates or changes during transport and update the receiving facility

When conducting an EMERGENCY transfer on a CCP Unit:

- NO TPA administered:
  - Discuss need for bolus antihypertensives with sending physician
  - Allow for permissive hypertension with maximum systolic BP 220 mmHg and/or maximum diastolic BP 120 mmHg

- TPA initiated (or given within last 24 hours):
  - Discuss need for bolus antihypertensives with sending physician to maintain BP within parameters for t-PA:
    - SBP less than 180 mmHg **AND** DBP less than 105 mmHg
  - Monitor for signs of bleeding/blood loss
  - If signs of bleeding and blood pressure is decreasing
    - Administer 500 mL boluses 0.9% sodium chloride until blood pressure improves (maximum 2000 mL 0.9% sodium chloride, monitor for signs of fluid overload)
    - Consider vasopressors as necessary to maintain cerebral perfusion pressure (Ref. CCT-M5)
  - If signs of intracranial hemorrhage and/or herniation:
    - IMMEDIATLEY discontinue TPA infusion if running
    - Reference CCT-N3 for management of intracranial hemorrhage

CCT - N2 ISCHEMIC STROKE

CCT

- Monitor neurological status closely and document any updates or changes during transport and update the receiving facility
- Initiate/continue blood pressure management with goals depending on if t-PA administered
  - NO TPA administered:
    - Allow for permissive hypertension to maximum systolic BP 220 mmHg and/or maximum diastolic BP 120 mmHg
    - If patient is severely hypertensive (SBP greater than 220 mmHg AND/OR DBP greater than 120 mmHg):
      - Initiate or titrate antihypertensive agents to reduce blood pressure to SBP less than 220 mmHg AND DBP less than 120 mmHg

        CAUTION – Avoid reduction of 25% or more from highest measured pressure unless signs of herniation

  - TPA initiated (or given within last 24 hours):
    - Allow for permissive hypertension to maximum systolic 180 mmHg AND/OR Diastolic 85 mmHg:
      - Initiate or titrate antihypertensive agents to reduce blood pressure to SBP less than 180 mmHg AND DBP less than 105 mmHg

        CAUTION - Avoid reduction below 160/90 mmHg to avoid worsening ischemic injury/penumbra size

    - If signs of intracranial hemorrhage and/or herniation or hemodynamically significant external hemorrhage:
      - Maintain SBP less than 140 mmHg and DBP less than 90 mmHg regardless of initial blood pressure
- Monitor closely for signs of neurological deterioration while blood pressure is being managed
- If signs of intracranial hemorrhage and/or herniation:
  - IMMEDIATELY discontinue TPA infusion if still running
  - Reference CCT-N3 for management of intracranial hemorrhage
- If patient develops external hemorrhage or gastrointestinal bleeding and hypotension, treat per CCT-M5

CCT - N2 ISCHEMIC STROKE

CCT (cont.)

Antihypertensive agents in Acute Stroke:

If patient is well established on sending facility medication with adequate hemodynamic control, continue current medication as directed by sending facility

- Nicardipine (IV/intraosseous)
  - Initiate infusion at 5 mg/hr
  - Titrate by 2.5 mg/hr every 5-15 minutes as needed
  - Maximum dose 15 mg/hr
- Labetalol (IV/intraosseous)
  - 1st dose: 10 mg slow IV Push over 2 minutes
    - If near BP goal, may lower 2nd and 3rd doses to avoid precipitous lowering of blood pressure
  - 2nd dose: 20 mg slow IV Push after 10 minutes as needed
  - 3rd dose: 40 mg slow IV Push after 10 minutes as needed

OLMC

- Contact OLMC as needed

PEARLS

- Monitor for signs of hemorrhagic conversion of ischemic stroke
- Avoid hypotension. Even brief episodes of hypotension can worsen ischemia

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- https://www.ahajournals.org/doi/pdf/10.1161/str.0b013e318284056a

CCT - N3 INTRACRANIAL HEMORRHAGE

ADULT and PEDIATRIC	GOALS OF CARE
	Safe transport to definitive care while monitoring neurological status and ensuring airway protection and optimal blood pressure management to minimize ongoing hemorrhage

CCP

- Discuss treatment plan (e.g., vasopressors, antihypertensives, IV fluids, etc.) with the sending physician and ensure needed medications are available
- Determine and document time interval:
  - **EXACT** time of symptom onset or discovery (hh:mm)
  - Last **KNOWN** Normal Time (hh:mm) (may or may not be same as onset)
  - If symptoms were present upon awakening from sleep
  - Name and phone number of individual who witnessed event
  - Document onset time, contact information for alternate historian
- Document initial and any subsequent National Institutes of Health Stroke Scale (NIHSS) scores from sending facility
- Position head of bed at 30° elevation or higher as patient tolerates
- Monitor blood pressure every 15 minutes.
- Monitor neurological status closely and document any updates or changes during transport and update the receiving facility
- Initiate/continue pain management as needed (Ref. PCEMS MOM Vol. 1 - M13)
- If signs of active cerebral herniation develop (e.g., decreasing GCS, Cushing's response, significant elevation in ICP, decorticate/decerebrate posturing, unilateral dilated/non-responsive pupil, etc.):
  - Increase ventilator rate to achieve **EtCO2 of 30-35 mmHg**
  - Avoid hypocapnia of EtCO2 less than 30 mmHg – single reading below 30 mmHg increases morbidity and mortality
- Monitor for seizure activity and treat per CCT-N1
- Monitor capillary blood glucose and administer dextrose for hypoglycemia

CCT

- Continue all anticoagulant reversal agents initiated by the referring facility
- If signs of active cerebral herniation develop (e.g., decreasing GCS, Cushing's response, significant elevation in ICP, decorticate/decerebrate posturing, unilateral dilated/non-responsive pupil, etc.):
  - Administer mannitol 1 gram/kg IV or intraosseous over 30 minutes (adults and pediatrics)

CCT - N3 INTRACRANIAL HEMORRHAGE

CCT (cont.)

- Blood pressure goal in confirmed or suspected intracranial hemorrhage:
  - Invasive blood pressure monitoring preferred for ICH (Ref CCT-CP6)
  - Maintain SBP less than 140 mmHg **AND** DBP less than 90 mmHg regardless of initial blood pressure
    - Nicardipine (IV/intraosseous)
      - Initiate infusion at 5 mg/hr.
      - Titrate by 2.5 mg/hr. every 5-15 minutes as needed
      - Maximum dose 15 mg/hr.
    - Labetalol (IV/intraosseous)
      - 1st dose: 10 mg slow IV Push over two (2) minutes
        - If near BP goal, may lower 2nd and 3rd doses to avoid precipitous lowering of blood pressure
      - 2nd dose: 20 mg slow IV Push after 10 minutes as needed
      - 3rd dose: 40 mg slow IV Push after 10 minutes as needed
    - Other medications as directed by sending facility (as long as achieving BP goals)
- If ICP monitoring is in place, may alter BP goals to maintain adequate cerebral perfusion pressure (CPP) greater than or equal to 60 mmHg (CPP = MAP – ICP)
- Monitor closely for signs of neurological deterioration while blood pressure is being managed

OLMC

- Contact OLMC as needed

PEARLS

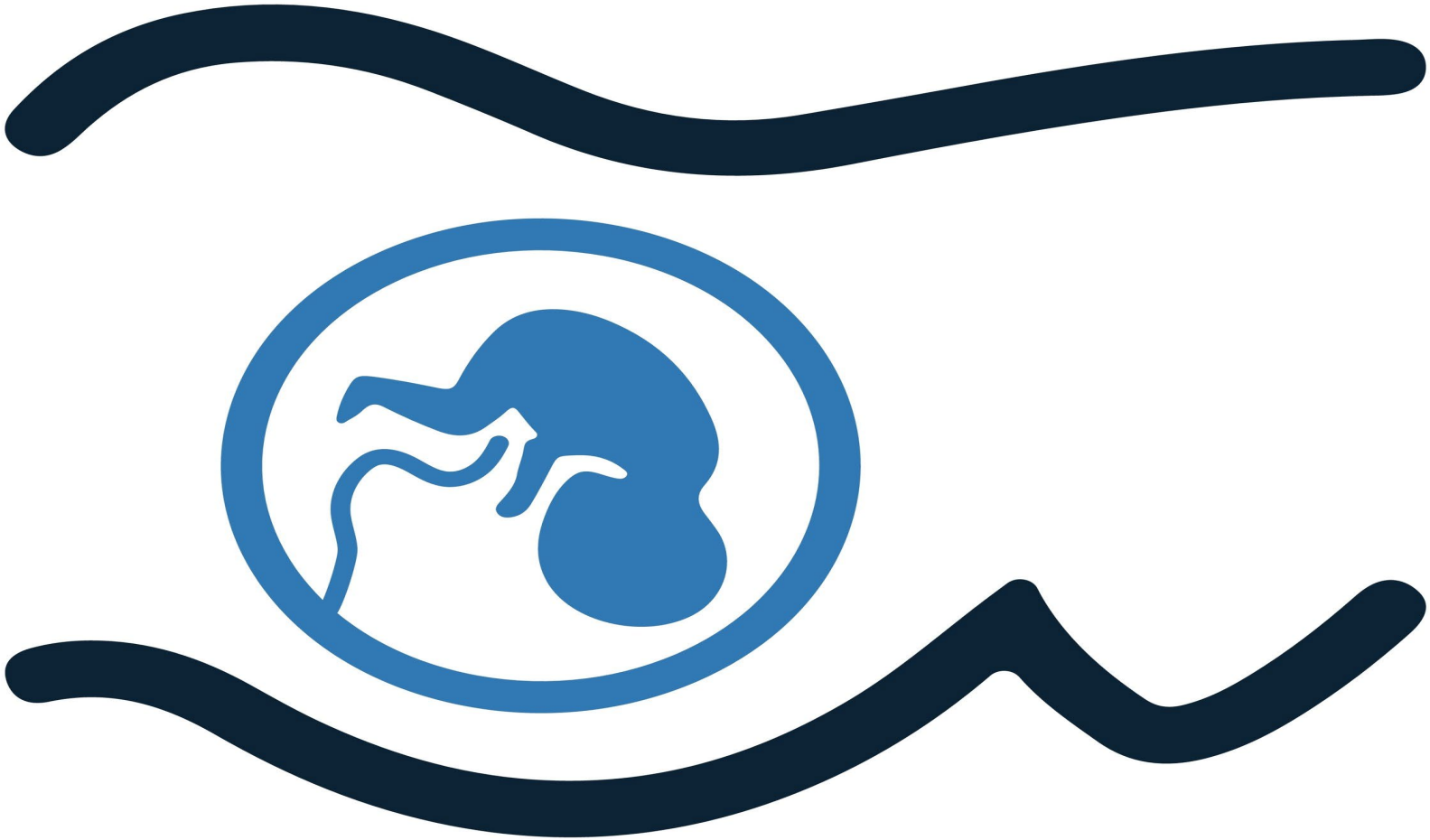
- Use caution with pupil exam – many patients have anisocoria (unequal pupil diameters) at baseline. A “blown pupil” will be maximally dilated
- Avoid hypotension when titrating blood pressure medications as even short-term hypotension can be detrimental by decreasing CPP

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- https://www.ahajournals.org/doi/full/10.1161/STR.0000000000000407 2022 Guideline for the Management of Patients with Spontaneous Intracerebral Hemorrhage: A Guideline From the American Heart Association/American Stroke Association



CCT OBSTETRICS

CCT OBSTETRICS

CCT - OB1 GENERAL OBSTETRICAL CARE

	GOALS OF CARE
ADULT and PEDIATRIC	• Prevent maternal and fetal complication by providing interventions deemed appropriate through continuous monitoring and assessment • Reduce maternal anxiety during transport by providing information and emotional support

CCP

- Discuss treatment plan (e.g., reason for transfer, fluids, stage of labor, concern for delivery enroute, etc.) with the sending physician and ensure needed medications and resources are available

  NOTE: It is mandatory to discuss risk-benefit of transfer and need for full CCT team if patient in active labor and/or receiving tocolytics

- Document gestational age, pregnancy history, maternal history (e.g., past medical history, GxPx, previous outcomes, previous complications, etc.)
- Determine and document any "High-Risk Pregnancy" designation
- Perform a complete and thorough assessment of mother and baby prior to departure
  - Visual inspection of the perineum may be indicated depending on the patient's presentation (e.g., to assess for rupture of membranes, bleeding, prolapsed cord, or presenting fetal part, etc.) and must be consented to by the patient and performed with at least two (2) crewmembers present
  - An internal pelvic exam is rarely indicated during transport and must be ordered by the treating physician or the OLMC Physician, consented to by the patient, and performed with at least two (2) crewmembers present
- If membranes ruptured, confirm fluid color, amount, odor, confirmation method and any other characteristics as reported by staff or as witnessed.
- Provide emotional support to patient and family if present

SAFETY ALERT

DO NOT depart a facility with a patient in active labor in which delivery is imminent

CCT - OB1 GENERAL OBSTETRICAL CARE

CCT
• Ensure appropriate and continuous fetal monitoring: ○ Electronic fetal monitoring must be initiated at the sending facility bedside for any patient greater than 24 weeks gestation and must be continued until transfer of care is completed at receiving facility • If patient is in controlled labor (e.g., using magnesium sulfate or other tocolytics), then they are considered stable for transport (Ref. CCT-OB2) • If there are any concerns over the legality of a rectal or pelvic examination, contact OLMC

OLMC

• OLMC consultation is mandatory prior to departure in the following circumstances:
  ○ Uncontrolled labor
  ○ Imminent Delivery
  ○ When assistance is needed in transfer risk assessment
• Contact OLMC as needed

REFERENCES
• Pending

CCT - OB2 PRETERM LABOR

ADULT and PEDIATRIC	GOALS OF CARE
	Safely transfer the patient to an appropriate receiving facility while slowing the progression of labor

CCP

- Provide emotional support to patient and family if present
- Discuss treatment plan (e.g., BP meds, tocolytics, IV fluids, etc.) with the sending physician and ensure needed medications are available
- Implement General Obstetrical Care (Ref. CCT-OB1)
- Confirm the time of administration of antibiotics and/or steroids if administered prior to transport
- If magnesium sulfate has been initiated by referring facility obtain and document serum magnesium level
- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- Maintain patient in a left lateral recumbent position as tolerated
- If patient is hypotensive, refer to CCT-M5

NOTE: Lactated ringers is the preferred IV fluid of choice during pregnancy

- Monitor for progression of labor and remain prepared for unexpected delivery
- Monitor and record total amount of fluid intake and output at conclusion of transport

CCT

- Discuss stage of labor and treatment plan with sending physician
- Follow standard approach to slowing/arresting progression of preterm labor unless specific alternate orders provided by treating physician:
  - Cervix 1-2 cm dilated, minimally effaced, and no tocolytics have been administered:
    - Terbutaline sulfate 0.25 mg subcutaneous every 20 minutes X three (3) doses
  - Cervix is dilated greater than two (2) cm, and no tocolytics have been administered:
    - Magnesium sulfate
      - Loading dose: Five (5) grams magnesium sulfate in 0.9% sodium chloride or D5W IV/intraosseous over 30 minutes
      - Continuous Infusion: Continue magnesium sulfate at two (2) gm/hr after loading dose completed

NOTE: DO NOT administer magnesium sulfate if nifedipine or other calcium channel blockers have been administered for uterine relaxation

CCT - OB2 PRETERM LABOR

CCT (cont.)

- Monitor for signs of magnesium toxicity anytime magnesium is administered:

Early Signs	e.g., cutaneous flushing, sweating, malaise, weakness, and drowsiness, etc.	▪ Reassure patient and provide comfort measures ▪ DO NOT slow/stop magnesium for early signs ▪ Monitor for progression to toxicity
Mild Toxicity	e.g., loss of deep tendon reflexes, 7-10 mEq/L	▪ Decrease magnesium sulfate infusion to 1 gm/hr. ▪ Assess deep tendon reflexes every 15-30 minutes
Moderate Toxicity	e.g., respiratory depression, 10-25 mEq/L	▪ Discontinue magnesium sulfate infusion ▪ Obtain 12 lead ECG ▪ Monitor vital signs every five (5) minutes ▪ Treat hemodynamic instability and arrhythmias as indicated ▪ Administer 1 gram calcium chloride IV/intraosseous over ten (10) minutes
Severe Toxicity	e.g., cardiac arrest, greater than 25 mEq/L	▪ Discontinue magnesium sulfate infusion ▪ Administer 2 grams calcium chloride IV/intraosseous ▪ Administer 100 mEq 8.4% sodium bicarbonate

- Treat cardiac arrest per PCEMS MOM Vol. 1 - C1

OLMC

- Contact OLMC for imminent delivery or if concern for magnesium toxicity
- Contact OLMC as needed

PEARLS

- Preterm labor is defined as regular and rhythmic contraction producing cervical changes after the 20th week of gestation until the 37th week of gestation
- False contractions (Braxton Hicks contractions) may be felt in 2nd or 3rd trimester. Causes include increased maternal activity, bladder distension, following sexual activity, and dehydration

QUALITY MEASURES

- Calls reviewed regularly

CCT - OB2 PRETERM LABOR

REFERENCES
• Advanced Concepts in OB Transport http://www.OBSTAT.org • CMQCC Preeclampsia toolkit, California Department of Public Health https://www.cmqcc.org/resource/2826/download#:~:text=Symptoms%20of%20magnesium%20sulfate%20toxicity,(%3E%2025mEq%2FL)

CCT - OB3 GESTATIONAL HYPERTENSION SYNDROMES

ADULT and PEDIATRIC	GOALS OF CARE
	Control gestational hypertension syndromes to reduce morbidity and mortality of mother and baby

CCP

- Provide emotional support to patient and family if present.
- Discuss treatment plan (e.g., BP meds, IV fluids, foley, etc.) with the sending physician and ensure needed medications are available.
- Implement General Obstetrical Care (Ref. CCT-OB1)
- Maintain a left lateral recumbent position as patient tolerates
- Confirm time of administration of antihypertensives
- If magnesium sulfate has been initiated by referring facility obtain and document serum magnesium level. Monitor per CCT-OB2
- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- If patient is hypotensive, refer to CCT-M5

  NOTE: Lactated ringers is the preferred IV fluid during pregnancy
- Monitor for progression of labor and remain prepared for unexpected delivery
- Monitor and record total amount of fluid intake and output at conclusion of transport
- Monitor airway in all gestational hypertension syndromes and be prepared for progression and advanced airway management, as indicated

CCT

- If systolic blood pressure is greater than 140 mmHg **OR** diastolic blood pressure greater than 90 mmHg initiate antihypertensive treatment:
  - If HR greater than 70:
    - Labetalol (IV/intraosseous)
      - 1st dose: 20 mg slow IV Push over 2 minutes
      - 2nd dose: 40 mg slow IV Push after 10 minutes as needed
      - 3rd dose: 80 mg slow IV Push after 10 minutes as needed
      - Maximum single dose 80 mg, maximum total dose 300 mg

      NOTE: If HR drops below 60 and additional BP control needed, switch to hydralazine
  - If HR less than 70:
    - Hydralazine
      - 1st dose: 5 mg slow IV push over 2 minutes
      - 2nd and subsequent doses: 10 mg slow IV push every 10 minutes as needed
      - Maximum single dose: 10 mg. Maximum total combined dose 25 mg

CCT - OB3 GESTATIONAL HYPERTENSION SYNDROMES

CCT (cont.)

- If concern for preeclampsia, refer to CCT-OB4
- Monitor fluid intake and urine output
- If after antihypertensive treatment, SBP greater than 160 and/or DBP greater than 110, contact OLMC or receiving perinatologist for additional orders

OLMC

- Contact OLMC for additional antihypertensive medications
- Contact OLMC as needed

PEARLS

- Gestational Hypertension: SBP greater than 140 mmHg and/or DPB greater than 90 mmHg after the 20th week of pregnancy
    - Urgent evaluation is indicated with SBP greater than 160 mmHg and/or DBP greater than 110 mmHg
- Gestational hypertension encompasses a variety of disease processes: chronic hypertension, gestational hypertension, preeclampsia, eclampsia, HELLP syndrome, etc.

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- Beech A, Mangos G. Management of hypertension in pregnancy. Aust Prescr. 2021 Oct;44(5):148-152. doi: 10.18773/austprescr.2021.039. Epub 2021 Oct 1. PMID: 34728879; PMCID: PMC8542489.

CCT - OB4 PREECLAMPSIA AND ECLAMPSIA

ADULT and PEDIATRIC	GOALS OF CARE
	Monitor for signs of preeclampsia and eclampsia and intervene to prevent maternal and fetal morbidity and mortality

CCP

- Discuss treatment plan (e.g., BP meds, magnesium, tocolytics, IV fluids, foley, etc.) with the sending physician and ensure needed medications are available.
- Confirm time of administration (or infusion start time) of antihypertensives, tocolytics, magnesium, or any other medications/infusions being administered
- If Magnesium Sulfate has been initiated by referring facility obtain and document serum magnesium level. Monitor per CCT-OB2
- Implement standard Obstetric Care (Ref CCT – OB1)
- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- Maintain a left lateral recumbent position as patient tolerates
- Monitor for progression of labor and remain prepared for unexpected delivery
- Monitor and record total amount of fluid intake and output at conclusion of transport
- Monitor airway in all gestational hypertension syndromes and be prepared for progression and advanced airway management as indicated.
- Provide emotional support to patient and family if present

CCT

- Treat hypertension per CCT-OB3
- Institute additional treatments as per standard approach below unless specific alternate orders from sending physician:
  - PREECLAMPSIA - Hypertension, Known proteinuria, or end organ dysfunction after 20 weeks gestation and up to 6 weeks post-partum:
    - Initiate or continue Magnesium Sulfate:
      - Loading dose: 5 grams in 250 mL 0.9% sodium chloride or D5W IV/intraosseous over 30 minutes
      - Maintenance dose: 2 gm/hr. IV/intraosseous
      - Monitor for signs of magnesium toxicity (Ref. CCT-OB2)
  - ECLAMPSIA - seizure activity in setting of preeclampsia:
    - Administer additional 4 grams magnesium sulfate bolus over 5 minutes
    - If seizure continues or reoccurs after administration of magnesium sulfate, administer benzodiazepine (Ref. CCT-N1)
    - If any concern for inadequate oxygenation or ventilation, perform airway management (Ref. CCT-CP1)

OLMC

- Contact OLMC for additional antihypertensive medications
- Contact OLMC as needed

CCT - OB4 PREECLAMPSIA AND ECLAMPSIA

PEARLS

- Definition of preeclampsia: SBP greater than 140 mmHg and/or DBP greater than 90 mmHg in patient at greater than or equal to twenty (20) weeks gestation or less than six (6) weeks post-partum AND must have either proteinuria OR end organ dysfunction. Preeclampsia is a diagnosis based on labs and clinical features.
- HELLP Syndrome is a variant of severe preeclampsia with the addition of hemolysis, elevated liver enzymes and low platelets and can have a high mortality rate.
- Blood pressure and seizure control are temporizing measures. The only definitive treatment of eclampsia is delivery of the fetus

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- Beech A, Mangos G. Management of hypertension in pregnancy. Aust Prescr. 2021 Oct;44(5):148-152. doi: 10.18773/austprescr.2021.039. Epub 2021 Oct 1. PMID: 34728879; PMCID: PMC8542489.
- Magley M, Hinson MR. Eclampsia. [Updated 2023 Jan 30]. In: StatPearls [Internet]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK554392/

CCT – OB5 VAGINAL BLEEDING

ADULT and PEDIATRIC	GOALS OF CARE
	Provide hemodynamic support and appropriate treatments for patients with postpartum vaginal bleeding

CCP

- Discuss treatment plan (e.g., BP meds, tocolytics, IV fluids, etc.) with the sending physician and ensure needed medications are available.
- Implement General Obstetrical Care (Ref. CCT-OB1)
- Confirm time of administration of antihypertensives, antibiotics and/or steroids if given prior to transport.
- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- Maintain a left lateral recumbent position as patient tolerates
- If patient is hypotensive, refer to CCT-M5

NOTE: Lactated Ringers is the preferred IV fluid during pregnancy

- Monitor for progression of labor and remain prepared for unexpected delivery
- Monitor and record total amount of fluid intake and output at conclusion of transport
- Estimate amount and color of blood loss by assessing OB pads or chux (greater than one [1] OB pad/hour is considered excessive)

CCT

- Discuss with sending physician the anticipated need for blood and blood products
- Discuss with sending physician need for tocolytics if patient is in labor (e.g., having contractions and cervical dilation)
- Treat hemorrhagic shock per CCT-M5
- Institute additional hemorrhage control as follows:
  - Prepartum and/or peripartum hemorrhage:
    - Initiate/titrate tocolytics as ordered by sending physician
  - Postpartum hemorrhage:
    - Perform external uterine massage to stimulate uterine contraction
    - If placenta delivered:
      - Prepare and initiate oxytocin (20 units oxytocin in 1000 mL lactated ringers)
        - Initial bolus 5 units (250 mL of the mixture IV)
        - Continued infusion 10 units/hour

OLMC

- Contact OLMC as needed

CCT – OB5 VAGINAL BLEEDING

PEARLS

- **Abruption** – premature separation of placenta from uterus prior to delivery. Painful dark red bleeding or no bleeding at all. Patient will present with uterine irritability, frequent contractions, decreased uterine resting tone, painful uterine tenderness. Causes include trauma, cigarette smoking, chronic HTN, multiparity, and history of placental abruption
- **Previa** – placenta overlying cervical os and tears with cervical changes during labor. Often painless vaginal bleeding. Tocolysis or corticosteroids may be considered in certain circumstances in the placenta previa patient. They remain controversial in the presence of abruption
- **Postpartum hemorrhage** – blood loss greater than 500 mL following vaginal delivery (greater than 1000 mL after cesarian section)
- Due to increased blood volume during pregnancy, patients may have a significant amount of blood loss prior to hypotension (up to 1000 mL). Have a high clinical suspicion to intervene prior to abnormal vital signs

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- Evensen A, Anderson JM, Fontaine P. Postpartum Hemorrhage: Prevention and Treatment. Am Fam Physician. 2017 Apr 1;95(7):442-449. PMID: 28409600.

CCT – OB6 NEONATAL RESUSCITATION

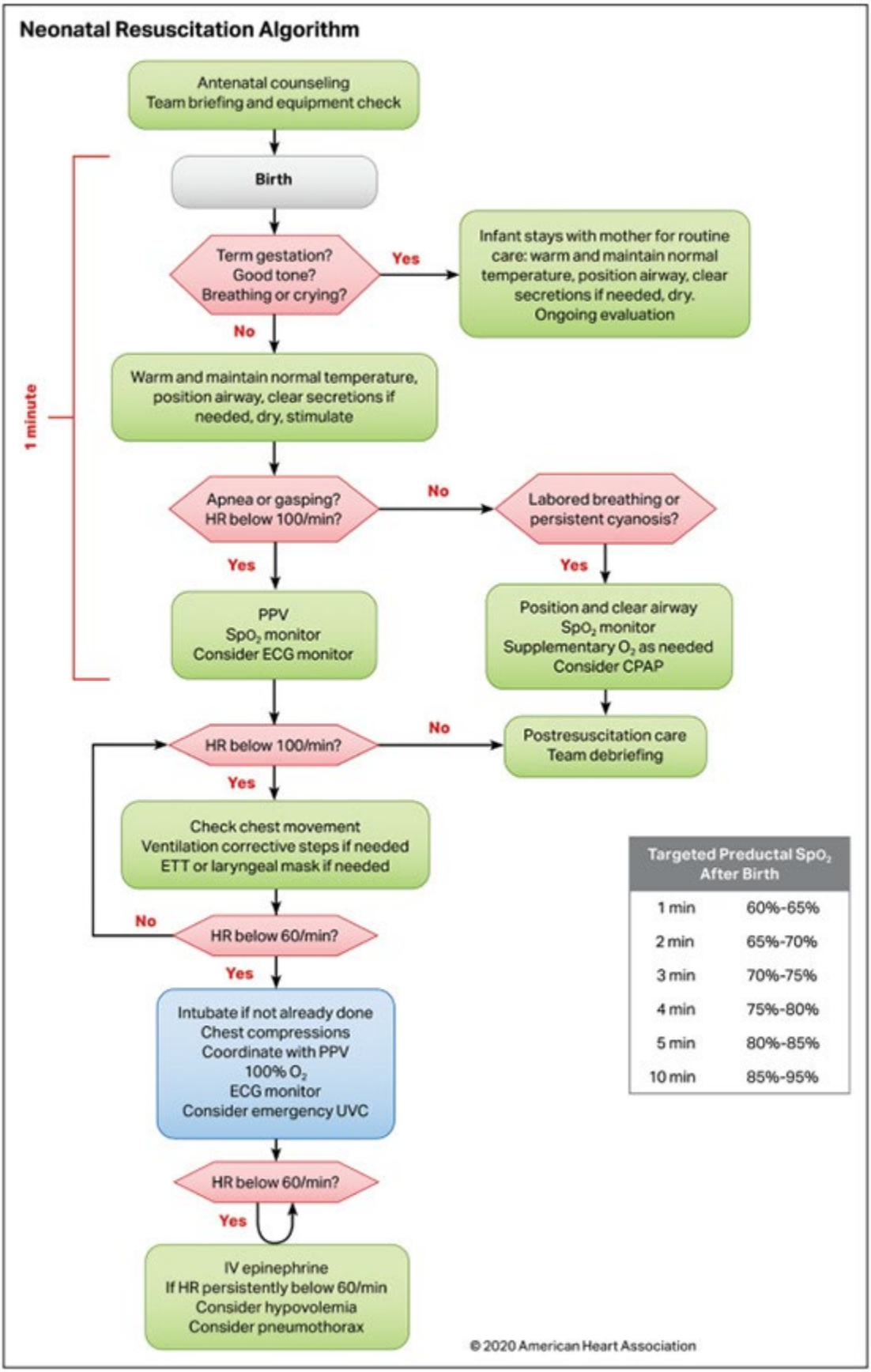
Neonate ONLY	GOALS OF CARE
	To provide appropriate assessment and care of the newborn infant

CCP

• CCT Clinicians of PCEMS will follow the American Heart Association Neonatal Resuscitation Algorithm for neonatal resuscitation
• The newborn should be evaluated immediately after birth and subsequently re-evaluated for respiratory effort, heart rate, and color every 30 seconds during the initial care until the newborn is stable
• Ventilation of the lungs is the **SINGLE** most important & effective action in neonatal resuscitation
  ○ Airway (position and clear)
  ○ Breathing (stimulate to breathe)
  ○ Circulation (assess heart rate and oxygenation)
• Dry, warm, position, provide tactile stimulation, suction mouth then nose when clearing airway
• Calculate APGAR at 1 and 5 minutes as time permits
• Transport the infant in a warm environment

CCT – OB6 NEONATAL RESUSCITATION

CCT



CCT – OB6 NEONATAL RESUSCITATION

ADDITIONAL INFORMATION

Targeted Preductal SpO2 after birth	
1 min	60-65%
2 min	65-70%
3 min	70-75%
4 min	75-80%
5 min	80-85%
10 min	85-95%

Apgar Score (Appearance, Pulse, Grimace, Activity, Respiration)

Calculated at 1 minute and 5 minutes post birth

7-10 is normal, 4-6 is moderately abnormal, 0-3 is abnormal

Score	0 Points	1 Point	2 Points
Appearance (skin color)	Cyanotic/pale	Peripheral Cyanosis	Pink
Pulse (Heart rate)	0	<100 bpm	100-140 bpm
Grimace (reflex irritability)	No response to stimulation	Grimace (facial movement)/weak cry when stimulated	Cry when stimulated
Activity (Tone)	Floppy	Some flexion	Well flexed and resisting extension
Respiration	Apneic	Slow, irregular breathing	Strong Cry

OLMC

- Contact OLMC as needed

PEARLS

Oxygen management for newborn

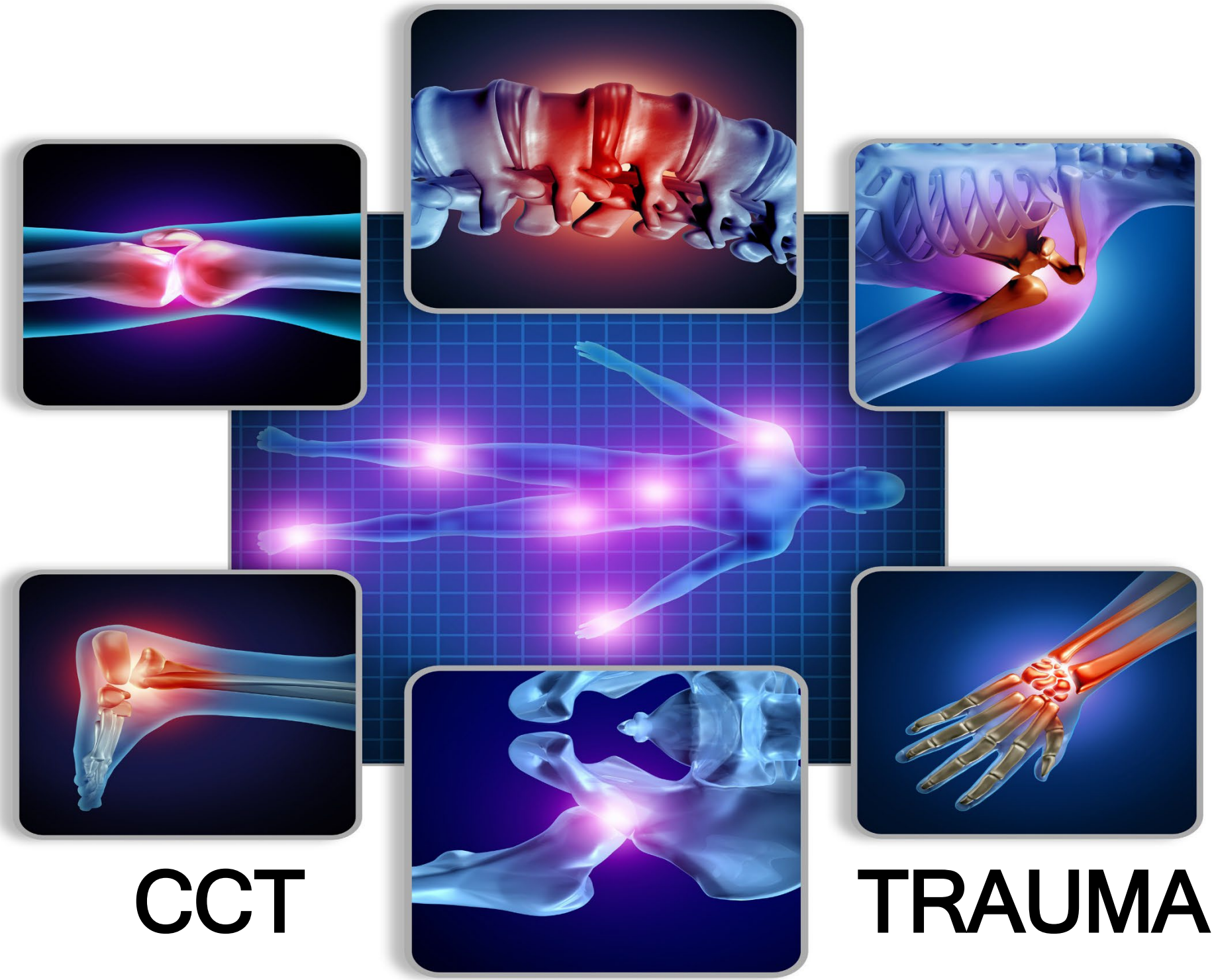
- Start free flow at 30%, liter flow at 10 lpm
- Initial FiO2 for PPV
  - Greater than or equal to 35 weeks gestational age = 21%
  - Less than 35 weeks gestational age = 21-30%
- Use SpO2 to guide oxygen concentration
- Use 100% oxygen during compressions

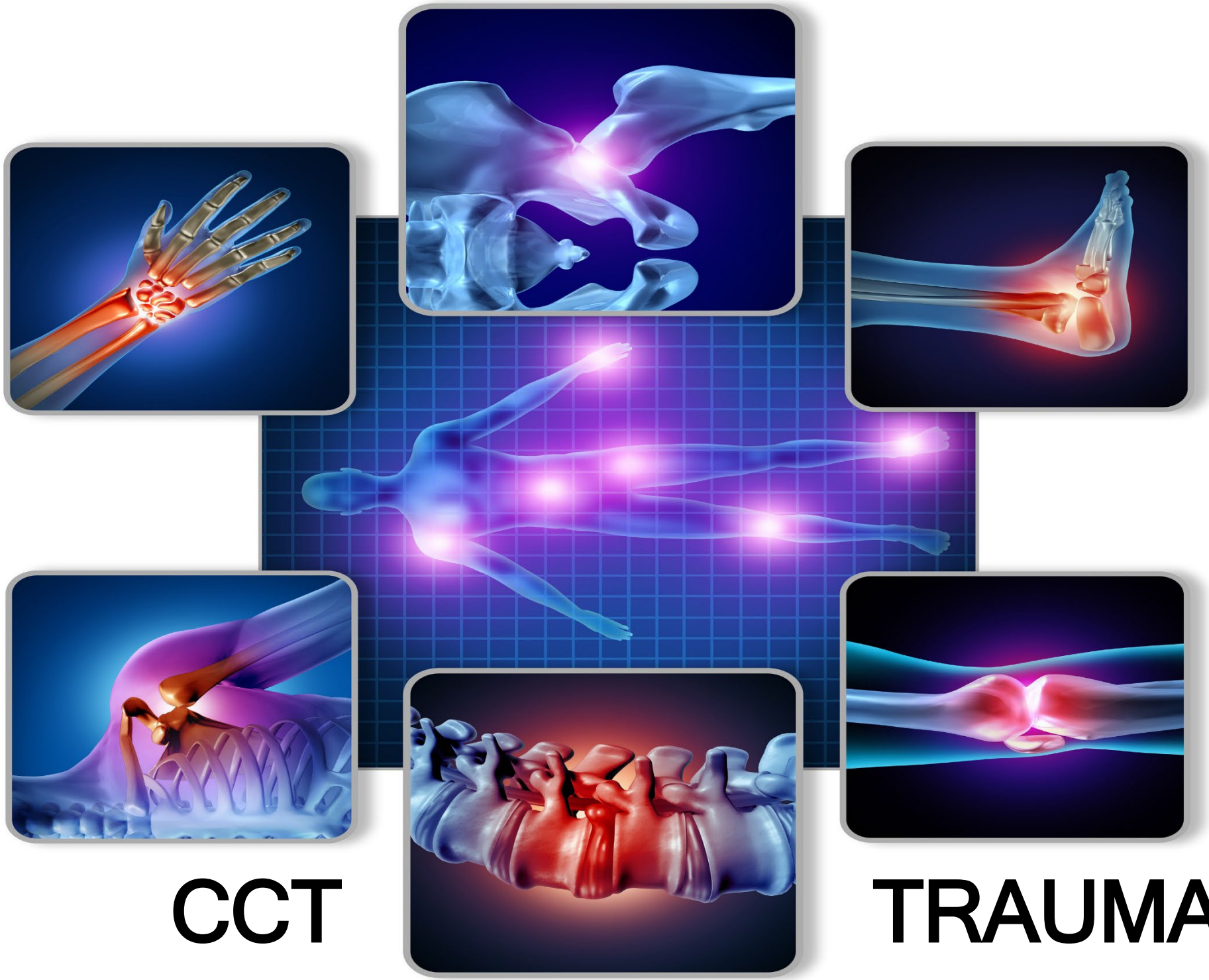
QUALITY MEASURES

- Calls reviewed regularly

CCT – OB6 NEONATAL RESUSCITATION

REFERENCES
• Neonatal Resuscitation Program via the American Academy of Pediatrics • ACOG Clinical – The Apgar Score, Committee Opinion Number 644; https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2015/10/the-apgar-score


CCT
TRAUMA


CCT
TRAUMA

CCT - T1 GENERAL TRAUMA

ADULT and PEDIATRIC	GOALS OF CARE
	Provide safe transport to a trauma facility while optimizing care, reducing morbidity/mortality, and minimizing discomfort

CCP

- Determine mechanism and injuries
- Discuss treatment strategies with sending physician including blood products, coagulopathy correction, TXA, permissive hypotension, calcium, need for orogastric/nasogastric tube placement, need for foley catheter placement, etc. and ensure needed medications and medical products are available for transport.
- Ensure two (2) large bore peripheral IV access sites
  - May substitute central access for one peripheral IV line, if already established
- If time and patient condition allow, update patient and family as to condition and transport plan
- Perform Primary Trauma Survey (XABCDE) and implement stabilizing treatments (expanded from PCEMS MOM Vol. 1 - T1):

X	Control any major, exsanguinating, or life-threatening hemorrhage using direct pressure followed by appropriate device or procedure when indicated (Ref. PCEMS MOM Vol. 1 - CP16 & CP18)
A	• Airway management (BLS maneuvers and adjuncts) as needed and implement spinal precautions as indicated (Ref. PCEMS MOM Vol. 1 - CP1, CP15, CT11) • If external airway is in place prior to arrival, confirm proper placement and secure device prior to transport. • If patient's airway is not secure, establish secure, patent airway (Ref. CCT-CP1)
B	• Provide supplemental oxygen to ensure oxygen saturation as close to 100% as possible • Assist ventilations at 12-16 breaths per minute with bag-valve-mask (BVM) device and appropriate airway adjunct as needed (Ref. PCEMS MOM Vol. 1 - CP1) • If patient on mechanical ventilator upon EMS arrival, assess adequacy of settings and discuss possible changes if needed to maintain oxygen saturations greater than 94% • If tension pneumothorax is present, perform needle decompression immediately (PCEMS MOM Vol. 1 - CP7) and consult with physician for placement of a chest tube prior to transport ○ If simple pneumothorax, monitor and provide supplemental oxygen/support as needed. • Chest Tube – Refer to CCT-CP13 for management

CCT - T1 GENERAL TRAUMA

CCP (cont.)

C	Assess for and treat any ongoing circulation threats:
	• Seal chest wounds (Ref. PCEMS MOM Vol. 1 CP17)
	• Re-assess and ensure hemorrhage control with direct pressure followed by appropriate device or procedure when indicated (Ref. PCEMS MOM Vol. 1 CP16 [if older child/device fits] & CP18)
	• If hypotensive initiate fluid resuscitation with 0.9% sodium chloride in 500 mL increments to target systolic blood pressure (SBP) and maximum volume as indicated:
	  ○ Major/multi-system trauma - Target SBP 80-90 mmHg; max volume 2000 mL
	  ○ Major head injury present – Target SBP 100-110 mmHg; max volume 2000 mL
	  ○ Burns without major/multi-system trauma (Ref. PCEMS MOM Vol. 1 T6)
	• If signs of hemorrhagic shock, reference PCEMS MOM Vol. 1 - T1 & CCT-M5

D	• Assess neurologic function. Maintain EtCO2 35-45 mmHg ○ If signs of herniation, hyperventilate to EtCO2 30-35 mmHg (Ref CCT-T2 for suspected head injuries)
E	Expose patient as indicated to ensure no missed injuries or something smaller and protect from environment/**KEEP WARM**

- Perform a complete head-to-toe physical assessment and ensure additional appropriate stabilizing care is completed:
  - Stabilize impaled objects in place – ***DO NOT REMOVE***
  - Dress wounds - Moist for eviscerations, dry for burns
  - Amputated body parts – Moist sterile inner packaging, ice/cold pack outer packaging
- Splint fractures and dislocations and document distal motor function, circulation, and sensation before and after; Elevate and apply cold packs when practical. Consider removal of tight clothing, jewelry, etc. distal to the injury
- Implement injury-specific additional BLS care as indicated (Ref. PCEMS MOM Vol. 1 - T2-T7)
- Repeat Primary Trauma Assessment (XABCDE) frequently during transport and implement any further needed treatments.
- Provide patient with pain management as needed (Ref. CCT-M1)
- Provide antiemetic for nausea/vomiting as needed (Ref. PCEMS MOM Vol. 1 - M1)

CCT - T1 GENERAL TRAUMA

CCP (cont.)

- Monitor and document chest tube output prior to and during transport. Notify receiving facility with any significant changes in output. Additionally, document any changes in output quality (e.g., serous to bloody)
- Administer high flow oxygen via NRB for suspected cardiac tamponade. Avoid PPV
- Monitor for and treat arrhythmias arising from suspected cardiac contusions

CCT

- Administer Blood Products as indicated (Ref. CCT-CP14)
  - If neurogenic shock, in addition to fluid resuscitation, may consider blood products and/or possible vasopressor agent (Ref. CCT-M5)
- Provide sedation as needed (Ref. CCT-M2, CCT-M3)

OLMC

- Contact OLMC as needed

PEARLS

- Patients who have had their cervical spine cleared do not require re-immobilization prior to transport unless there is a specific indication to do so. A cervical collar should be left in place if present and not previously cleared by the sending facility
- Monitor trauma patients closely. A single episode of hypoxia, hypocapnia, or hypotension increases morbidity and mortality
- Simple pneumothoraces can be monitored; tension pneumothoraces must be addressed.

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- National Model EMS Clinical Guidelines https://nasemso.org/projects/model-ems-clinical-guidelines/

CCT - T2 HEAD TRAUMA

ADULT and PEDIATRIC	GOALS OF CARE
	Optimize physiologic parameters to prevent secondary brain injury and maximize outcomes

CCP

- Discuss treatment plan with sending physician and verify needed medications/products are available from sending facility (e.g., antiepileptics, mannitol, blood, TXA, dexmedetomidine, etc.)
- Conduct primary assessment and address any life threats prior to transport
- Maintain appropriate spinal motion restriction as indicated (Ref. PCEMS MOM Vol. 1 - CP15)
- Elevate head of bed thirty (30) degrees unless prevented by spinal precautions, hypotension, or otherwise ordered by sending physician
- Maintain SBP of 100-110 mmHg or MAP greater than or equal to 65 mmHg
- If patient is already intubated/mechanically ventilated
  - Confirm ventilator settings and adjust as necessary to maintain oxygenation and ventilation
  - Maintain EtCO2 of 35-45 mmHg unless signs of herniation (see Cerebral Herniation – CCT – Bullet #3)
- Assess for signs of intracranial injury (decreasing GCS, evidence of Cushing's Triad, other signs of increasing ICP)
  - If present, consider intubation for the patient (Ref. CCT-CP1, CCT-CP3)
  - Document neurological status prior to RSI/intubation
- Prevent hypothermia

CCT

- If intracranial pressure monitor is in place, document pressure prior to and after transfer to team monitor leaving facility and during transport (Ref. CCT-CP8)
- If patient needs to be intubated, Document neurological status prior to RSI/intubation
- Titrate interventions to maintain adequate cerebral perfusion pressure (CPP):
  - Goal CPP equal to 50-70 mmHg
  - Ensure adequate sedation as part of ICP management (Ref. CCT – M3)
  - Ensure adequate blood pressure to support ICP
- If signs of active cerebral herniation (e.g., decreasing GCS, Cushing's response, significant elevation in ICP, decorticate/decerebrate posturing, unilateral dilated/non-responsive pupil, etc.) develop:
  - Increase ventilator rate to achieve **EtCO2 of 30-35 mmHg**
  - Avoid hypocapnia of EtCO2 less than 30 mmHg – single reading below 30 mmHg increases morbidity and mortality.
  - Administer mannitol 1 gram/kg IV or intraosseous over thirty (30) minutes (adults and pediatrics)
- Monitor for seizure activity and treat per CCT-N1
- Monitor blood glucose and administer dextrose for hypoglycemia

CCT - T2 HEAD TRAUMA

OLMC

- Contact OLMC as needed

PEARLS

- Maintain Cerebral Perfusion Pressure (CPP = MAP – ICP)
- Avoid SBP less than 90 mmHg, SpO2 less than 90%, and EtCO2 less than 35 mmHg (unless herniation is suspected, then no lower than 30 mmHg)
- Up to 25% of the population has unequal pupils at baseline. When assessing herniation, evaluate for a “blown pupil” which is maximally dilated

QUALITY MEASURES

- Calls reviewed regularly

REFERENCES

- Critical Care Transport, 2nd Edition, AAOS
- Spaite DW, Bobrow BJ, Keim SM, Barnhart B, Chikani V, Gaither JB, Sherrill D, Denninghoff KR, Mullins T, Adelson PD, Rice AD, Viscusi C, Hu C. Association of Statewide Implementation of the Prehospital Traumatic Brain Injury Treatment Guidelines With Patient Survival Following Traumatic Brain Injury: The Excellence in Prehospital Injury Care (EPIC) Study. JAMA Surg. 2019 Jul 1;154(7):e191152. doi: 10.1001/jamasurg.2019.1152. Epub 2019 Jul 17. PMID: 31066879; PMCID: PMC6506902

CCT CLINICAL PROCEDURES

CCT CLINICAL PROCEDURES

CCT - CP1 ADULT AIRWAY MANAGEMENT

INDICATIONS

- Safely and effectively perform airway management in the mobile critical care environment. Optimize conditions for successful endotracheal intubation by employing appropriate equipment, techniques, and training while minimizing risk and discomfort to the patient
- Prehospital airway management by the Critical Care Team will be approached in a stepwise fashion as below, always being prepared to rapidly move to the next step if unsuccessful

CONTRAINDICATIONS

- None

CAUTIONS

- EXTREME CAUTION should be exercised prior to attempting Rapid Sequence Intubation (RSI) in a patient with anticipated difficult airway or poor physiological baseline
- Nasotracheal intubation is NOT AUTHORIZED in Pinellas County

PROCEDURE

1. Any patient requiring ventilatory assistance will be managed with bag-valve-mask (BVM) ventilation, non-invasive positive pressure ventilation (NIPPV) or non-rebreather mask (NRB) as clinically indicated until the need for an advanced airway is present, choice of advanced airway device is made, and preparations for placement are complete
   a. A patient who has a functional tracheostomy shall be ventilated via their tracheostomy
2. A patient in cardiac arrest or in whom endotracheal intubation (ETI) is anticipated to be especially difficult will have the King Airway device employed primarily
   a. Other patients will have endotracheal intubation using RSI and video laryngoscopy unless contraindicated
3. If the initial device (ETI, King, tracheostomy replacement, etc.) is unsuccessful, an alternative advanced device should be attempted
   a. If the selected advanced devices are unsuccessful, bag-valve-mask (BVM) ventilations should be employed as a temporizing measure until arrival at hospital
4. If endotracheal intubation, King Airway placement, and bag-valve-mask (BVM) ventilation are all unsuccessful, a surgical cricothyroidotomy will be performed as rescue airway (Ref. PCEMS MOM Vol. 1 - CP2)

COMPLICATIONS

- Inability to adequately ventilate/oxygenate
- Local trauma related to selected airway management strategy
- Physiological complications of positive pressure ventilation strategies

NOTES

- Every patient should receive an evaluation for airway difficulties prior to administration of sedatives and paralytics
- Adequate sedation must ALWAYS be given with paralytics. Use of intramuscular paralytics will have prolonged time of onset

CCT - CP1 ADULT AIRWAY MANAGEMENT

CCT - CP 1.1 BAG VALVE MASK VENTILATION

INDICATIONS
• Respiratory insufficiency/failure/arrest • Pre-oxygenation prior to advanced airway placement attempt

CONTRAINDICATIONS
• None

CAUTIONS
• An effective seal may be difficult in a patient with an abnormal facial shape, beard, lack of teeth, and/or facial trauma • Watch for aspiration risk with positive pressure (e.g., emesis, bleeding, etc.)

PROCEDURE
• Assemble equipment per manufacturer's instructions and connect to oxygen source • Attach EtCO2 filterline set (appropriate size) between mask and bag-valve device • Place OPA/NPA if patient able to tolerate and not contraindicated (NPA contraindicated in head/facial trauma) • Utilizing 2-person technique whenever possible, ventilate at baseline rate of 12-16 breaths per minute unless clinically indicated • Adjust ventilation rate to achieve adequate oxygen (O2) saturation and EtCO2 35-45 mmHg unless clinical scenario necessitates therapeutic hyperventilation (with goal EtCO2 30-35 mmHg)

COMPLICATIONS	
• Inability to maintain adequate seal • Inappropriate hyperventilation • Gastric distension	• Hypotension and/or pneumothorax resulting from positive pressure ventilation

NOTES
• None

CCT - CP1 ADULT AIRWAY MANAGEMENT

CCT - CP1.2 NON-INVASIVE POSITIVE PRESSURE VENTILATION (NIPPV)

INDICATIONS
• Obstructive airway pathology or pulmonary edema leading to respiratory failure • Pulmonary edema, COPD exacerbation, pneumonia with worsening hypoxia, asthma, cystic fibrosis, increased work of breathing/respiratory fatigue, hypoxemia, hypercarbia

CONTRAINDICATIONS
• Altered mental status • Vomiting and risk of aspiration • Non-compliance

CAUTIONS
• Effective seal may be difficult in a patient with an abnormal facial shape, beard, lack of teeth, and/or facial trauma • NIPPV with a transport ventilator is similar to but NOT identical to hospital BiPAP machine • Use caution with NIPPV in a patient with hypotension as all positive pressure ventilation modes may worsen hemodynamic status • Monitor for hypotension or signs of pneumothorax • Apnea is a contraindication for NIPPV. Monitor for need for advanced airway and ventilatory support

PROCEDURE

• Perform initial patient assessment and connect patient to CCT monitoring equipment
• Select and fit mask:
  ○ If using CCT mask (preferred):
  ▪ Assemble equipment per manufacturer instructions
  ▪ Ensure appropriate mask size selected
  ▪ Ensure adequate seal and inspect for any leaks
  ○ If transitioning from facility machine, choose initial settings to match as closely as possible. If using hospital mask:
  ▪ Confirm baseline settings
  ▪ Remove exhalation port adapter when changing to CCT vent
  ▪ Inspect patient mask to determine compatibility with CCT ventilator and patient seal.
  ▪ Assess for any air leaks as these may trigger alarms or significantly alter the level of respiratory assistance being provided
• Determine initial parameters:
  ○ If initiating NIPPV without prior clinical guidance, initial settings should be:
  ▪ Inspiratory pressure: 10 cmH20
  ▪ Expiratory pressure: 5 cm H20
  ▪ FiO2: 100%

PROCEDURE (cont.)

- If continuing therapy in place at facility, may match facility settings

- Perform initial setup of ventilator as below:
  - LTV 1200 Ventilator Quick Setup (Ref. CCT-CT3 for full quick guide)
    - Power on LTV1200 ventilator
    - SAME PATIENT is displayed
      - Rotate selector to NEW PATIENT, press and release SELECT button
    - INFANT is displayed, rotate selector to appropriate patient size and press SELECT
      - The ventilator will begin cycling with default settings for this patient size
    - Press and release the "Assist/Control, SIMV/CPAP" mode button until the NPPV LED flashes. Press the button once more to confirm
      - The "NPPV" LED will continue to flash. "SET IPAP" will be displayed. The Pressure Support Control display will be bright. All other controls will be dim
    - Adjust the IPAP utilizing the Set Value Dial and watching the Pressure Support LED window
      - As the IPAP is set remember this is an additive, or closed system. The actual IPAP will equal the final PS + PEEP
    - Once the IPAP is set as desired, press the PRES. SUPPORT button to confirm.
      - "SET EPAP" will display. The PEEP Control display will be bright. All other controls will be dim
    - Turn the Set Value dial to adjust the EPAP setting
      - 5 cmH_2O is often a good starting point for the EPAP setting. Adjust the EPAP to correct oxygenation problems. **MAXIMUM EPAP 10 cmH20**.
    - Press the PEEP button to confirm the desired EPAP setting
    - Maintain a 5 to 8 cmH_2O difference between inspiratory and expiratory pressures
      - REMEMBER THAT THE LTV1200 COMPENSATES FOR PEEP. To avoid gastric insufflation, the total PIP should not exceed 20 cmH2O
        - Set an Inspiratory Time of 0.8 to 1.2 seconds. Note Inspiratory Time from facility machine
        - The sensitivity is likely to need to be set significantly higher than would be typical for standard mechanical ventilation to avoid assisting the patient more than they are comfortable with

- Titrate ventilator settings as below:
  - Titrate FiO2 to maintain SpO2 greater than 94%
  - Titrate IPAP up in increments of 2 cmH_2O to support oxygenation
  - Titrate EPAP up in increments of 2 cm H_2O to support ventilation
  - When adequate oxygenation and ventilation achieved, titrate IPAP/EPAP down as tolerated for patient comfort and titrate FiO2 down to prevent prolonged unnecessary oxygen stress
    - Monitor patient for mental status decline, worsening respiratory failure, and progression to need for advanced airway/full ventilator support

CCT - CP1 ADULT AIRWAY MANAGEMENT

REFERENCES
• https://err.ersjournals.com/content/27/149/180029 • Revel Ventilator Operators Manual • LTV1200 Ventilator Operators Manual

CCT - CP1 ADULT AIRWAY MANAGEMENT

CCT – CP1.3 ADULT RAPID SEQUENCE INTUBATION

INDICATIONS
• Respiratory failure and/or inability to protect the airway

CONTRAINDICATIONS
• Allergy or adverse reaction to any of the medications • Relative contraindication – Inability to ventilate with BVM

CAUTIONS

SAFETY ALERT

EXTREME CAUTION should be exercised prior to attempting Rapid Sequence Intubation in a patient whom airway management is anticipated to be particularly difficult

****THIS PROTOCL REQUIRES BOTH THE CCT RN AND CCT PARAMEDIC TO BE PRESENT****

PROCEDURE

1. Ensure two (2) large bore peripheral IV access sites
    - May substitute central access for one peripheral IV line, if already established
2. Pre-oxygenate patient, ideally for at least 3-5 minutes
    - Utilize high flow oxygen via standard nasal cannula (non-EtCO2 - maximum oxygen flow) in addition to NRBM (maximum oxygen flow)
    - BVM may be used on a patient with inadequate respiratory effort, but caution must be taken to avoid gastric insufflation
3. Assemble all needed equipment within reach of operator (video laryngoscope and laryngoscope blades, conventional laryngoscope and laryngoscope blades, appropriately sized endotracheal tube, lubrication, syringe, suction, BVM, OPA/NPA, Bougie, EtCO2 monitoring, appropriately sized extra glottic airway device as backup). Test equipment prior to initiating procedure
4. Choose and prepare appropriate induction agent (choose only one agent):
    - Etomidate - 0.3 mg/kg IV
    - Ketamine - 2 mg/kg IV
    - Midazolam - 0.2 mg/kg IV (0.1 mg/kg IV if patient is hypotensive)
5. Choose and prepare appropriate paralytic (choose only one agent)
    - Rocuronium - 1 mg/kg IV
    - Succinylcholine - 1.5 mg/kg IV
        - Avoid in renal disease/dialysis, trauma/crush injury, burns, and history of malignant hyperthermia
6. Prepare video laryngoscope (insert battery, select proper blade size, remove protective lens cover, slide blade onto camera stick and secure in place with clip)

CCT - CP1 ADULT AIRWAY MANAGEMENT

PROCEDURE (cont.)

7. Administer sedative and wait 15-30 seconds for effect and then administer paralytic. Flush IV line after each medication administration with 0.9% normal saline
8. After medication effect verified, perform video laryngoscopy (1st choice) or direct laryngoscopy (2nd choice) and pass ET tube so the cuff is just distal to the vocal cords
    - Max 15 seconds per attempt and two (2) combined attempts TOTAL
9. Inflate balloon and assess for bilateral breath sounds, quiet epigastrium, and confirm placement with EtCO2 waveform
    - **Use of continuous waveform capnography is mandatory for any patient receiving ventilator assistance**
10. If suspected mainstem intubation (diminished sounds unilaterally) – deflate ETT cuff, retract ET tube 1-2 cm, reinflate cuff and re-assess positioning
11. Secure tube with commercial tube holder
12. If intubation is unsuccessful after two (2) attempts, place extra glottic airway (Ref. PCEMS MOM Vol. 1 - CP1.2)
13. Ventilate at baseline rate of 12-16 breaths per minute. Adjust ventilation rate to achieve adequate O2 saturation greater than 94% and EtCO2 35-45 mmHg
    - Adjust as disease state indicates
14. Provide ongoing sedation (Ref. CCT-M3)
15. Contact OLMC for consideration of additional doses of induction agents and/or paralytics
16. Continue to monitor and reassess as necessary

COMPLICATIONS

- Adverse reaction(s) to medication(s)
- Ineffective sedation/paralysis
- Esophageal intubation
- Mainstem intubation
- Peri-intubation hypotension
- Difficulty with ongoing sedation
- Unrecognized displacement
- Pneumothorax because of PPV

NOTES

- Rocuronium has a slower onset of paralysis but lasts longer
    - Dose of rocuronium can be increased to achieve faster paralysis but will have longer duration
- Any patient receiving a paralytic must receive adequate doses of sedation

CCT – CP2 PEDIATRIC AIRWAY MANAGEMENT

BACKGROUND
Pediatric prehospital airway management is particularly anxiety inducing and requires an organized stepwise approach. Research has demonstrated that outcomes are equivalent in pediatric patients managed with either prehospital bag-valve-mask or endotracheal intubation **Pediatric RSI should be reserved for exceptional circumstances when non-invasive means have failed** Airway management techniques are similar to adult techniques but keep in mind changes in anatomy and physiology that alter airway positioning and ventilation settings

CP2.1 BAG-VALVE-MASK VENTILATION

INDICATIONS
• Inability to maintain airway • Obstructive lung pathology

CONTRAINDICATIONS
• Allergy or adverse reaction to any of the medications • Relative contraindication – inability to ventilate with BVM

CAUTIONS
• Effective seal is crucial and may be difficult in a pediatric patient • Facial trauma may further complicate

PROCEDURE
1. Assemble equipment per manufactures instructions and connect to oxygen source 2. Attach EtCO2 filterline set (appropriate size) between mask and bag-valve device 3. Position patient in “sniffing position”. Place a folded sheet under the scapulae for a patient less than two (2) years old or under the occiput for a patient older than two (2) years 4. Place NPA/OPA if patient tolerates (and no contraindications such as facial trauma) 5. Utilizing 2-person technique whenever possible, ventilate at baseline rate of 12-16 breaths per minute unless clinically indicated 6. Adjust ventilation rate to achieve adequate oxygen (O2) saturation and EtCO2 of 35-45 mmHg unless clinical scenario necessitates therapeutic hyperventilation (with goal EtCO2 30-35 mmHg)

COMPLICATIONS	
• Inability to maintain adequate seal • Inappropriate hyperventilation • Gastric distension	• Hypotension and/or pneumothorax resulting from positive pressure ventilation

CCT – CP2 PEDIATRIC AIRWAY MANAGEMENT

CP2.2 RAPID SEQUENCE INTUBATION

INDICATIONS
• Respiratory insufficiency, failure and/or arrest

CONTRAINDICATIONS
• None

CAUTIONS
• Endotracheal intubation in children will alter hemodynamic status • May be difficult with facial/neck trauma, blood, or other secretions in the airway • Patient may have limited mobility or congenital malformation of neck or jaw

PROCEDURE

1. Refer to PCEMS Handtevy Pediatric Equipment and Medication Guidebook, for recommendations on medication dosages, equipment sizes and normal respiratory rate for patient age
2. Ensure two (2) or more functional IV/intraosseous access lines
    - May substitute central access for one peripheral IV line if already established
3. Pre-oxygenate patient, ideally for at least 3-5 minutes
    - Utilize high flow oxygen via nasal cannula (non-EtCO2 - maximum oxygen flow) in addition to NRBM (maximum oxygen flow)
    - BVM may be used on a patient with inadequate respiratory effort, but caution must be taken to avoid gastric insufflation
4. Assemble all needed equipment within reach of operator (video laryngoscope and laryngoscope blades, conventional laryngoscope and laryngoscope blades, appropriately sized endotracheal tube, lubrication, syringe, suction, BVM, OPA/NPA, Bougie, EtCO2 monitoring, and OG tube). Test equipment prior to initiating procedure
5. Consider pretreatment with atropine
    - 0.02 mg/kg IV
        - Minimum dose - 0.1 mg
        - Maximum dose - 0.4 mg
6. Choose and prepare appropriate induction agent (choose only one agent):
    - Etomidate (age greater than or equal to 6 months) - 0.3 mg/kg IV
    - Ketamine - 1 mg/kg IV
    - Midazolam - 0.1 mg/kg IV
7. Prepare appropriate paralytic (choose only one agent)
    - Rocuronium - 1 mg/kg IV (first line in a pediatric patient)
    - Succinylcholine - 2 mg/kg IV
        - Avoid in renal disease/dialysis, trauma/crush injury, burns, and history of malignant hyperthermia

CCT – CP2 PEDIATRIC AIRWAY MANAGEMENT

PROCEDURE (cont.)

8. Prepare video laryngoscope (insert battery, select proper blade size, remove protective lens cover, slide blade onto camera stick and secure in place with clip)
9. Administer sedative and wait 15-30 seconds for effect and then administer paralytic. Flush IV line after each medication administration
10. After medication effect verified, perform video laryngoscopy (1st choice) or direct laryngoscopy (2nd choice) and pass ET tube so cuff is just distal to the vocal cords
    - Max 15 seconds per attempt and two (2) combined attempts TOTAL
    - If unsuccessful after two (2) attempts, reassess airway, apply BVM oxygenation and prepare for two (2) additional attempts
    - If still unsuccessful after four (4) attempts, contact OLMC
11. Inflate balloon (if present) and assess for bilateral breath sounds, quiet epigastrium, and confirm placement with EtCO2 waveform
    - **Use of continuous waveform capnography is mandatory for any patient receiving ventilator assistance**
12. If suspected mainstem intubation (diminished sounds unilaterally) – deflate ETT cuff, retract ET tube 0.5-1 cm, reinflate cuff and re-assess positioning
13. Secure tube with commercial tube holder
14. Select age appropriate initial ventilatory rate. Adjust ventilation rate to achieve adequate O2 saturation and EtCO2 35-45 mmHg
    - Adjust as disease state indicates
15. Provide ongoing sedation (Ref. CCT-M3)
16. Consider need for continued chemical paralysis, contact OLMC for discussion prior to administering continued paralysis

COMPLICATIONS

- Inability to place tube
- Esophageal placement
- Unrecognized displacement
- Hypotension and/or pneumothorax resulting from positive pressure ventilation

COMPLICATIONS

- Adverse reaction(s) to medication(s)
- Ineffective sedation/paralysis
- Esophageal intubation
- Mainstem intubation
- Peri-intubation hypotension
- Difficulty with ongoing sedation
- Unrecognized displacement
- Pneumothorax because of PPV

NOTES

- Pediatric patients have difficult airways due to anatomical and physiological differences – anterior airway, “floppy” epiglottis, large tongue to mouth ratio, large occiput

CCT – CP2 PEDIATRIC AIRWAY MANAGEMENT

REFERENCES

- Kneyber MCJ, de Luca D, Calderini E, Jarreau PH, Javouhey E, Lopez-Herce J, Hammer J, Macrae D, Markhorst DG, Medina A, Pons-Odena M, Racca F, Wolf G, Biban P, Brierley J, Rimensberger PC; section Respiratory Failure of the European Society for Paediatric and Neonatal Intensive Care. Recommendations for mechanical ventilation of critically ill children from the Paediatric Mechanical Ventilation Consensus Conference (PEMVECC). Intensive Care Med. 2017 Dec;43(12):1764-1780. doi: 10.1007/s00134-017-4920-z. Epub 2017 Sep 22. PMID: 28936698; PMCID: PMC5717127.

CCT – CP3 TRACHEOSTOMY CHANGE

INDICATIONS

- Tracheostomy obstruction or failure

CONTRAINDICATIONS

- Tracheostomy placed less than seven (7) days ago indicating immature tract

CAUTIONS

- Hemorrhage
- Pneumothorax
- Subcutaneous emphysema
- Dislodged tube
- Tracheal damage

PROCEDURE

1. Explain the procedure to the patient if able
2. Plan for backup airway as clinically indicated should you be unable to place a new tracheostomy
3. Gather necessary equipment
   - Sterile gloves
   - Sterile tracheostomy tube, dressing, trach ties
   - Saline solution or water-soluble lubrication
   - Sterile 10 mL syringe
4. Leave tracheostomy tube in its sterile packaging and add a small amount of water- soluble sterile lubrication
5. Position the patient supine with support under shoulder to hyperextend the neck (if patient tolerates)
6. Don sterile gloves
7. Insert tracheostomy tie through slit in the flange of the outer cannula
8. Ensure that the obturator and inner cannula properly fit the outer cannula. If a cuffed tracheostomy tube is used, assess the integrity of the cuff. Refer to package instructions for specific information
9. Place the obturator in the outer cannula
10. Lubricate the tip of the obturator and outer cannula with sterile saline solution or water-soluble lubricant
11. Ensure that the tracheostomy cuff of the tube to be removed is deflated
12. While holding the tracheostomy tube in place, cut the ties of the tube to be removed
13. Remove the malfunctioning tracheostomy tube from the stoma and immediately insert the sterile replacement tracheostomy tube. During insertion, the obturator should be held securely inside the outer cannula
14. After insertion of the tube, withdraw the obturator immediately
15. Secure the tie in a triple knot at the side of the neck. Tension of tie should allow for easy placement of an index finger underneath the tie. A velcro tracheostomy tube strap is another option
16. Insert the inner cannula and lock in place. Inflate the tracheostomy cuff (if ordered)

CCT – CP3 TRACHEOSTOMY CHANGE

PROCEDURE (cont.)

17. Place the sterile tracheostomy dressing/drain sponge next to the skin surface under the neck plate
18. Ensure that the obturator is readily available for reinsertion of the tube if displaced
19. Discard disposable equipment

COMPLICATIONS

- False tract formation
- Loss of airway
- Tracheal trauma

NOTES

- The patient's airway should be cleared by coughing or suctioning prior to changing the tracheostomy tube.
- The obturator is to remain with the patient at all times.
- A second complete sterile tracheostomy tube of the same size should be readily available.
- It is recommended that two CCT members be present during the tracheostomy tube change

REFERENCES

- Tracheostomy Tube Change https://www.ncbi.nlm.nih.gov/books/NBK555919/

CCT – CP4 MECHANICAL VENTILATION

INDICATIONS

- Provide ongoing ventilator support of the intubated patient during transport as well as initiation of ventilatory support after endotracheal intubation as clinically indicated

CONTRAINDICATIONS

- None

CAUTIONS

- Patients requiring mechanical ventilation need constant monitoring with adjustments to their ventilatory settings to avoid further deterioration as well as prevention of barotrauma

PROCEDURE

Patients receiving new ventilatory support (e.g., EMS Initiated):

- Confirm patent airway device prior to initiating mechanical ventilation
- PCEMS CCT default ventilator settings: AC Mode, Rate of 16, Tv 6 mL/kg, FiO2 100%, PEEP 5 cmH_2O
- Titrate minute ventilation (Tv x rate) to achieve adequate ventilation/EtCO2 35-45 mmHg
- Titrate FiO2 and PEEP to achieve adequate oxygenation/SpO2 greater than 94%
- Continue titration of ventilatory settings as below
- If unable to achieve adequate oxygenation and ventilation with default settings and titration, consider alternate ventilatory modes as below

Patients on pre-existing ventilatory support being transitioned for transfer:

- Determine baseline settings
- Confirm patent airway device
- Determine if patient optimized or stable on sending facility settings
  - If YES – continue
  - If NO - discuss with sending MD/RT or OLMC prior to transitioning to EMS ventilator
- Attach patient to prepared ventilator:
  - Once ventilator settings have been input in the transport ventilator, hold the "**Select**" button for 3 seconds, "Standby?" appears
  - Press Select, "**Confirm?"** appears
  - Press Select, "**IN STANDBY!"** appears
    - The ventilator is now in standby mode (not delivering any ventilatory support) and ready to ventilate once crew is ready to connect to the patient. This will hold all pre-set parameters without the need to turn off the ventilator
  - Once circuit is attached and crew is ready to connect to the patient, press the "**Exit**" button on the upper panel and the ventilator will initiate ventilations using the parameters that were set by the team

CCT – CP4 MECHANICAL VENTILATION

PROCEDURE (cont.)

Ongoing Titration of Mechanical Ventilation:

- Lung protection
  - Tidal volume should be based on the patients Ideal or Predicted Body Weight (Ref. CCT-CT6)
  - Ideal body weight is calculated based on height measured in inches
    - Male: 50 + 2.3 (height – 60)
    - Female: 45.5 + 2.3 (height – 60)
  - Can utilize Clinical Tool for Predicted Body Weight (Ref CCT-CT6)
  - Reduce tidal volume until P_{plat} (plateau pressure) less than 30 cmH_2O
    - Tidal volumes can be as low as 4 mL/kg if necessary
    - CAUTION: Consider increasing rate to maintain minute ventilation (V_e); monitor I:E ratio and avoid inverse ratio ventilation
- Oxygenation
  - Initial FiO2 should be 100% until SpO2 is identified or obtained and is greater than 94%
  - PEEP should be set at 5 cmH2O. PEEP may be increased to reduce FiO2 requirements in the long-term setting
- Ventilation
  - Ventilatory rate - Used to control minute ventilation to adjust pCO2 and acidosis
    - (Current respiratory rate X pCO2) / Desired pCO2 = new respiratory rate
  - Initial respiratory rates (per minute)
    - Adult: 8-12
    - Child: 12-20
    - Infant/small child: 20-30
    - CAUTION – adjust as necessary based on disease state to avoid worsening acid/base disorders
- Flow and I:E ratio
  - I:E ratio = ratio of inspiratory (I) time vs. expiratory (E) time during 1 breath cycle, independent of the respiratory rate
  - Reducing the i-Time increases flow (VCALC) and increases Peak Inspiratory Pressure (PIP)
  - Be alert to I:E ratio and avoid inverse ratio ventilation

CCT – CP4 MECHANICAL VENTILATION

PROCEDURE (cont.)

Selection of Alternate Modes:

- If unable to achieve adequate ventilatory support with default settings (as above), consider switching to an alternate mode as follows:
  - Assist Control (A/C) - Used for full control of the intubated patient's ventilations
  - Synchronized Intermittent Mandatory Ventilation (SIMV) - Used to assist or supplement spontaneous efforts initiated by the patient's own respiratory drive
  - Continuous Positive Airway Pressure + Pressure Support (CPAP+PS) - Used to supplement or assist both intubated and non-intubated patient's respiratory drive
  - Volume Control (VC)
  - Used to deliver a set (constant) tidal volume over a set inspiratory time and ensuring a minimum minute ventilation. Can be machine or assist breaths. Volume control breaths are time cycled.
  - Generally, well tolerated for most patients unless:
    - Ventilation is suboptimal due to high PIP alarms
    - Poor oxygenation exists, despite appropriate alveolar recruitment with PEEP to 20 cmH_2O
    - Flow requirements cannot be met with current compliance and inspiratory times
  - Pressure Control (PC)
    - Used to control respiratory pressure levels while optimizing peak airway pressures. Elevates the pressure to the pressure control setting, above set PEEP, and maintains that pressure for the set inspiratory time. Pressure Control breaths may be machine or assist breaths.
    - Should be considered for pediatric patients
    - Less risk of barotrauma compared to other breath types
    - Ability to ventilate many pathologies
    - Tidal volumes vary breath to breath
  - Pressure Regulated Volume Control (PRVC)
    - Used to deliver target tidal volumes and set rates with the lowest possible (minimum) inspiratory pressure. Ventilator delivers breaths at a target pressure that is calculated before each breath. The target pressure is the pressure needed to deliver a Tidal Volume equal to the set Tidal Volume
    - The target pressure is adjusted as patient's pulmonary compliance changes, based on the desired volume
    - The maximum allowed target pressure will be at least 5 cmH_20 less than the set High Airway Pressure Alarm setting

COMPLICATIONS

- Barotrauma/pneumothorax
- Difficulty finding ventilation mode best suited to patient's pathology

CCT – CP4 MECHANICAL VENTILATION

NOTES
• Pending

REFERENCES
• https://www.gehealthcare.com/-/media/15110907ca764a3f9ff4c1442434588f.pdf • LTV 1200 Ventilator Operators Manual

CCT – CP5 SWAN-GANZ CATHETER

INDICATIONS

- Assess and detect inadequate perfusion in states of complex hemodynamic instability, some combination of obstructive, cardiogenic, distributive, and hypovolemic shock
- Monitoring cardiac output measurements
- Evaluation or diagnosis of Pulmonary Hypertension
- Titration of therapies to specific hemodynamic endpoints as instructed by sending facility

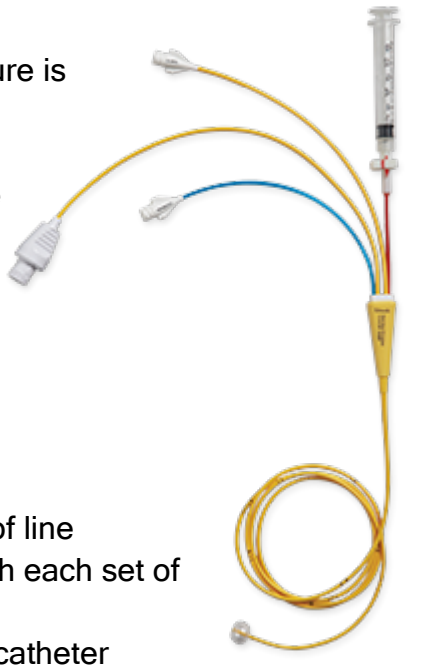
CONTRAINDICATIONS

- Tricuspid or pulmonary valve prosthesis or vegetation
- Endocarditis
- Right heart mass (tumor or thrombosis)

CAUTIONS

- Risk of cardiac irritation and dysrhythmias
- Extended wedging places patient at risk of pulmonary infarct–ENSURE CATHETER IS NOT WEDGED PRIOR TO DEPARTING FACILITY!
- All signs of incidental wedging of the PA catheter will be dealt with quickly and efficiently.
- All signs of catheter displacement will be dealt with quickly and efficiently.

PROCEDURE



1. Obtain and record the Pulmonary Artery Pressure (PAP) Systolic/Diastolic and Mean pressure readings from referring facilities monitor
2. If a “wedge” or Pulmonary Artery Capillary Wedge (PCWP) pressure is needed, obtain from referring facility/staff.

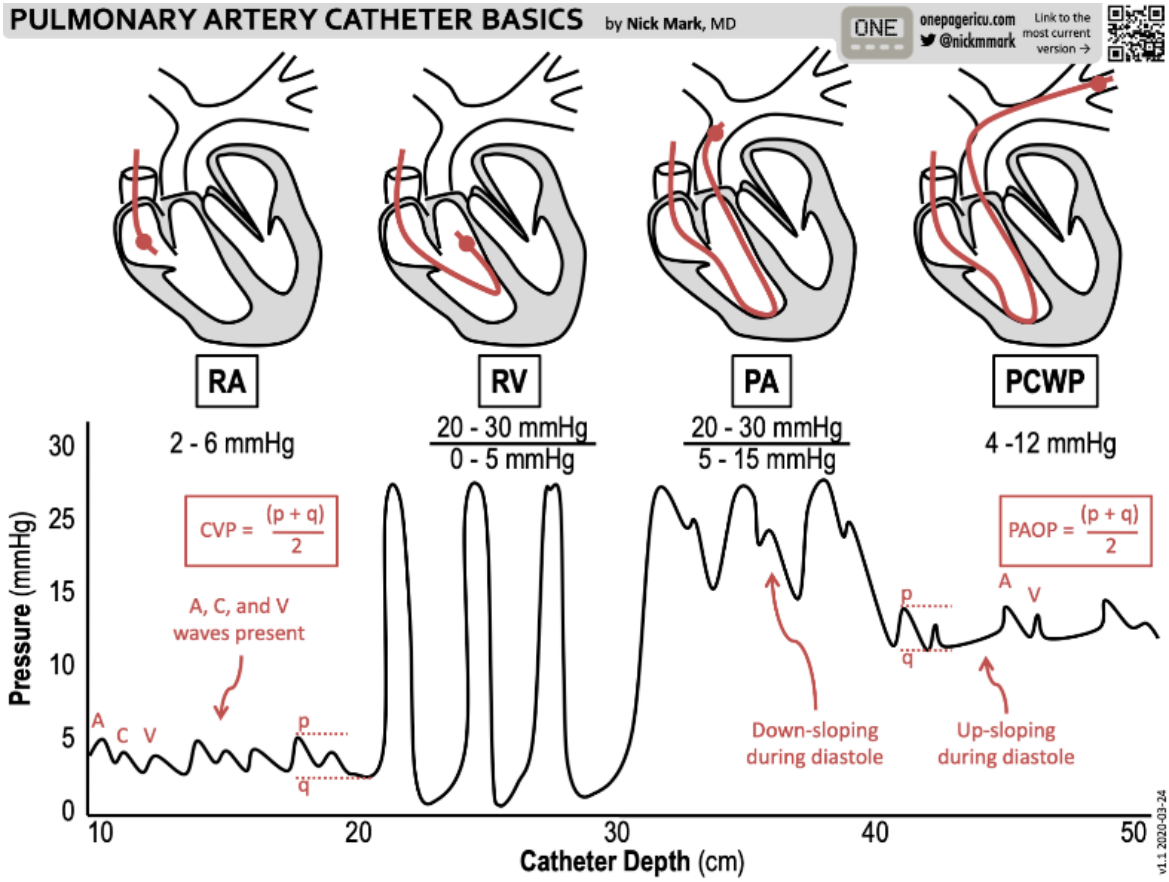
   NOTE: CCT Team members are prohibited from obtaining Wedge pressures

3. Inspect and document the insertion site. Include the Swan-Ganz insertion depth
   - Secure transducer at phlebostatic axis
   - Attach invasive cable to pressure line and CCT monitor
   - When ready, zero the pressure line
   - Document zeroing, waveform, pressure readings, and depth of line
4. Pressure readings with mean pressure should be documented with each set of vital signs
5. Document all interventions that take place regarding Swan-Ganz catheter
6. Label all pressure tracings and document the tracings on the patient care report.
7. If inadvertent displacement of catheter to ventricle is suspected (ventricular ectopy + ventricular waveform):
   - Deflate balloon and withdraw catheter until RA waveform is obtained
   - Secure catheter, change any drips to distal port and closely monitor ECG

CCT – CP5 SWAN-GANZ CATHETER

PROCEDURE (cont.)

8. Never advance catheter



COMPLICATIONS

- Pneumothorax
- Air embolism
- Vessel rupture
- Thromboembolism
- Pulmonary infarct

NOTES

- None

REFERENCES

- Rodriguez Ziccardi M, Khalid N. Pulmonary Artery Catheterization. [Updated 2021 Aug 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482170/

CCT – CP6 INTRACRANIAL PRESSURE (ICP) MONITORING

INDICATIONS

- Monitoring in conditions that increase intracranial pressure (such as hemorrhage, edema, TBI, post craniotomy/surgery, space occupying lesions, malabsorption of CSF)

CONTRAINDICATIONS

- Patients receiving anticoagulants or who have had a bleeding disorder
- Scalp infections

CAUTIONS

- Use only sterile 0.9% sodium chloride to fill the pressure tubing and NEVER use a heparinized solution
- Maintain tight/secure connections
- Always have the patient alarms activated
- Keep the system free of air to ensure maximal accuracy
- Maintain proper leveling and zeroing of the system (proper level for the transducer being the Foramen of Monro measured at the level of the tragus/inner ear or the outer canthus of the eye)
- Notify sending/receiving physician if blood is seen in the pressure tubing

PROCEDURE

- Maintain patient's head position per physician's order (usually 30 degrees)
- Check and document dressing site and appearance
- Confirm in physician orders, level of drain and any other patient specific monitoring requirement
- If tubing becomes occluded during transport, do not flush or manipulate line. Notify receiving staff upon arrival
- Document in ePCR drainage amount, color, ICP and any other pertinent information

Monitoring ICP Waveforms:

- Transducer must be kept at external auditory canal with head of bed at a consistent level (usually 30 degrees)
- Zero and calibrate line after moving patient to stretcher

Zeroing Transducer

- Ensure drainage system is 'OFF' to the patient
- Secure drainage system on an IV pole on the stretcher
- Level transducer. Set chamber so transducer is level with tragus (or pre-designated location). Ensure transducer is level with the leveling system provided
- Set chamber to 'Zero' mark

CCT – CP6 INTRACRANIAL PRESSURE (ICP) MONITORING

PROCEDURE (cont.)

Zeroing Transducer (cont.)

- Connect transducer cable to transducer
- Change invasive monitoring setup to ICP for monitoring
- TURN the stopcock so that it is 'OFF' to the patient and 'OPEN' to the transducer vent port
- OPEN the transducer vent port to atmosphere by removing the port cap (open to air). Ensure the cap remains sterile
- ZERO the monitor
- DEPRESS the ZERO button. Advise when zero process completed
- RECAP the transducer vent port
- For ICP monitoring, TURN stopcock so that it is 'OPEN' to the patient and 'OFF' to the drainage system

Drainage

- Review physician's order to place ventriculostomy to drain (vs. monitoring)
- To place the system to drain, the stopcock at the zero level is opened to the drainage bag side. The drip chamber is placed so that the zero level is at the foramen of Monro (Point of communication between the 3rd and lateral ventricles of the brain). Anatomical landmark for foramen of Monroe is the external auditory canal
- The Buretrol will be moved so the pressure line is at the ordered level of drainage
- The system must always be secured on a pole. The system is adjusted to obtain the zero level
- To obtain ICP readings, turn 'OFF' to drain for a minimum of one (1) minute prior to readings
- If patient set up for drainage, clamp tubing between patient and drain chamber:
    - during transfers to/from stretcher
    - anytime patient's head is lowered
    - patient repositioning
    - suctioning
    - any other procedure expected to cause increased CSF drainage

COMPLICATIONS

- CSF leakage
- Air leakage into the subarachnoid space or ventricle
- OVERDRAINAGE of CSF leading to ventricular collapse and herniation
- Inappropriate therapy related to ICP readings with dampened waveforms, electromechanical failure, or operator error such as inappropriate leveling

CCT – CP6 INTRACRANIAL PRESSURE (ICP) MONITORING

NOTES
• Keep the stopcock to the drainage system closed when performing pressure monitoring (affects accuracy) • Avoid over-drainage of CSF by draining only approximately two (2) mL of fluid per time (the height of the drainage cylinder will determine how quickly the fluid drains) • Never open drainage to patient when at the Zero mark. This will lead to excessive and unwanted CSF drainage

REFERENCES
• Increased Intracranial Pressure and Monitoring, rn.com, AMN Healthcare education Services; https://lms.rn.com/getpdf.php/1764.pdf

CCT – CP7 CENTRAL VENOUS PRESSURE (CVP) MONITORING

INDICATIONS

- Monitoring of central venous pressure, vascular access, infusion of irritant substances, inadequate peripheral access, transvenous pacing

CONTRAINDICATIONS

- Venous obstruction, increased intracranial pressure, severe coagulopathy, trauma at site of insertion

CAUTIONS

- pneumothorax, hemothorax, hematoma, air embolism, insertion into arterial system

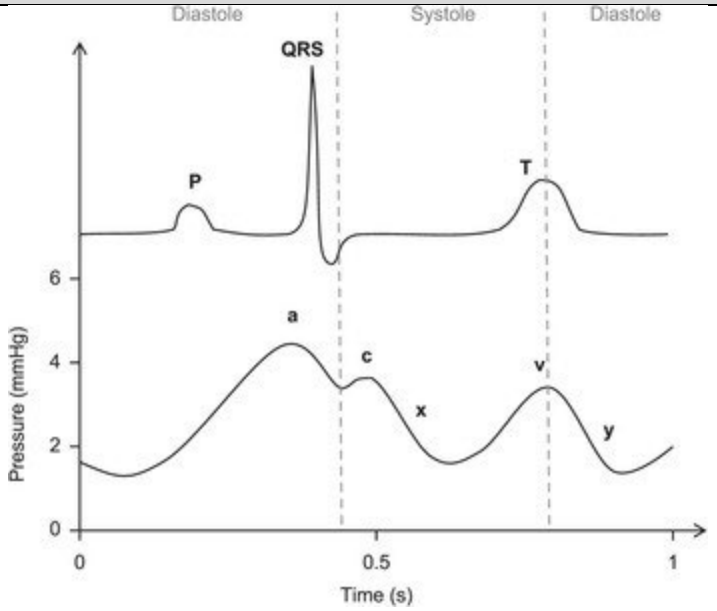
PROCEDURE

1. Assess and obtain pressure waveform on referring facility monitor
2. When indicated (poor waveform, poor pressure readings) obtain a pre-transport waveform strip from referring facility as well as post transport strip from receiving facility
3. Evaluate pressure line for compatibility with CCT equipment
4. Examine pressure line to assure no air bubbles are present
    - Flush air bubbles through open stopcock prior to zeroing line
5. Assure pressure bag is inflated to 300 mmHg
6. Attach appropriate pressure cable to the monitor and the transducer port of the pressure tubing
7. The transducer will be secured at the phlebostatic axis (4th intercostal space, mid-axillary, level of right atrium)
    - Excess tubing should be coiled and taped in an orderly fashion
8. Zero the pressure line
    - Set stopcock “off to the patient” (pointed towards the rigid wall tubing) and open the stopcock to air (atmosphere)
    - Press “Zero” on monitor – sets atmospheric pressure as zero reference point
    - Recap stopcock and turn stopcock to open position
9. Square wave test (the “fast flush test”)
    - Snap flush to generate square wave
    - Check for oscillations as an indicator of the harmonic characteristics of the system
        - Normally only 1-2 oscillations before returning to baseline
    - 3 or more oscillations before returning to baseline indicates underdamped system
    - If no oscillations, then it’s overdamped (response speed is too slow)
10. The waveform will be assessed on the CCT monitor, pressure reading obtained and strip printed for documentation
11. CVP readings will be documented with each set of vital signs once the line is zeroed
12. Documentation - Use the Change Over Invasive Line in ePCR to document:
    - Time line is connected to CCT equipment
    - Time line is zeroed
    - Condition of waveform

CCT – CP7 CENTRAL VENOUS PRESSURE (CVP) MONITORING

PROCEDURE (cont.)
13. When line is changed to CCT equipment, zeroed and condition of waveform will be documented in the ePCR 14. Site, type of invasive line, waveform description, sensation, and mobility of extremity will be documented in the ePCR 15. Distal pulses and capillary refill time should be documented as part of the patient assessment

COMPLICATIONS	
• Pneumothorax/hemothorax • Hematoma	• Arterial bleeding • Air embolism

NOTES	
• **a** = peak atrial contraction (follows p wave on ECG). Tricuspid valve closes, causing dicrotic notch • **c** = RV contraction, closing and bulging the tricuspid valve into atria • **x** = atrial pressure declines during atrial relaxation • **v** = passive atrial filling, against a closed tricuspid valve • **y** = passive blood flows from RA into RV on opening of tricuspid valve	 https://www.cambridge.org/core/books/basic-physiology-for-anaesthetists/venous-pressure-waveforms/8811FF96BB5EAD145E40A6435F3D413F
• CVP determinates include: ○ Right atrial pressure ○ Intravascular fluid volume ○ Pulmonary vascular resistance ○ Intrathoracic/pleural pressure ○ Intra-abdominal pressure	

REFERENCES
• https://litfl.com/cvp-measurement/ • https://www.britishjournalofnursing.com/content/clinical/central-venous-pressure-monitoring-in-critical-care-settings/

CCT – CP8 INVASIVE ARTERIAL BLOOD PRESSURE (IABP) MONITORING

INDICATIONS

- Labile blood pressures, hemodynamic instability, titration of vasoactive medications, Intra-Aortic Balloon Counter pulsation, situations where non-invasive monitoring will be unreliable

CONTRAINDICATIONS

- Inadequate collateral flow, extremities with vascular insufficiency

CAUTIONS

- None

PROCEDURE

1. Obtain current pressure reading and waveform from facility monitor
    - When indicated (poor waveform, poor pressure readings) obtain a pre-transport waveform strip from referring facility as well as post transport strip from receiving facility
2. Document the following:
    - Location of line
    - Condition of insertion site
    - Distal pulses, sensation, movement, and capillary refill times
    - Any signs of hematoma, increasing size of current hematoma
3. Evaluate pressure line for compatibility with CCT equipment
4. Attach appropriate pressure cable to the monitor and the transducer port of the pressure tubing
5. Secure arterial access site and store excess tubing in orderly fashion
6. Examine pressure line to assure no air bubbles are present
    - Flush air bubbles through open stopcock prior to zeroing line
7. Zero the pressure line
    - Set stopcock “off to the patient (pointed towards the rigid wall tubing) and open the stopcock to air (atmosphere)
    - Press “Zero” on monitor – sets atmospheric pressure as zero reference point
    - Recap stopcock and turn stopcock to open position
8. Square wave test (aka fast flush test)
    - Snap flush to generate square wave
    - Check for oscillations as an indicator of the harmonic characteristics of the system
    - usually only 1 oscillation before returning to baseline
        - 2 or more oscillations before returning to baseline indicates underdamped
        - if no oscillations, then system is overdamped (response speed is too slow)
9. Assure the pressure bag is at 300 mmHg throughout transport
10. If arterial line/sheath is in a femoral artery, assist patient in keeping leg straight
11. If inadvertent dislodgement of arterial sheath, firm direct pressure will be applied and held in place until patient is handed off to receiving staff
    - Pressure should be applied over insertion site and slightly superior to insertion site to control bleeding
12. Monitor and document arterial pressure with each set of vital signs

CCT – CP8 INVASIVE ARTERIAL BLOOD PRESSURE (IABP) MONITORING

COMPLICATIONS

- Pain, thrombosis and distal ischemia, infection, retrograde air embolism, inadvertent drug/air injection, hematoma, pseudo-aneurysm, bleeding

NOTES

- Intra-arterial pressure monitoring is more accurate than noninvasive blood pressures in patients who are obese, hypotensive, peripherally vasoconstricted or severely hypertensive.
- Common sources of error:
  - Bubbles in catheter-transducer system causing decreased resonant frequency
  - Clotting in arterial catheter
  - Elastic catheter walls cause increased damping
  - Cannula wont flush because it is kinked or clotted

REFERENCES

- https://litfl.com/arterial-line-and-pressure-transducer/
- Nguyen Y, Bora V. Arterial Pressure Monitoring. [Updated 2023 Mar 19]. In: StatPearls [Internet]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK556127/

CCT – CP9 FETAL MONITORING

INDICATIONS

- Assess fetal well-being during interfacility transport and early detection of fetal distress

CONTRAINDICATIONS

- None

CAUTIONS

- None

PROCEDURE

1. Lay out 2 fetal monitoring belts on transport stretcher. Move or assist patient to stretcher
2. Expose abdomen when patient is supine
3. Turn on fetal monitor
4. If continuous fetal monitoring has been in place, replace hospital device with CCT monitoring device
5. If no continuous fetal monitoring has been done (e.g., patient in an Emergency Department) inquire where the facility was observing Fetal Heart Tones (FHT) during their examination
6. Apply gel to the ultrasound probe. Slowly scan the probe across the abdomen until the FHT is located. Secure the ultrasound device with one elastic belt
7. Palpate the abdomen to locate the fundus
8. Apply the tocodynamometer (pressure transducer) without gel to the fundal area and secure with the other elastic fetal monitoring belt
    - Zero the pressure transducer to allow for more accurate tracings of contractions
9. Monitor the FHR and contractions throughout transport
10. Document the following in the ePCR
    - Variability
    - Accelerations/Decelerations
    - Contractions
    - Fetal heart rate and location of fetal heart tones (should be documented with each set of vital signs)

COMPLICATIONS

- Loss of fetal tone location (e.g., fetal movement)
- Minimal risk to mother

NOTES

- Factors affecting Electronic Fetal Monitoring
    - Gestational age
    - Obesity
    - Vibration (road noise)
- If a scene call (e.g., MVC involving pregnancy) it may be more appropriate to utilize the fetal doppler to record FHT's

CCT – CP9 FETAL MONITORING

REFERENCES
• Pending

CCT - CP10 IMPELLA DEVICE

INDICATIONS

- Safely transport the cardiac patient with Impella Device in place to a tertiary care facility for continued care

CONTRAINDICATIONS

- None

CAUTIONS

- Use extreme caution when moving patient to avoid displacement or advancement of the device
- Be sure to obtain Abiomed representative's contact information prior to transport for assistance with issues that arise during transport

PROCEDURE

1. Obtain updated patient report at bedside from nurse and Abiomed representative if available regarding Impella and controller
2. Invasive monitoring
    - If arterial line is present, monitor and record invasive blood pressures per protocol (Ref. CCT-CP8)
    - If Swan Ganz is present, monitor and record PA pressures per protocol, record depth of catheter per protocol (Ref. CCT-CP5)
    - If CVP is present, monitor and record CVP readings per protocol. (Ref. CCT-CP7)
    - If more than two invasive lines present, capture CVP initially, then monitor Swan- Ganz catheter for PA pressures for remainder of transport. Monitor Arterial Blood Pressures. CVP can be checked intermittently as needed
3. Connect patient to CCT monitoring equipment
4. Transfer infusions to CCT pumps
5. Prior to moving patient to CCT stretcher, confirm depth of Impella catheter and ensure all Tuohy Borst connections are tight and secure (to prevent forward migration of Impella catheter)
    - Use extreme caution when moving patient to stretcher. Slack in catheter may allow for movement inside the body. Rough movements may cause migration or displacement of the device.
    - The leg with insertion site should remain straight at all times
    - Frequently check insertion site for bleeding
6. Ensure head of bed is no higher than thirty (30) degrees
7. Ensure the controller has been plugged in and charging. Battery power should last sixty (60) minutes if fully charged
8. Record all vital signs per protocol
9. Record Impella readings prior to transport and at end of transport

CCT - CP10 IMPELLA DEVICE

PROCEDURE (cont.)

Address And Correct Any Alarms

Pump position wrong

- Indicates inlet and outlet are on same side of aortic valve
- Motor current waveform is flat
- Press Flow Control soft button and use selector knob to change **P-level** to **P-2**, then press scroll knob

Suction

- Causes can include low volume in Left Ventricle, improper position, right heat failure
- If suction alarm occurs, a lower than normal flow is noted on controller, leading to decreased hemodynamic support
- If present, press **Flow Control** soft button and use selector knob to reduce **P-level** down 1-2 settings, then press scroll knob again
- Check CVP reading. CVP of at least 10 mmHg is recommended. If less than 10, administer fluid bolus
- If suction continues, reduce P- level and additional 2 levels until suction resolves or P-2 is reached. **Never set P-level below P-2**

Purge

- Controller makes changes to dextrose infusion rate to protect motor
- CCT cannot change dextrose concentrations – if machine recommends change of dextrose notify receiving facility
    - Purge pressure low - assess for loose connections or leaks
    - Purge pressure high
        - Assess for kinks in line (most common cause)
        - Check yellow side arm to make sure it is straight

Air in Purge Line

- Will cause purge system failure, must be corrected IMMEDIATELY
- Press the **Purge System** soft button and scroll to **de-air purge system** and press selector knob
- Follow on screen prompts
- Make sure purge fluid bag is not empty or inverted and tubing is not clamped
- Disconnect purge tubing from Impella catheter
- Press **OK** to initiate the De-Air function
- Once De-Air progress is complete the system advances to next screen
- Confirm no air in tubing. If air is present, repeat the De-Air process
- Connect purge tubing to Impella catheter to complete the De-Air procedure
- Report all issues to the receiving facility!

CCT - CP10 IMPELLA DEVICE

PROCEDURE (cont.)

Cardiac Arrest/CPR

- If CPR is required, press **flow control** button, use selector knob to scroll to **P-2**, press selector to confirm. Proceed with compressions
- If ROSC, confirm motor control current is pulsatile, then return to original P-level. If non pulsatile current, remain at P-2

COMPLICATIONS

- Impella displacement/malposition, bleeding, device malfunction, arrhythmia, cardiac arrest

NOTES

- During transport the placement screen should remain visible to help determine location of the Impella
- If controller indicates improper position, contact sending physician or Abiomed representative. Do not initiate transport with Impella improperly positioned.
- Native heart function may be decreased. Treat on MAP and not SBP
- No need to make changes to console if defibrillation is needed

REFERENCES

- Gottula AL, Shaw CR, Milligan J, et al. Impella in transport: Physiology, mechanics, Complications, and transport considerations. Air Medical Journal. 2021;41(1):114-127. doi:10.1016/j.amj.2021.10.003
- https://www.heartrecovery.com/education/education-library
- http://www.abiomedtraining.com

CCT - CP11 INTRA-AORTIC BALLOON PUMP (IABP)

INDICATIONS

- Cardiogenic shock, extensive MI, unstable angina refractory to nitrates, coronary perfusion for high grade proximal stenosis of left/right main coronary artery, prophylactic support for PCI

CONTRAINDICATIONS

- Aortic valve insufficiency, dissecting aortic aneurysm, blood dyscrasias, severe atherosclerosis of aorta, severe PVD

CAUTIONS

- Displacement may cause occlusion of the left subclavian

PROCEDURE

1. Inspect insertion site for bleeding. Document catheter and balloon size
2. Evaluate pulses (bilateral - radial, posterior tibial and dorsalis pedis pulses), capillary refill time and extremity temperature
3. Identify and secure all IABP chest leads to avoid unintentional removal
4. Place patient on CCT cardiac monitor
5. All patients with IABP will have an arterial line in place. Documentation of the arterial line is required (Ref. CCT-CP8). If IABP is running on Fiber Optics, indicate so. If no Fiber Optics, arterial line must be zeroed for use
6. Establish baseline vital signs. Evaluate hemodynamics and clinical condition. Include blood pressure, heart rate/rhythm, respiratory rate and quality, arterial blood pressure and augmented diastolic pressure
7. Keep head of stretcher/bed at lowest position tolerated by patient. DO NOT raise stretcher/bed greater than thirty (30) degrees
8. Maintain IABP at prescribed timing (1:1, 1:2, 1:3) Document timing augmentation, location of catheter, catheter and balloon size, and trigger source (ECG, pressure, pacer, internal)
9. Place patient on stretcher, instruct patient to keep affected leg straight
10. Once patient is loaded, secure IABP with ratchet strap to d-rings in the side wall of vehicle (modifications may be made when in back-up vehicle)
11. Reconfirm catheter placement and function after every patient movement

Management of COMPLICATIONS

- Balloon leak/rupture
  - Observe tubing for blood
  - If blood in pneumatic tubing shut off the device and leave intact
  - Notify receiving facility and physician immediately
- IABP Failure
  - Evaluate patient's condition and hemodynamics
  - Transport crew will try to troubleshoot the device to correct problem and maintain patient safety

CCT - CP11 INTRA-AORTIC BALLOON PUMP (IABP)

PROCEDURE (cont.)

- If IABP is inoperable for greater than 20-30 minutes, inflate IABP manually with 60 ml syringe and 3-way stopcock using 40 ml of air once every 3-5 minutes to avoid clot formation
- Displacement of IAB catheter may lead to loss of pulse in left arm due to occlusion of the left subclavian, or lower displacement can cause occlusion to renal arteries

COMPLICATIONS

- Displacement, arrhythmia, balloon rupture, local trauma, bleeding

NOTES

- If balloon site remains inactive for an extended period of time (20-30 minutes) then clots can begin to form on the IAB catheter
- Patient placed higher than 30 degrees can lead to catheter displacement
- Most IABP consoles run in “AUTO” mode. All timing is automatically performed by the machine. There are times where the machine may not be able to auto correct or update the timing. This may need to be done manually
- If IAB console allows for Fiber Optics, it will be used. In the event of Fiber Optic failure, be prepared to change to arterial pressure. Transducer will have to be leveled and line zeroed for arterial pressure use

REFERENCES

- https://www.getinge.com/us/products/cardiosave-iabp-rescue/
- Khan TM, Siddiqui AH. Intra-Aortic Balloon Pump. [Updated 2023 Apr 24]. In: StatPearls [Internet]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK542233/

CCT - CP12 TEMPORARY TRANSVENOUS PACEMAKER

INDICATIONS

- Provide pacemaker support during transport to prevent hypotension and end organ damage

CONTRAINDICATIONS

- All contraindications are relative
- Excessive risk of bleeding due to vascular access, infection, hemodynamically stable bradycardias

CAUTIONS

- None

PROCEDURE

1. Place patient on CCT monitor
2. Insert batteries into pacemaker
    - Batteries should be removed when not in use to prevent corrosion
3. Set pacemaker controls
    - Capable of atrial and ventricular pacing
    - Review pacemaker settings on referring facilities temporary pacemaker
4. Power on the CCT pacemaker
5. Input matching settings from referring facility onto the CCT pacemaker
    - Dial in rate
    - Dial in output. Be sure to select the correct output setting (atrial vs ventricular or both if dual chamber pacing)
    - Set sensitivity
    - Set pacing mode (usually VVI)
6. Connect pacer wires to temporary pacemaker
    - Cables with leads/heartwire - the patient cable with lead/heartwire plugs into socket on top of unit. In the absence of patient cables, temporary transvenous leads plug directly into the two smaller sockets.
    - Match the positive (+) and negative (-) leads to the positive (+) and negative (-) sockets or clips (as applicable).
        - There may be instances where the leads are reversed in polarity to obtain capture. CCT will connect in the same manner as the sending facility.
7. Check cardiac monitor to ensure capture.
    - If no capture, increase milliamps slowly until capture is obtained and this is now the threshold (minimum stimulus needed to consistently elicit a cardiac depolarization). Once threshold is reached, double the milliamps.
8. Secure temporary pacemaker to patient or stretcher
9. Monitor vitals per protocol

CCT - CP12 TEMPORARY TRANSVENOUS PACEMAKER

PROCEDURE (cont.)

10. Document pacemaker settings in ePCR
    - Rate
    - Milliamps
    - Sensitivity
    - Mode

TROUBLESHOOTING

- **Failure to pace** without a spike present is usually caused by a broken or loose connection, electrode fracture, battery or critical failure
  - Check and tighten all connections
  - Check for any equipment that might cause electrical interference and remove if possible
  - Replace battery if needed
  - Apply transcutaneous pacer and pace if needed for symptomatic bradycardia
- **Failure to "sense"** occurs when the pacemaker does not sense an intrinsic beat. Competitive pacing spikes or complexes are seen on the EKG. With failure to sense, the under-sensing leads to over-pacing.
  - Check and tighten all connections
  - Check the sensitivity setting; make it as sensitive as possible
  - Place the patient in a position where adequate sensing was last observed
    - A left lateral recumbent position may help
  - Increase the pacing rate to override the intrinsic rhythm if possible
  - Turn the pacemaker off if it is not needed, but do not disconnect from the electrode wires
    - Notify the receiving physician of this immediately
  - Monitor the patient closely if effective sensing is not regained after the above interventions.
- **Over-sensing** usually occurs because the pacemaker sensitivity is set too high
  - Suspect when pauses are seen intermittently on the EKG or when the paced rate falls below that set on the pacemaker generator
  - This pacemaker induced problem may be mistaken for electrode fracture or impending generator failure
  - Oversensing leads to under-pacing
    - Decrease the sensitivity on the pacemaker
    - Replace the pacemaker generator if the problem continues
- Consider transcutaneous pacing

COMPLICATIONS

- Failure to pace, lead displacement, arrhythmia, local trauma, cardiac perforation

NOTES

- Critical Care Transport will be using the temporary pacemaker on interfacility transport where a temporary pacemaker is already placed using predetermined thresholds from referring facility
- Extension pins may be needed if moving individual wires over to new pacemaker

CCT - CP12 TEMPORARY TRANSVENOUS PACEMAKER

REFERENCES
• Tjong FVY, de Ruijter UW, Beurskens NEG, Knops RE. A comprehensive scoping review on transvenous temporary pacing therapy. Neth Heart J. 2019 Oct;27(10):462-473. doi: 10.1007/s12471-019-01307-x. PMID: 31392624; PMCID: PMC6773795.

CCT - CP13 CHEST TUBE MANAGEMENT

INDICATIONS
• Pneumothorax, hemothorax, hemopneumothorax, pleural effusion, empyema, chylothorax

CONTRAINDICATIONS
• None

CAUTIONS
• Kinking of chest tube can create tension pneumothorax • DO NOT tape connections • DO NOT attempt to reinsert partially/completely dislodged chest tubes

PROCEDURE

1. Prior to transport inspect the patient's chest wall to ensure that all connections are tight, and that tubing is not kinked
   - Check the skin around the insertion site for subcutaneous emphysema
   - Be sure that the tube is properly secured to the patient
2. Note the color, consistency, and amount of drainage
   - Note any air leak in the water chamber. Inquire about previous air leaks
   - Mark the current level of drainage on the chest tube drainage unit with a marker or piece of tape
   - A sudden increase in the amount of drainage indicates hemorrhage or sudden patency of a previously obstructed tube
3. CCP Only: Water seal tube for transport
4. Full CCT Team:
   - The suction hose should be clamped during travel time between suction devices
   - Connect wall suction when available and adjust to create a gentle rolling of bubbles in the water seal chamber. Vigorous bubbling results in water loss
   - Verify the level of the suction control chamber is as prescribed by referring physician (use negative 20 cmH_2O if no level given)
5. **NEVER** raise the chest tube above the chest or the drainage will back up into the chest.
   - The chest tube and drainage system should hang below the patient or be placed on the floor and secured in an upright position

Troubleshooting

- **Partial Dislodgment** of the chest tube
  - Indicated by one or more drain holes visible. All openings should be sealed with occlusive dressing to prevent air from entering the pleural cavity
  - The chest tube should be secured, and interventions documented
  - DO NOT attempt to reinsert the chest tube due to increased risk of infection

CCT - CP13 CHEST TUBE MANAGEMENT

PROCEDURE (cont.)

- **Complete Dislodgement** of the chest tube
  - If the chest tube falls out or is accidentally pulled out, it is important to quickly seal the insertion site
  - Use a gloved hand to cover site until occlusive dressing is prepared
  - Occlusive dressing is necessary to prevent air from entering the pleural cavity. Apply a 3-sided occlusive dressing (Ref. PCEMS MOM Vol. 1 - CP17)
  - Burp dressing as needed to prevent development of tension physiology
  - Perform needle decompression if evidence of tension pneumothorax (e.g., hemodynamic collapse, respiratory failure, etc.) (Ref. PCEMS MOM Vol. 1 - CP7)
- Disconnect from drainage system
  - Reconnect as soon as possible
- Drain system damaged
  - Open a bottle of sterile water and place chest tube into water to create a water seal
  - Clamp chest tube before removing from water
  - Connect to new system

COMPLICATIONS

- Displacement, air leak, local trauma, obstruction, tubing/equipment malfunction, tension pneumothorax, bleeding

NOTES

- Clamping chest tube should only be done when changing the drainage system, trouble shooting for air leaks, or by physician order

REFERENCES

- https://www2.getinge.com/us/education/chest-drain-education/
- https://www.teleflex.com/usa/en/product-areas/surgical/educational-portal/pleur-evac/
- Anderson D, Chen SA, Godoy LA, Brown LM, Cooke DT. Comprehensive Review of Chest Tube Management: A Review. *JAMA Surg.* 2022;157(3):269-274. doi:10.1001/jamasurg.2021.7050

CCT - CP14 BLOOD AND BLOOD PRODUCTS

INDICATIONS

Packed Red Blood Cells (PRBC)	History of obvious or suspected acute blood loss
Platelets	Platelet deficiency, serious bleeding disorder (loss/consumption), platelet dysfunction
Fresh Frozen Plasma (FFP)	Need of clotting factors or need increased blood volume from hypovolemia or hypovolemic shock
Whole blood	Typically reserved for cases of severe hemorrhage

CONTRAINDICATIONS

- Patient/surrogate refusal of blood products

CAUTIONS

- The use of whole blood:
  - is not indicated when component specific therapy is available
  - when component therapy is available can lead to complications (e.g., volume overload)
- If severe transfusion reaction is suspected, IMMEDIATELY STOP the infusion

PROCEDURE

1. Confirm consent for blood administration is with patient's chart and patient has blood band in place
2. Verify transfusion checklist
   - Patient name, social security number or hospital number match transfusion record
   - Type and number on transfusion record form match product bag
   - Pre-transfusion vital signs including temperature are documented on transfusion record
   - Transfusion record signed and dated by administering nurse
   - Original copies should remain with patient
3. If the CCT is to initiate blood or blood products during transport, verify order and facility checklist with nurse prior to transport
4. Obtain necessary equipment from sending facility (administration tubing, blood products, etc.)
5. Prior to administration, the CCT RN and CCT Paramedic will complete the facility pre-transfusion checklist and document in ePCR
6. Blood and blood products should have a dedicated vascular access site
7. If utilizing multi-lumen catheter, use the most distal port
8. Record patient's temperature at start of transfusion then again 15, 45 and 60 minutes after infusion started
   - If increase of two (2) degrees or more above baseline temperature, discontinue blood infusion

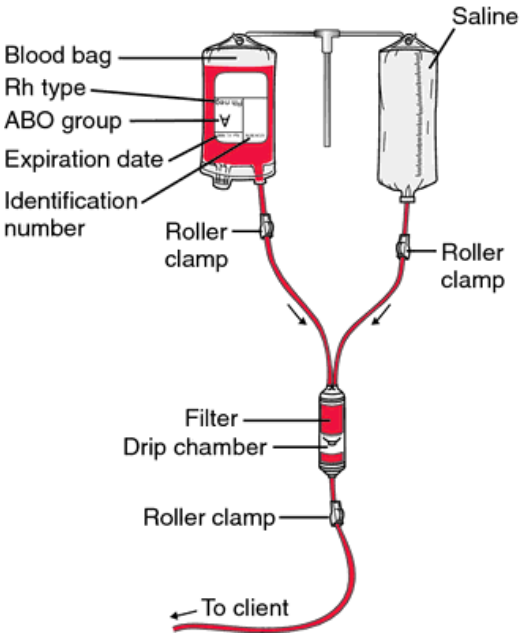
CCT - CP14 BLOOD AND BLOOD PRODUCTS

PROCEDURE (cont.)

9. If infusion completes during transport, the crew shall complete the transfusion slip with date, time, amount infused, and any reactions that occurred
10. It is the responsibility of the receiving facility to return the transfusion slip to the sending facility blood bank
11. Complete Blood Product intervention in PCR

Infusion

1. Verify checklist
2. Prime Y-type blood tubing with 0.9% sodium chloride and slowly begin infusing
   - Attach blood bag to Y-type blood tubing
   - Clamp 0.9% sodium chloride line
   - Open clamp to flow and adjust flow to run slowly for first 15 minutes.
   - If no adverse reaction, increase flow based on patient condition and transfusion times
   - Usual infusion time 1.5 - 4 hours, can be faster in emergent situations
3. Monitor vital signs per protocol
4. Monitor for signs of adverse reaction. If adverse reaction noted, **STOP** infusion, and refer to PCEMS MOM Vol. 1 - M2 Allergic Reactions & Anaphylaxis and contact OLMC (Ref. CCT-CS2)
5. Blood tubing should be changed with each new unit of blood



CCT - CP14 BLOOD AND BLOOD PRODUCTS

PROCEDURE (cont.)

Management of Adverse Reactions

All suspected transfusion reactions must be reported to the sending and receiving facility

MILD REACTIONS		
Reaction	**Description**	**Management**
Allergic Transfusion Reaction	Simple allergic reaction without anaphylaxis; often only itching/hives	• Provide supportive care for allergic reactions (Ref. PCEMS MOM M2 & P8) • Monitor for anaphylaxis • Continue infusion
Febrile Non-hemolytic Transfusion Reaction	Fever and chills without systemic symptoms	• Continue transfusion • Evaluate for alternate causes of fever • Provide supportive care (Ref. PCEMS M2 & P8)
Hypotensive Transfusion Reaction	Drop in blood pressure without alternate cause of hypotension. SBP decrease by 30 mmHg or more OR SBP less than 80 mmHg within minutes of onset of transfusion. Returns to baseline when transfusion stopped. Most often seen with platelet transfusion	• Stop transfusion and monitor BP • Evaluate for alternate etiology of hypotension

CCT - CP14 BLOOD AND BLOOD PRODUCTS

PROCEDURE (cont.)

SEVERE (LIFE THREATENING) REACTIONS		
Reaction	**Description**	**Management**
Transfusion Associated Circulatory Overload (TACO)	Pulmonary edema due to excessive volume administered	• Diuresis • Ventilatory support as needed (Ref. CCT-A2, CCT-CP1, CP2) • May continue transfusion if able to provide adequate respiratory support
Transfusion-Related Acute Lung Injury (TRALI)	Immune cells in recipient's lung are activated by donor blood factors; presents with fever, chills, respiratory distress	• Provide respiratory support/intubation as indicated (Ref. CCT-A2, CCT-CP1, CP2) • Discontinue transfusion
Acute Hemolytic Transfusion Reaction (AHTR)	Intravascular hemolysis of transfused red blood cells (often due to ABO incompatibility); symptoms include fever, chills, flank pain, oozing from IV access sites	• Discontinue transfusion • Give 1000-2000 mL LR, IV bolus while monitoring for airway compromise (will require IV hydration and diuresis at receiving facility)
Transfusion Associated Sepsis	Transfused blood contained microorganisms; symptoms of sepsis; rare	• Treat Sepsis (Ref. PCEMS M9)
Anaphylactic Transfusion Reaction	Anaphylaxis from transfused blood, often IgA related	• Discontinue transfusion immediately • Treat anaphylaxis (Ref. PCEMS M2 & P8)

COMPLICATIONS

- Fever, hemolysis, embolism, graft vs host disease, infection, bleeding

CCT - CP14 BLOOD AND BLOOD PRODUCTS

NOTES
• If a transfusion reaction is suspected, save all unused blood products to return to the lab for testing and identification of possible errors • Fevers are common with transfusions (temperature rise of greater than one (1) °C). If the fever is accompanied by flank/back pain, chills, or hypotension, then you must consider emergent conditions (febrile hemolytic transfusion reaction, transfusion associated sepsis) • Graft versus host disease is a condition where immunocompromised recipients are exposed to lymphocytes in the donated blood. May have delayed symptoms of fever, rash, liver abnormalities, jaundice, and anemia. The mortality is as high as 90%

REFERENCES
• https://www.americannursetoday.com/the-rules-of-transfusion-best-practices-for-blood-product-administration-2/ • https://www.bloodworksnw.org/medical-services/transfusion-medicine/rates-volumes-duration-transfusions • https://www.emra.org/emresident/article/blood-transfusion-reactions-taco-trali-and-other-considerations/

CCT – CP15 NASOGASTRIC TUBE INSERTION AND MANAGEMENT

INDICATIONS

- Gastric decompression in a patient receiving assisted ventilations, removal of gastric contents, drainage and or lavage in drug overdose or poisoning, aid in the prevention of vomiting and aspiration

CONTRAINDICATIONS

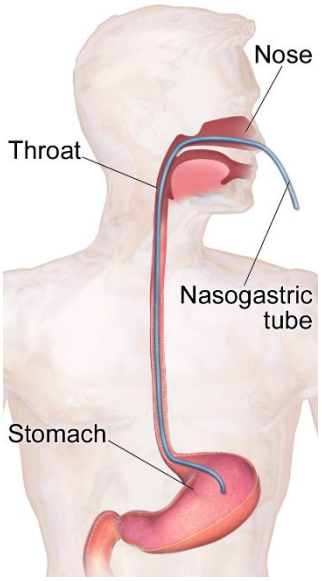
- Basilar skull fracture
- Severe facial trauma

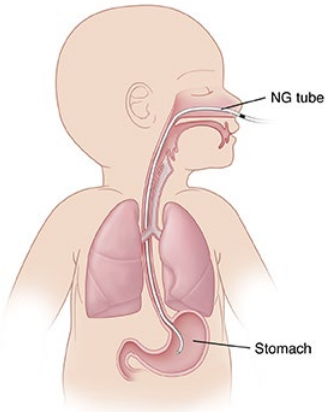
CAUTIONS

- None

PROCEDURE

- If patient is alert, explain procedure to the patient
- If possible, sit patient upright for optimal neck/stomach alignment
- Examine nostrils for deformities/obstructions to determine best nare for insertion
- Measure tubing from bridge of nose to earlobe, then down to the point midway between the patient's navel and the tip of the sternum
- Mark the measured length of the tube with a piece of tape or make note of the distance
- Lubricate 2 - 4 inches of the tube tip with water soluble lubricant to reduce patient discomfort
- Pass the tube via chosen nare posteriorly, past the pharynx and into the esophagus then the stomach
- Having the patient take small sips of water during insertion and passing of the tube may assist in advancing the tube, unless patient is "nothing by mouth" (NPO)
- If resistance is met, rotate the tube slowly with a downward advancement toward the closest ear. DO NOT force the tube
- Withdraw the tube immediately if the patient experiences a change in respiratory status, if the tube coils in the mouth, or the patient coughs and becomes cyanotic
- Once in the esophagus, advance the tube to the previously predetermined depth.
- Check for placement by injecting 5-20 mL (dependent upon patient size) of air from a 60 mL catheter tip syringe
    - Insufflate air quickly while auscultating with a stethoscope over the stomach.
        - If the tube is in the stomach, a gurgling sound will be heard
        - If the tube is in the esophagus (not deep enough) or in the trachea, the air sounds will be muffled or absent





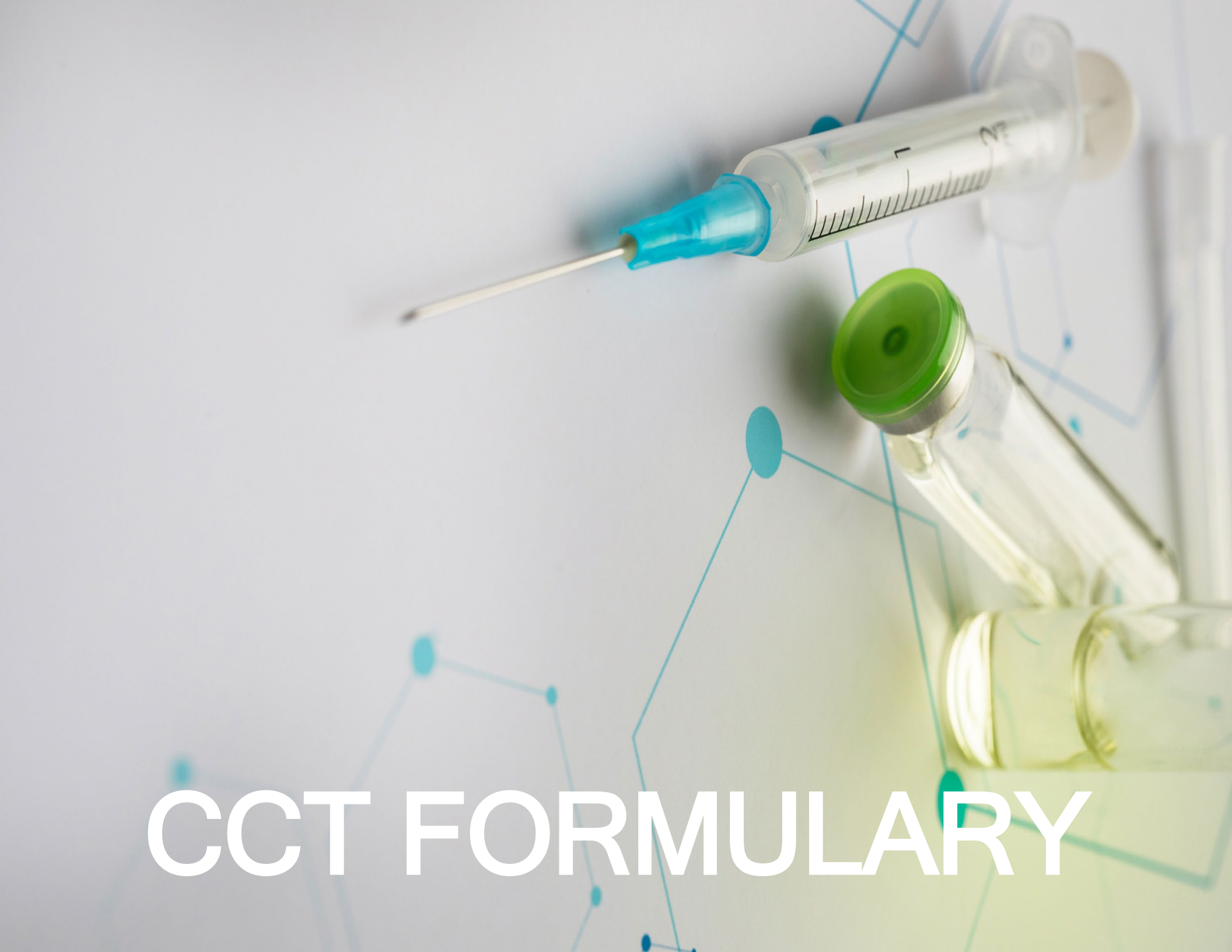
CCT – CP15 NASOGASTRIC TUBE INSERTION AND MANAGEMENT

PROCEDURE (cont.)
• Once placement is confirmed, attach to suction tubing • Place suction unit on low, non-continuous suction to facilitate evacuation of stomach contents • Discontinue suction when there is no further return of stomach contents • Secure tube to patient nose with tape • Document quantity and quality of the evacuated gastric contents.

COMPLICATIONS
• Aspiration (emesis), tissue trauma, bleeding, tracheal placement, curling of tubing in oropharynx/esophagus during insertion, esophageal perforation

NOTES
• Infants can suck on a pacifier during the procedure to aid in the passage of the tube • DO NOT rely on a cuffed endotracheal tube to prevent passage into the trachea • Always confirm proper placement of a gastric tube

REFERENCES
• https://litfl.com/nasogastric-and-orogastric-tubes/



CCT FORMULARY

CGT FORMULARY

CCT-F1 ARGATROPAN

Trade Name	N/A	
Class(es)	Synthetic Direct Thrombin Inhibitor	
Action(s)	Reversibly binds to the thrombin active site. Capable of inhibiting the action of both free and clot-associated thrombin.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• Major bleeding • History of hypersensitivity to argatroban	
Precaution(s)	• Hemorrhage can occur at any site in the body in a patient receiving argatroban. Risk may be increased in severe hypertension • Concomitant use of argatroban with antiplatelet agents, thrombolytics and other anticoagulants may increase the risk of bleeding • Start with lower dose when administering to a patient with hepatic impairment	
Pharmacokinetics	**Onset:** Immediate (steady state levels of both drug and anticoagulant attained within 1 to 3 hours)	**Duration:** Levels maintained until the infusion is discontinued or the dosage adjusted
Authorized Routes of Administration	• Intravenous	

Technique for Administration	• DO NOT mix with other drugs prior to dilution
	• Dilution is not required for the argatroban injection 50 mg/50 mL (1 mg/mL) vial
	• Argatropan 250 mg/2.5 mL should be diluted in 0.9% sodium chloride injection, 5% dextrose injection or lactated ringers' injection to a final concentration of 1 mg/mL
	  ○ The contents of each 2.5 mL vial should be diluted 100-fold by mixing with 250 mL of diluent
	  ○ Use 250 mg (2.5 mL) per 250 mL of diluent or 500 mg (5 mL) per 500 mL of diluent
	  ○ The constituted solution must be mixed by repeated inversion for one (1) minute	

CCT-F1 ARGATROPAN

Handling	• Retain in original carton to protect from light • If the solution is cloudy or insoluble precipitate is noted, the vial should be removed and returned to the EMS Central Supply Warehouse for proper destruction
PEARLS	N/A
Y-Site Compatibility	N/A
Interactions	N/A
Reference	https://dailymed.nlm.nih.gov/dailymed/

CCT-F2 CISATRACURIUM BESYLATE

Trade Name	N/A	
Class(es)	Nondepolarizing Neuromuscular Blocker	
Action(s)	Binds competitively to cholinergic receptors on the motor endplate to antagonize the action of acetylcholine, resulting in blockade of neuromuscular transmission. This action is antagonized by acetylcholinesterase inhibitors such as neostigmine.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• Known hypersensitivity to cisatracurium	
Precaution(s)	• Residual Paralysis – A patient with neuromuscular disease are at higher risk. Use a lower initial bolus dose and consider using a reversal agent. • Benzyl Alcohol – Consider combined daily load of benzyl alcohol from all sources when the 10 mL multiple dose vials are used in infants • Risk of Seizure – Monitor level of neuromuscular blockade during long-term administration to limit exposure to toxic metabolites • Hypersensitivity Reactions & Anaphylaxis – Severe hypersensitivity reactions including anaphylactic reactions have been reported. Consider cross-reactivity among neuromuscular blocking agents, both depolarizing and non-depolarizing • Risk of Death due to Medication Errors – **Accidental administration can cause death** • Inadequate Anesthesia – Use in the presence of appropriate sedation and monitor the patient to ensure level of anesthesia is adequate	
Pharmacokinetics	**Onset:** 1 – 3 minutes	**Duration:**
Authorized Routes of Administration	• Intravenous **ONLY**	
Technique for Administration	• DO NOT administer with alkaline solutions simultaneously in the same intravenous line • Cisatracurium besylate injection is not compatible with propofol injection or ketorolac injection for Y-site administration • Base subsequent dosing based on the patients' responses to the initial doses	

CCT-F2 CISATRACURIUM BESYLATE

Handling	• Accidental administration of neuromuscular blocking agencts may be fatal • Store with the cap and ferrule intact and in a manner that minimizes the possibility of selecting the wrong product
PEARLS	• Not recommended for rapid sequence endotracheal intubation due to the time required for its onset of action
Y-Site Compatibility	• 5% Dextrose Injection, USP • 0.9% Sodium Chloride Injection, USP • 5% Dextrose and 0.9% Sodium Chloride Injection, USP • Sufentanil Citrate Injection, diluted as directed • Alfentanil Hydrochloride Injection, diluted as directed • Fentanyl Citrate Injection, diluted as directed • Midazolam Hydrochloride Injection, diluted as directed • Droperidol Injection, diluted as directed
Interactions	• Succinylcholine – May decrease time to onset of maximum neuromuscular blockade • Inhalational anesthetics, antibiotics, local anesthetics, magnesium salts, procainamide, lithium, quinidine – May potentiate or prolong neuromuscular blockade action. Use peripheral nerve stimulator and monitor clinical signs or neuromuscular blockade • Phenytoin & Carbamazepine – May shorten duration of neuromuscular blockade. Use peripheral nerve stimulator and monitor clinical signs of neuromuscular blockade
Reference	https://dailymed.nlm.nih.gov/dailymed/

CCT-F3 DEXMEDETOMIDINE HYDROCHLORIDE

Trade Name	Precedex, Igalmi	
Class(es)	Alpha2-adrenergic Receptor Agonist Sedative	
Action(s)	Dexmedetomidine is a relatively selective, centrally-acting, alpha2-adrenergic agonist with sedative, analgesic, and sympatholytic properties but without significant ventilatory effects.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-CS6 Sapphire Infusion Pump Tubing Selection • CCT-M3 Sedation of the Intubated Patient	
Contraindication(s)	• None	
Warnings & Precaution(s)	• Monitoring: Continuously monitor patients while receiving Dexmedetomidine hydrochloride in 0.9% sodium chloride injection • Bradycardia and Sinus Arrest: Have occurred in young healthy volunteers with high vagal tone or with different routes of administration, e.g., rapid intravenous or bolus administration • Hypotension and Bradycardia: May necessitate medical intervention. May be more pronounced in patients with hypovolemia, diabetes mellitus, or chronic hypertension, and in the elderly. Use with caution in patients with advanced heart block or severe ventricular dysfunction • Co-administration with Other Vasodilators or Negative Chronotropic Agents: Use with caution due to additive pharmacodynamic effects • Transient Hypertension: Observed primarily during the loading dose. Consider reduction in loading infusion rate • Arousability: Patients can become aroused/alert with stimulation; this alone should not be considered as lack of efficacy • Tolerance and Tachyphylaxis: Prolonged exposure to dexmedetomidine beyond 24 hours may be associated with tolerance and tachyphylaxis and a dose-related increase in adverse events	
Pharmacokinetics	**Onset:** 5 to 10 minutes	**Duration:** 60 – 120 minutes
Authorized Routes of Administration	• Intravenous	
Technique for Administration	• Administer using a controlled infusion device	

CCT-F3 DEXMEDETOMIDINE HYDROCHLORIDE

Handling	• N/A
PEARLS	• Carefully monitor blood pressure and heart rate
Y-Site Compatibility	• DO NOT coadminister dexmedetomidine through the same IV catheter with blood, serum, or plasma because physical compatibility has not been established • Dexmedetomidine is compatible with 0.9% Sodium Chloride Injection, 5% Dextrose Injection, Lactated Ringer's Injection, 20% mannitol, 0.3% potassium chloride solution, and 100 mg/mL magnesium sulfate solution
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1271

CCT-F4 DOBUTAMINE HYDROCHLORIDE

Trade Name	Dobutrex	
Class(es)	Cardiac Dopaminergic Agents	
Action(s)	Dobutamine is a direct-acting sympathomimetic. It is primarily an agonist at beta1-adrenergic receptors, with minor beta2 and alpha1 stimulatory effects. Clinical actions reflect both beta agonism by the (+) isomer and the alpha agonism by the less potent (-) isomer. Agonism at the beta1-adrenergic receptor predominates and increases myocardial contractility and stroke volume with modest chronotropic effects, resulting in increased cardiac output. The inotropic effects are dose-dependent. Dobutamine's secondary hemodynamic effects include decreases in systemic vascular resistance (afterload) and ventricular filling pressure (preload). Systolic blood pressure is generally elevated as a consequence of increased stroke volume, although diastolic blood pressure and mean arterial pressure are usually unchanged with normal doses in normotensive patients. Increased myocardial contractility results in increased coronary blood flow and myocardial oxygen consumption. Dobutamine has minimal effect on pulmonary vascular resistance. Unlike dopamine, dobutamine does not affect dopaminergic receptors, nor does it cause release of norepinephrine from sympathetic nerve endings	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-M5 Shock	
Contraindication(s)	• Dobutamine is contraindicated in patients with idiopathic hypertrophic subaortic stenosis and in patients who have shown previous manifestations of hypersensitivity to dobutamine	
Warnings & Precaution(s)	• Because dobutamine facilitates atrioventricular conduction, patients with atrial fibrillation are at risk of developing rapid ventricular response. In patients who have atrial fibrillation with rapid ventricular response, a digitalis preparation should be used prior to institution of therapy with dobutamine. • Patients with preexisting hypertension appear to face an increased risk of developing an exaggerated pressor response	
Pharmacokinetics	**Onset:** 2 minutes	**Duration:** Not documented
Authorized Routes of Administration	• Intravenous	

CCT-F4 DOBUTAMINE HYDROCHLORIDE

Technique for Administration	• Concentrate must be diluted with a compatible IV solution (e.g., 5% Dextrose Injection, 10% Dextrose Injection, 0.9% Sodium Chloride Injection, 5% Dextrose and 0.9% Sodium Chloride Injection, 5% Dextrose and 0.45% Sodium Chloride Injection, Lactated Ringer's Injection) prior to administration • Administer diluted solution by IV infusion using a controlled infusion device • DO NOT administer simultaneously with solutions containing sodium bicarbonate or strong alkaline solutions (incompatible). • Solutions containing dextrose should not be administered through the same administration set as blood, as this may cause pseudoagglutination or hemolysis
Handling	• Premixed bags of dobutamine in 5% Dextrose Injection solutions may exhibit a pink color that, if present, will increase with time. This color change is due to slight oxidation of the drug, but there is no significant loss of potency • A sulfur dioxide odor may occur upon removal of the product from the overwrap container. This does not pose risk to the clinician or the patient • Use caution to avoid inadvertent bolus administration or inadvertent interruption of the infusion, particularly during line changes, when flushing the line, or during syringe/bag changes • Initiate infusion at a low rate and titrate every few minutes to reach the optimal dosage based on patient response.
Handling (cont.)	• Dosage titration is guided by the patient's response, including systemic blood pressure, urine flow, frequency of ectopic activity, heart rate, and (whenever possible) measurements of cardiac output, central venous pressure, and/or pulmonary capillary wedge pressure
PEARLS	• N/A
Y-Site Compatibility	• DO NOT coadminister dexmedetomidine through the same IV catheter with blood, serum, or plasma because physical compatibility has not been established
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=3534

CCT-F5 ESMOLOL

Trade Name	Brevibloc	
Class(es)	Anti-arrhythmics, Class II, Selective Beta-Blockers	
Action(s)	Esmolol is a beta1-selective adrenergic receptor blocking agent. It inhibits the beta1 receptors located chiefly in cardiac muscle; however, this preferential effect is not absolute, and at higher doses, it begins to inhibit beta2 receptors located in the bronchial and vascular musculature. Esmolol produces effects typical of a beta-blocker, including decrease in the heart rate, increase in sinus cycle length, prolongation of the sinus node recovery time, prolongation of the AH interval during normal sinus rhythm and during atrial pacing, and an increase in antegrade Wenckebach cycle length. Esmolol has no significant intrinsic sympathomimetic or membrane-stabilizing activity at therapeutic dosages.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-C2 Aortic Emergency	
Contraindication(s)	• Severe sinus bradycardia • Heart block greater than first degree • Sick sinus syndrome • Decompensated heart failure • Cardiogenic shock • Coadministration of IV cardiodepressant calcium-channel antagonists (e.g., verapamil) in close proximity to esmolol hydrochloride in sodium chloride injection • Pulmonary hypertension • Known hypersensitivity to esmolol	
Warnings & Precaution(s)	• Risk of hypotension, bradycardia, and cardiac failure • May mask symptoms of hypoglycemia and alter glucose levels • Risk of myocardial ischemia when abruptly discontinued in patients with coronary artery disease	
Pharmacokinetics	**Onset:** Extremely rapid	**Duration:** Steady-state esmolol concentrations are proportional to the infusion rate and decrease rapidly after discontinuation
Authorized Routes of Administration	• Intravenous	
Technique for Administration	• N/A	

CCT-F5 ESMOLOL

Handling	• N/A
PEARLS	• Rapid onset, short duration • **Massive accidental overdoses of esmolol hydrochloride have resulted from dilution errors**. Some of these overdoses have been fatal while others resulted in permanent disability. Bolus doses in the range of 625 mg to 2.5 g (12.5 to 50 mg/kg) have been fatal
Y-Site Compatibility	• Not compatible with Sodium Bicarbonate (5%) solution (limited stability) or furosemide (precipitation)
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1159

CCT-F6 HEPARIN SODIUM

Trade Name	Hep-Lock, Hep-Lock U/P, Hepflush-10, Monoject Prefill Advanced Heparin Lock Flush, SASH Normal Saline and Heparin	
Class(es)	Glycosaminoglycan anticoagulant	
Action(s)	Heparin exerts its anticoagulant action by accelerating the activity of antithrombin III (ATIII) to inactivate thrombin; however, heparin does not lyse existing clots	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• History of heparin-induced thrombocytopenia (HIT) or heparin-induced thrombocytopenia and thrombosis (HITTS) • Known hypersensitivity to heparin or pork products • In whom suitable blood coagulation tests cannot be performed at appropriate intervals • An uncontrolled bleeding state, except when this is due to disseminated intravascular coagulation	
Warnings & Precaution(s)	• **Fatal Medication Errors: Confirm choice of correct strength prior to administration** • **Bleeding is the chief sign of heparin overdosage** • Hemorrhage: Hemorrhage, including fatal events, has occurred in patients receiving heparin. Use caution in conditions with increased risk of hemorrhage • HIT and HITTS: Monitor for signs and symptoms and discontinue if indicative of HIT and HITTS • Benzyl Alcohol Toxicity: Use preservative-free formulation in neonates and infants • Monitoring: Blood coagulation tests guide therapy for full-dose heparin.	
Pharmacokinetics	**Onset:** Immediately	**Duration:** Immediately
Authorized Routes of Administration	• Intravenous	

CCT-F6 HEPARIN SODIUM

Technique for Administration	• Intermittent IV Injection - Administer IV either undiluted or in 50 to 100 mL of 0.9% Sodium Chloride Injection • Dilute in 0.9% Sodium Chloride Injection, 5% Dextrose Injection, or Lactated Ringer's Injection. Invert container at least 6 times after diluting to ensure adequate mixing. Periodically mix during the infusion • Infuse intravenously via an electronic infusion pump • When heparin is added to an infusion solution for continuous intravenous administration, the container should be inverted at least six times to ensure adequate mixing and prevent pooling of the heparin in the solution
Handling	• N/A
PEARLS	• DO NOT use Heparin Sodium Injection as a “catheter lock flush” product • DO NOT administer via intramuscular injection due to risk of hematoma at the injection site • **Use extreme caution during the preparation, dispensing, and administration of any heparin-containing products**. Heparin injection is available in various concentrations, and the inadvertent administration of the incorrect concentration could result in devastating consequences.
Y-Site Compatibility	• Not compatible with Sodium Bicarbonate (5%) solution (limited stability) or furosemide (precipitation)
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1159

CCT-F8 KETAMINE HYDROCHLORIDE

Trade Name	Ketalar	
Class(es)	Other General Anesthetics	
Action(s)	Ketamine is a nonbarbiturate, phencyclidine derivative that produces sedation, amnesia, and analgesia. Potent analgesia occurs even at subanesthetic doses. Unlike narcotics and inhalational anesthetics, ketamine is capable of producing an anesthetic state characterized by cardiovascular and respiratory stimulation, normal or slightly enhanced skeletal muscle tone, normal pharyngeal-laryngeal reflexes, and independent airway maintenance	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-U1 Universal Approach to Patient Care • CCT-M1 Pain Management • CCT-M3 Sedation of the Intubated Patient • CCT-CP1 Adult Airway Management • CCT-CP2 Pediatric Airway Management	
Contraindication(s)	• In patients for whom a significant elevation of blood pressure would be a serious hazard • Known hypersensitivity to ketamine or to any excipient	
Warnings & Precaution(s)	• Hemodynamic Instability: Monitor vital signs and cardiac function during Ketamine Hydrochloride Injection administration • Risk of Respiratory Depression: May occur with overdosage or too rapid a rate of administration. Maintain adequate oxygenation and ventilation • Risks of Ketamine Hydrochloride Injection alone for Procedures of the Pharynx, Larynx, or Bronchial Tree: Pharyngeal and laryngeal reflexes are not suppressed with Ketamine Hydrochloride Injection when it is used alone. Avoid use as a sole anesthetic agent in surgery or diagnostic procedures of the pharynx, larynx, or bronchial tree. Muscle relaxants may be required • Pediatric Neurotoxicity: Long-term cognitive deficits may occur when used for longer than 3 hours in children ≤3 years	
Pharmacokinetics	**Onset:** 60 seconds	**Duration:** 5 minutes – 2 hours

CCT-F8 KETAMINE HYDROCHLORIDE

Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**

Technique for Administration	• IV Push –
	  ○ DO NOT administer the 100 mg/mL concentration without proper dilution. Dilute the desired dose with an equal volume of Sterile Water for Injection, 0.9% Sodium Chloride Injection, or 5% Dextrose Injection. Use immediately after dilution
	  ○ Administer slowly over a period of 60 seconds not to exceed 0.5 mg/kg/minute. More rapid administration may result in respiratory depression and enhanced pressor response

Handling	• N/A
PEARLS	• Ketamine has a 1-arm brain circulation time (i.e., drug effects are seen rapidly, in the time it takes the drug to reach the brain from the injection site in the arm) when given intravenously
Y-Site Compatibility	• Theophylline or Aminophylline: Concomitant administration of Ketamine Hydrochloride Injection and theophylline or aminophylline may lower the seizure threshold. Consider using an alternative to Ketamine Hydrochloride Injection in patients receiving theophylline or aminophylline • Sympathomimetics and Vasopressin: Sympathomimetics and vasopressin may enhance the sympathomimetic effects of ketamine. Closely monitor vital signs when Ketamine Hydrochloride Injection and sympathomimetics or vasopressin are co-administered and consider dose adjustment individualized to the patient's clinical situation • Benzodiazepines, Opioid Analgesics, or Other CNS Depressants: Concomitant use of ketamine with opioid analgesics, benzodiazepines, or other central nervous system (CNS) depressants, including alcohol, may result in profound sedation, respiratory depression, coma, and death. Closely monitor neurological status and respiratory parameters, including respiratory rate and pulse oximetry, when Ketamine Hydrochloride Injection and opioid analgesics, benzodiazepines, or other CNS depressants are co-administered. Consider dose adjustment individualized to the patient's clinical situation
Interactions	• See references

CCT-F8 KETAMINE HYDROCHLORIDE

Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1999

CCT-F9 LORAZEPAM

Trade Name	Ativan	
Class(es)	Anticonvulsants, Benzodiazepines, Anxiolytics, Benzodiazepines, Benzodiazepine Sedative/Hypnotics	
Action(s)	Benzodiazepines act at the level of the limbic, thalamic, and hypothalamic regions of the CNS, and can produce any level of CNS depression required including sedation, hypnosis, skeletal muscle relaxation, anticonvulsant activity, and coma.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-M2 Anxiolysis • CCT-M3 Sedation of the Intubated Patient	
Contraindication(s)	• NOT FOR USE IN NEONATES CONTAINS BENZYL ALCOHOL • Patients with a known sensitivity to benzodiazepines or its vehicle (polyethylene glycol, propylene glycol and benzyl alcohol), in patients with acute narrow-angle glaucoma, or in patients with sleep apnea syndrome • It is also contraindicated in patients with severe respiratory insufficiency, except in those patients requiring relief of anxiety and/or diminished recall of events while being mechanically ventilated. • The use of Lorazepam injection intra-arterially is contraindicated because, as with other injectable benzodiazepines, inadvertent intra-arterial injection may produce arteriospasm resulting in gangrene which may require amputation	
Warnings & Precaution(s)	• Avoid coadministration with opioids if possible due to potential for profound sedation, respiratory depression, coma, and death	
Pharmacokinetics	**Onset:** IV 15 – 20 minutes Intramuscular 1 – 2 hours	**Duration:** IV 6 to 8 hours
Authorized Routes of Administration	• Intravenous	

CCT-F9 LORAZEPAM

Technique for Administration	• Prior to intravenous use, lorazepam injection must be diluted with an equal amount of compatible diluent • Intravenous injection should be made slowly and with repeated aspiration • Care should be taken to determine that any injection will not be intra-arterial and that perivascular extravasation will not take place
Handling	• N/A
PEARLS	• For status epilepticus, IV administration is preferred over Intramuscular because therapeutic blood concentrations are reached more quickly with IV administration • Intramuscular administration - Inject deeply into a large muscle mass (e.g., anterolateral thigh or deltoid [children and adolescents only])
Y-Site Compatibility	• None specified
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=996

CCT-F10 MANNITOL

Trade Name	Osmitrol	
Class(es)	Diagnostic Agents, Other Mucolytics for Cystic Fibrosis, Osmotic Diuretics, Osmotic Therapy, Other Irrigating Solutions	
Action(s)	Intravenous mannitol exerts its osmotic diuretic effect as a solute of relatively small molecular size being largely confined to the extracellular space. Mannitol hinders tubular reabsorption of water and enhances excretion of sodium and chloride by elevating the osmolarity of the glomerular filtrate. The increase in extracellular osmolarity induces the movement of intracellular water to the extracellular and vascular spaces. This action underlies the role of mannitol in reducing intracranial pressure, intracranial edema, and intraocular pressure	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-T2 Head Trauma • CCT-N3 Intracranial Hemorrhage	
Contraindication(s)	• Well established anuria due to severe renal disease • Severe pulmonary congestion or frank pulmonary edema • Active intracranial bleeding except during craniotomy • Severe dehydration • Progressive renal damage or dysfunction after institution of mannitol therapy, including increasing oliguria and azotemia • Progressive heart failure or pulmonary congestion after mannitol therapy is started	
Warnings & Precaution(s)	• Excessive loss of water and electrolytes may lead to serious imbalances • The diuresis after rapid infusion of mannitol may increase preexisting hemoconcentration. With continued use of mannitol a loss of water in excess of electrolytes can cause hypernatremia • Shift of sodium-free intracellular fluid into the extracellular compartment after mannitol infusion may lower serum sodium concentration and aggravate preexisting hyponatremia.	
Pharmacokinetics	**Onset:** 20 – 40 minutes	**Duration:** 1 – 3 hours
Authorized Routes of Administration	• Intravenous **ONLY**	

CCT-F10 MANNITOL

Technique for Administration	• Administer using a sterile, filter-type administration set to prevent the unintentional administration of mannitol crystals. The size of the filter used varies and ranges from 0.2-micron up to 5-micron • To prevent air embolism, use a non-vented infusion set or close the vent on a vented set • Infusion into a large central vein is preferred. If central access is unavailable, administer via a large peripheral vein using a small-bore needle.
Handling	• Visually inspect parenteral products for particulate matter and discoloration prior to administration whenever solution and container permit. Do not administer unless solution is clear • Inspect for crystals prior to administration. Higher concentrations of mannitol (more than 15%) have a greater tendency to crystallize, particularly when exposed to low temperature • Flexible containers: If crystals are visible, dissolve by warming the solution up to 70 degrees C (158 degrees F) with agitation. Some formulations recommend warming to a temperature no greater than 60 degrees C (140 degrees F). Heat the solution using a dry-heat cabinet with the overwrap intact. **DO NOT heat in water or a microwave oven due to the potential for contamination or damage**. **If the crystals cannot be completely redissolved, discard the container.** • Vials for injection: If crystals are visible, dissolve by warming bottles in hot water at 80 degrees C (176 degrees F) and shaking vigorously. Mannitol 25% may be autoclaved at 121 degrees C (250 degrees F) for 20 minutes at 15 psi. • Allow the solution to cool to room or body temperature before reinspecting for crystals and use. • For flexible bags stored in overwrap, there may be some opacity of the plastic due to moisture absorption during the sterilization process. This is normal and does not affect the solution quality or safety; the opacity will diminish gradually
PEARLS	• N/A

CCT-F10 MANNITOL

Y-Site Compatibility	• DO NOT administer mannitol simultaneously with blood products through the same administration set due to the possibility of pseudoagglutination or hemolysis. • If coadministration is essential, add at least 20 mEq of sodium chloride to each liter of mannitol solution to avoid pseudoagglutination
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1149

CCT-F11 MILRINONE LACTATE

Trade Name	Primacor	
Class(es)	Positive Inotropic Agents	
Action(s)	Positive inotrope and vasodilator with little chronotropic activity. Milrinone selectively inhibits phosphodiesterase III, preventing breakdown of cyclic adenosine monophosphate (cAMP) in cardiac and vascular muscle cells. This results in increased myocardial contractility and vasodilation. Milrinone also improves diastolic relaxation (lusitropy), thus reducing preload, afterload, and systemic vascular resistance	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• Milrinone lactate injection is contraindicated in patients who are hypersensitive to it	
Warnings & Precaution(s)	• The use of milrinone intravenously has been associated with increased frequency of ventricular arrhythmias, including non-sustained ventricular tachycardia.	
Pharmacokinetics	**Onset:** 2 minutes	**Duration:** 1.5 – 5 hours
Authorized Routes of Administration	• Intravenous/Intraosseous **ONLY**	
Technique for Administration	• Administer with a controlled infusion device • Administer over 10 to 60 minutes • Observe the patient closely with cardiac monitor • Milrinone drawn from vials should be diluted prior to maintenance dose administration. The diluents that may be used are 0.45% Sodium Chloride Injection USP, 0.9% Sodium Chloride Injection USP, or 5% Dextrose Injection USP	
Handling	• N/A	
PEARLS	• N/A	

CCT-F11 MILRINONE LACTATE

Y-Site Compatibility	• DO NOT administer simultaneously with blood or furosemide. • Furosemide is incompatible with milrinone; precipitation may occur if given together in the same line
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1147

CCT-F12 NICARDIPINE HYDROCHLORIDE

Trade Name	Cardene	
Class(es)	Dihydropyridine Calcium Channel Blockers	
Action(s)	Nicardipine inhibits the influx of extracellular calcium across the cell membranes of myocardial and vascular smooth muscle without altering serum calcium concentrations. Nicardipine is more selective to vascular smooth muscle than to cardiac muscle. Thus, nicardipine relaxes the peripheral vasculature without affecting inotropy.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-C2 Aortic Emergency • CCT-N2 Ischemic Stroke • CCT-N3 Intracranial Hemorrhage	
Contraindication(s)	• DO NOT use in patients with advanced aortic stenosis	
Warnings & Precaution(s)	• Closely monitor response in patients with angina, heart failure, impaired hepatic function, or renal impairment • To reduce the possibility of venous thrombosis, phlebitis, and vascular impairment, **DO NOT USE SMALL VEINS**, such as those on the dorsum of the hand or wrist. • **Exercise extreme care to avoid intra-arterial administration or extravasation** • To minimize the risk of peripheral venous irritation, change the site of infusion of nicardipine hydrochloride every 12 hours	
Pharmacokinetics	**Onset:** 2 – 5 minutes	**Duration:** 30 minutes – 4 hours
Authorized Routes of Administration	• Intravenous/Intraosseous **ONLY**	
Technique for Administration	• Administer via a central line or large peripheral vein • Monitor blood pressure and heart rate during and after the infusion to avoid tachycardia or too rapid or excessive reduction in blood pressure	
Handling	• **VIAL** - Dilute each vial (25 mg) with 240 mL of compatible IV solution to yield a 0.1 mg/mL concentration	
PEARLS	• N/A	

CCT-F12 NICARDIPINE HYDROCHLORIDE

Y-Site Compatibility	• Nicardipine injection is compatible with 5% Dextrose Injection, 5% Dextrose and 0.9% Sodium Chloride Injection, 5% Dextrose and 0.45% Sodium Chloride Injection, 5% Dextrose Injection with 40 mEq/L potassium chloride, 0.9% Sodium Chloride Injection, and 0.45% Sodium Chloride Injection • **Nicardipine is NOT compatible with Lactated Ringer's Injection or Sodium Bicarbonate Injection**
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=2169

CCT-F13 NITROGLYCERIN

Trade Name	Tridil
Class(es)	Nitrites and Nitrates, Plain Peripheral Vasodilators
Action(s)	Nitroglycerin is converted to nitric oxide (NO), a reactive free radical. Nitric oxide, the active intermediate compound common to all agents of this class, activates the enzyme guanylate cyclase, thereby stimulating the synthesis of cyclic guanosine 3',5'-monophosphate (cGMP). This second messenger then activates a series of protein kinase-dependent phosphorylations in the smooth muscle cells, eventually resulting in the dephosphorylation of the myosin light chain of the smooth muscle fiber and the subsequent release, or extrusion, of calcium ions. The contractile state of smooth muscle is normally maintained by a phosphorylated myosin light chain (stimulated by an increase in calcium ions). Thus, the nitrite- or nitrate-induced dephosphorylation of the myosin light chain signals the cell to release calcium, thereby relaxing the smooth muscle cells and producing vasodilation
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-CS3 Critical Care Transport Utilization • CCT-AD2 Respiratory Failure • CCT-C1 Acute Coronary Syndrome
Contraindication(s)	• Patients who are allergic to it • Patients with pericardial tamponade, restrictive cardiomyopathy, or constrictive pericarditis, cardiac output is dependent upon venous return. Intravenous nitroglycerin is contraindicated in patients with these conditions. • Patients with increased intracranial pressure • DO NOT use in patients who are taking certain drugs for erectile dysfunction (phosphodiesterase inhibitors) such as sildenafil, tadalafil, or vardenafil. Concomitant use can cause severe hypotension, syncope, or myocardial ischemia • DO NOT use in patients who are taking the soluble guanylate cyclase stimulator riociguat. Concomitant use can cause hypotension
Warnings & Precaution(s)	• N/A

CCT-F13 NITROGLYCERIN

Pharmacokinetics	**Onset:** Immediate	**Duration:** Several minutes after administration
Authorized Routes of Administration	• Intravenous/Intraosseous **ONLY**	
Technique for Administration	• **VIAL** - Dilute in 5% Dextrose Injection or 0.9% Sodium Chloride Injection to a final concentration of 200 to 400 mcg/mL depending on patient's fluid status. A common dilution is 50 mg in 250 mL of 5% Dextrose Injection or 0.9% Sodium Chloride Injection • Solutions containing dextrose without electrolytes should not be administered through the same administration set as blood, as this may result in pseudoagglutination or hemolysis	
Handling	• Significant adsorption (80% of the nitroglycerin in solution) occurs with standard infusion sets made of PVC plastic. Use glass bottles only and special tubing provided by the manufacturer	
PEARLS	• N/A	
Y-Site Compatibility	• N/A	
Interactions	• See references	
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1148	

CCT-F14 SODIUM NITROPRUSSIDE

Trade Name	Nipride, Nitropress
Class(es)	Peripheral Vasodilators, Plain
Action(s)	The peripheral vasodilatory effects of nitroprusside are due to a direct action of the drug on arterial and venous smooth muscle. Other smooth muscle tissue in the body is not affected, and myocardial contractility is unaffected. Nitroprusside-induced peripheral vasodilation results in a reduced left ventricular afterload, and this, along with a reduced venous return to the heart (due to venous pooling of the blood and decreased arteriolar resistance), results in a slight increase in heart rate and decrease in cardiac output in hypertensive patients. In patients with congestive heart failure, nitroprusside improves left ventricular heart performance, with increases in cardiac index, cardiac output, and stroke volume. Heart rate also slows in these patients, and arrhythmias can be reduced or abolished. Nitroprusside also can decrease myocardial oxygen demand, which is beneficial to patients with ischemia
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration
Contraindication(s)	• Should not be used in the treatment of compensatory hypertension, where the primary hemodynamic lesion is aortic coarctation or arteriovenous shunting • Patients with congenital (Leber's) optic atrophy or with tobacco amblyopia have unusually high cyanide/thiocyanate ratios. These rare conditions are probably associated with defective or absent rhodanase, and sodium nitroprusside should be avoided in these patients • Should not be used for the treatment of acute congestive heart failure associated with reduced peripheral vascular resistance such as high-output heart failure that may be seen in endotoxic sepsis

CCT-F14 SODIUM NITROPRUSSIDE

Warnings & Precaution(s)	• Cyanide toxicity - Nitroprusside metabolism produces dose-related cyanide. Nitroprusside infusion rates more than 2 mcg/kg/minute generate cyanide ion faster than the body can normally dispose of it. A patient's ability to buffer cyanide will be exceeded in less than 1 hour at the maximum dose rate (10 mcg/kg/minute) • Limit infusions at the maximum rate to as short a duration as possible. • Discontinue nitroprusside and consider specific treatment (e.g., sodium nitrite, sodium thiosulfate) if cyanide toxicity develops. • Most of the cyanide produced during the metabolism of nitroprusside is eliminated in the form of thiocyanate. • Thiocyanate is life-threatening when concentrations reach approximately 200 mg/L; therefore, routine monitoring of plasma thiocyanate concentrations is recommended in patients with normal renal function when cumulative nitroprusside doses exceed 7 mg/kg/day.	
Pharmacokinetics	**Onset:** 1 to 2 minutes	**Duration:** 1 – 10 minutes after discontinuing the infusion
Authorized Routes of Administration	• Intravenous/Intraosseous **ONLY**	
Technique for Administration	• Monitor blood pressure continuously, preferably using an intraarterial pressure sensor • Confirm the drug effect at any infusion rate after an additional 5 minutes before titrating to a higher dose	

Handling	• **SINGLE DOSE VIALS**
	  ○ DO NOT administer by direct IV injection. **Further dilution is necessary before infusion**
	• **READY-TO-USE (RTU) VIALS**
	  ○ Further dilution is not necessary before infusion
	• Protect the diluted solution (single use or RTU) from light using an opaque sleeve, aluminum foil, or other opaque material	

PEARLS	• N/A	
Y-Site Compatibility	• N/A	
Interactions	• See references	

CCT-F14 SODIUM NITROPRUSSIDE

Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=3404

CCT-F15 OCTREOTIDE ACETATE

Trade Name	Sandostatin	
Class(es)	Somatostatin and analogs	
Action(s)	The pharmacologic effects of octreotide are similar to those of somatostatin, a hypothalamic peptide. Although the exact mechanism of action is not known, octreotide is believed to act at somatostatin receptors	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• Sensitivity to this drug or any of its components	
Warnings & Precaution(s)	• Patients with cirrhosis and fatty liver disease have prolonged elimination of octreotide. Specific guidelines for dosage adjustments in hepatic impairment are not available for the immediate-release injection solution	
Pharmacokinetics	**Onset:** Rapidly	**Duration:** 12 hours
Authorized Routes of Administration	• Intravenous or intraosseous **ONLY**	
Technique for Administration	• In emergency situations, octreotide may be administered undiluted by intermittent direct IV injection. Give IV slowly over 3 minutes • Intermittent IV Infusion - Dilute in 50 mL to 200 mL of 0.9% Sodium Chloride or 5% Dextrose injection • Continuous Infusion - Dilute in 50 mL to 200 mL of 0.9% Sodium Chloride or 5% Dextrose injection	
Handling	• Octreotide injection solution may be allowed to reach room temperature prior to administration. Do not warm artificially.	
PEARLS	• N/A	
Y-Site Compatibility	• Octreotide acetate is not compatible in Total Parenteral Nutrition (TPN) solutions because of the formation of a glycosyl octreotide conjugate which may decrease the efficacy of the product	

CCT-F15 OCTREOTIDE ACETATE

Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=438

CCT-F16 OXYTOCIN

Trade Name	Pitocin
Class(es)	Labor Inducers
Action(s)	Synthetic oxytocin elicits the same pharmacological response produced by endogenous oxytocin, with cervical dilation, parity, and gestational age as predictors of the dose response to oxytocin administration for labor stimulation. Oxytocin increases the sodium permeability of uterine myofibrils, indirectly stimulating contraction of the uterine smooth muscle
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration

Contraindication(s)	• Oxytocin is contraindicated in any of the following conditions:
	  ○ significant cephalopelvic disproportion
	  ○ unfavorable fetal positions or presentations which are undeliverable without conversion prior to delivery, e.g., transverse lies
	  ○ in obstetrical emergencies where the benefit-to-risk ratio for either the fetus or the mother favors surgical intervention
	  ○ in cases of fetal distress where delivery is not imminent
	  ○ hypertonic uterine patterns
	  ○ hypersensitivity to the drug.
	• Prolonged use in uterine inertia or severe toxemia is contraindicated
	• Should not be used in cases where vaginal delivery is not indicated, such as cord presentation or prolapse, total placenta previa, and vasa previa

CCT-F16 OXYTOCIN

Warnings & Precaution(s)	• Oxytocin, when given for induction or stimulation of labor, must be administered only by intravenous infusion (drip method) and with adequate medical supervision • Overstimulation of the uterus by improper administration can be hazardous to both mother and fetus • Maternal deaths due to hypertensive episodes, subarachnoid hemorrhage, rupture of the uterus, and fetal deaths and permanent CNS or brain damage of the infant due to various causes have been reported to be associated with the use of parenteral oxytocic drugs for induction of labor or for augmentation in the first and second stages of labor • Oxytocin should be considered for use only in patients who have been carefully selected. Pelvic adequacy must be considered and maternal and fetal conditions thoroughly evaluated before use of the drug	
Pharmacokinetics	**Onset:** Immediately	**Duration:** approximately 1 hour
Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**	
Technique for Administration	• Administer using an infusion pump to ensure accurate dosing. Experts recommend the use of smart infusion pumps with an engaged dose error-reduction system for oxytocin infusions • When an oxytocin infusion is discontinued, promptly remove and discard any unused portion of the infusion and change the IV line to ensure no residual drug is left in the tubing	
Handling	• N/A	
PEARLS	• Prior to administration, an IV infusion of 0.9% Sodium Chloride or other appropriate IV fluid should be already running for use in case of adverse reactions • Magnesium sulfate should be readily available for myometrial relaxation, if necessary • The dosage of oxytocin is determined by the uterine response. Dosage and infusion must be individualized and initiated at a very low level	

CCT-F16 OXYTOCIN

Y-Site Compatibility	• N/A
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1666

CCT-F17 PHENYLEPHRINE HYDROCHLORIDE

Trade Name	Vazculep, Biorphen	
Class(es)	Cardiac Stimulants Excluding Dopaminergic Agents	
Action(s)	Phenylephrine is a potent vasoconstrictor. It possesses both direct and indirect sympathomimetic effects. Phenylephrine is used parenterally to achieve cardiovascular effects. The dominant effect is agonism at alpha-adrenergic receptors (direct effect)	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• None	
Warnings & Precaution(s)	• Exacerbation of Angina, Heart Failure, or Pulmonary Arterial Hypertension • Can precipitate angina in patients with severe arteriosclerosis or history of angina, exacerbate underlying heart failure, and increase pulmonary arterial pressure • Peripheral and Visceral Ischemia: can cause excessive peripheral and visceral vasoconstriction and ischemia to vital organs • Skin and Subcutaneous Necrosis: Extravasation during intravenous administration may cause necrosis or sloughing of tissue • Bradycardia: can cause severe bradycardia and decreased cardiac output	
Pharmacokinetics	**Onset:** almost immediately	**Duration:** 15 – 20 minutes
Authorized Routes of Administration	• Intravenous or intraosseous **ONLY**	
Technique for Administration	• Use infusion pump for administration	
Handling	• Ready-to-Use (RTU) – DO NOT dilute before administration • IV Push - Concentrated products require dilution; admix 1 mL of the 10 mg/mL solution with 99 mL of 5% Dextrose Injection or 0.9% Sodium Chloride Injection for a final concentration of phenylephrine 100 mcg/mL. • Continuous Infusion - Central line access is preferred	

CCT-F17 PHENYLEPHRINE HYDROCHLORIDE

PEARLS	• DO NOT inject phenylephrine into extremities such as fingers, toes, nose, and genitalia because it can cause severe tissue necrosis due to vasoconstriction of small blood vessels
Y-Site Compatibility	• PENDING
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=3539

CCT-F18 PROPOFOL

Trade Name	Diprivan	
Class(es)	Other General Anesthetics	
Action(s)	Propofol appears to inhibit the NMDA subtype of glutamate receptors by channel gating modulation and has agonistic activity at the GABAA receptor.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-CS6 Sapphire Infusion Pump Tubing Selection • CCT-M3 Sedation of the Intubated Patient	
Contraindication(s)	• Known hypersensitivity to propofol, egg or soybean	
Warnings & Precaution(s)	• **Hypersensitivity Reactions**: Serious and sometimes fatal reactions • **Microbial Contamination:** Strict aseptic technique must be maintained during handling. **Propofol Injectable Emulsion vials are never to be accessed more than once or used on more than one person**. Administration should commence promptly and be completed within 12 hours after the vial has been opened. Discard unused drug product. DO NOT use if contamination is suspected • **Cardiovascular Depression**: Cases of bradycardia, asystole, and cardiac arrest have been reported. Pediatric patients are susceptible to this effect, particularly when fentanyl is given concomitantly	
Pharmacokinetics	**Onset:** within 40 seconds from start of the injection	**Duration:** 10 – 15 minutes once discontinued
Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**	
Technique for Administration	• Disinfect the vial rubber stopper using 70% isopropyl alcohol • Allow an adequate interval (i.e., 3 to 5 minutes) between dose adjustments to assess clinical effects • Do not mix propofol with other medications before administration	

CCT-F18 PROPOFOL

Handling	• **Dilution** - Propofol is provided as a ready-to-use formulation. However, should dilution be necessary, propofol may only be diluted with 5% Dextrose Injection, and it should not be diluted to a concentration of less than 2 mg/mL because it is an emulsion. In diluted form, it is more stable when in contact with glass than with plastic (95% potency after 2 hours of running infusion in plastic) • **Intermittent IV Injection** - Withdraw propofol into a sterile syringe immediately after a vial is opened. When withdrawing propofol from vials, use a sterile vent spike. Label the syringe with appropriate information, including the date and time the vial was opened. To minimize pain on injection when administering propofol to pediatric patients, boluses may be administered via antecubital fossa or larger veins of the forearm or small veins if pretreated with lidocaine. Pain during intravenous injection may be reduced by prior injection of IV lidocaine (1 mL of a 1% solution). It is recommended that lidocaine be administered before propofol administration or that it be added to propofol immediately before administration and in quantities not exceeding 20 mg lidocaine/200 mg propofol.
PEARLS	• Propofol injectable emulsion is not recommended for induction of anesthesia below the age of 3 years or for maintenance of anesthesia below the age of 2 months • Clinical experience with the use of in-line filters and propofol is limited. Only administer propofol through a filter with a pore size of 5 micron or more unless it has been demonstrated that the filter does not restrict the flow of propofol and/or cause the breakdown of the emulsion • Use filters with caution and where clinically appropriate • Continuous monitoring is necessary due to the potential for restricted flow and/or breakdown of the emulsion
Y-Site Compatibility	• When administered using a y-type infusion set, propofol injectable emulsion has been shown to be compatible with the following intravenous fluids: ○ 5% Dextrose Injection, USP ○ Lactated Ringers Injection, USP ○ Lactated Ringers and 5% Dextrose Injection ○ 5% Dextrose and 0.45% Sodium Chloride Injection, USP ○ 5% Dextrose and 0.2% Sodium Chloride Injection, USP
Interactions	• See references

CCT-F18 PROPOFOL

Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1719

CCT-F19 ROCURONIUM BROMIDE

Trade Name	Zemuron	
Class(es)	Muscle Relaxants, Peripherally Acting	
Action(s)	Nondepolarizing neuromuscular blocking agents (NMBAs) such as rocuronium produce skeletal muscle paralysis by competing with ACh for cholinergic receptor sites at the motor end-plate. Neuromuscular blockade progresses in a predictable order, beginning with muscles associated with fine movements (e.g., eyes, face, and neck), followed by muscles of the limbs, chest, and abdomen and, finally, the diaphragm. Larger doses increase the chance of respiratory depression associated with relaxation of the intercostal muscles and the diaphragm. Muscle tone returns in the reverse order.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-CP1 Adult Airway Management • CCT-CP2 Pediatric Airway Management	
Contraindication(s)	• Hypersensitivity (e.g., anaphylaxis) to Rocuronium Bromide or other neuromuscular blocking agents	
Warnings & Precaution(s)	• **Appropriate Administration and Monitoring**: Use only if facilities for intubation, mechanical ventilation, oxygen therapy, and an antagonist are immediately available • **Anaphylaxis**: Severe anaphylaxis has been reported. Consider cross-reactivity among neuromuscular blocking agents • **Risk of Death due to Medication Errors**: Accidental administration can cause death. • **Need for Adequate Anesthesia**: Must be accompanied by adequate anesthesia or sedation. • **Residual Paralysis**: Consider using a reversal agent in cases where residual paralysis is more likely to occur	
Pharmacokinetics	**Onset:** 1 – 3 minutes in general	**Duration:** 22 – 67 minutes
Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**	

CCT-F19 ROCURONIUM BROMIDE

Technique for Administration	• To avoid distress to the patient, administer rocuronium only after unconsciousness has been induced • Adequate amnesia, sedation, and analgesia should accompany neuromuscular blockade • Intermittent IV Injection - No dilution necessary • Continuous IV Infusion - Dilute with 0.9% Sodium Chloride Injection, 5% Dextrose Injection, 5% Dextrose and 0.9% Sodium Chloride Injection, Lactated Ringer's Injection, or Sterile Water for Injection to a concentration up to 5 mg/mL
Handling	• **Accidental administration of neuromuscular blocking agents can be fatal. Store rocuronium with the cap and ferrule intact, in a manner that minimizes the possibility of selecting the wrong product.**
PEARLS	• Adequacy of respiration must be assured through assisted or controlled ventilation.
Y-Site Compatibility	• DO NOT mix rocuronium with alkaline solutions (e.g., barbiturate solutions such as thiopental) in the same syringe or administer simultaneously during IV infusion through the same needle or through the same IV line; rocuronium has an acidic pH • Succinylcholine: Use before succinylcholine has not been studied • Reduced Rocuronium Bromide activity possible: Anticonvulsants • If Rocuronium Bromide is administered via the same infusion line that is also used for other drugs, it is important that this infusion line is adequately flushed between administration of Rocuronium Bromide and drugs for which incompatibility with Rocuronium Bromide has been demonstrated or for which compatibility with Rocuronium Bromide has not been established
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=3861

CCT-F20 SUCCINYLCHOLINE CHLORIDE

Trade Name	Anectine, Quelicin
Class(es)	Muscle Relaxants, Peripherally Acting
Action(s)	• Muscle contraction is initiated by an action potential traveling from the central nervous system to the nerve terminal. • Succinylcholine, a depolarizing neuromuscular blocking agent, produces skeletal muscle paralysis by competing with ACh for cholinergic receptor sites at the motor end-plate
Authorized Indication(s)	• CCT-CP1 Adult Airway Management • CCT-CP2 Pediatric Airway Management
Contraindication(s)	• Succinylcholine is contraindicated in patients after the acute phase of injury after major burns, multiple trauma, extensive denervation of skeletal muscle, or upper motor neuron injury. • In such individuals, succinylcholine can cause severe hyperkalemia, which can result in serious cardiac arrhythmias and cardiac arrest. Risk of hyperkalemia increases over time and usually peaks 7 to 10 days after the injury; however, risk is dependent on the extent and location of injury, and the precise onset and duration of the risk period are unknown • Succinylcholine is contraindicated in persons with skeletal muscle myopathy or known or suspected genetic susceptibility to malignant hyperthermia
Warnings & Precaution(s)	• Acute rhabdomyolysis with hyperkalemia followed by ventricular dysrhythmias, cardiac arrest, and death has occurred after use in apparently healthy pediatric patients who were subsequently found to have undiagnosed skeletal muscle myopathy • When a healthy-appearing pediatric patient develops cardiac arrest soon after administration of succinylcholine chloride, not felt to be due to other causes, immediate treatment for hyperkalemia should be instituted • In the presence of signs of malignant hyperthermia, appropriate treatment should be instituted concurrently • Reserve use of succinylcholine chloride in pediatric patients for emergency intubation or instances where immediate securing of the airway is necessary, or for intramuscular use when a suitable vein is inaccessible

CCT-F20 SUCCINYLCHOLINE CHLORIDE

Pharmacokinetics	**Onset:** approximately 1 minute	**Duration:** 2 minutes
Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**	
Technique for Administration	• To avoid distress to the patient, administer succinylcholine after unconsciousness has been induced; in emergent life-threatening situations, it may be necessary to administer succinylcholine before unconsciousness. Adequate amnesia, sedation, and analgesia should accompany neuromuscular blockade • Pretreatment with anticholinergic agents (e.g., atropine) may reduce the occurrence of bradyarrhythmias • Monitor heart rate, blood pressure, and oxygen saturation during neuromuscular blockade. • Continuously monitor temperature and expired carbon dioxide to aid in early recognition of malignant hyperthermia. Monitor ECG; peaked T-waves are an early sign of cardiac arrest secondary to rhabdomyolysis and hyperkalemia	

Handling	• Store in refrigerator at 2 to 8 degrees C (36 to 46 degrees F) until vial expiration date
	• Dilution:
	  ○ Succinylcholine supplied in single-dose vials (100 mg/mL) must be diluted before use
	  ○ Succinylcholine supplied in multiple-dose vials (20 mg/mL) or prefilled syringes (20 mg/mL) do not require dilution before use.	

PEARLS	• **Accidental administration of neuromuscular blocking agents can be fatal** • **Store succinylcholine with the cap and ferrule intact, in a manner that minimizes the possibility of selecting the wrong product.** • Due to the risk for rhabdomyolysis and life-threatening hyperkalemia that has occurred in pediatric patients with unidentified myopathies, reserve succinylcholine use in pediatric patients for emergent situations when immediate securing of the airway is needed; intermittent IV infusions and continuous IV infusions are generally not recommended in pediatric patients	

CCT-F20 SUCCINYLCHOLINE CHLORIDE

Y-Site Compatibility	• DO NOT mix succinylcholine with alkaline solutions; succinylcholine is acidic (pH 3 to 4.5) and may not be compatible with alkaline solutions having a pH more than 8.5 (e.g., barbiturate solutions).
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=1376

CCT-F21 VASOPRESSIN

Trade Name	Vasostrict, Pitressin	
Class(es)	Vasopressin (ADH) and Analogs	
Action(s)	Vasopressin exerts its antidiuretic effects by increasing the resorption of water at the renal collecting ducts	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration • CCT-M5 Shock	
Contraindication(s)	• Vasopressin injection 1 mL single dose vial does not contain chlorobutanol and is therefore contraindicated only in patients with a known allergy or hypersensitivity to 8-L-arginine vasopressin	
Warnings & Precaution(s)	• Can worsen cardiac function • Reversible diabetes insipidus	
Pharmacokinetics	**Onset:** rapid	**Duration:** 20 minutes after infusion discontinued
Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**	
Technique for Administration	• N/A	

Handling	• Store between 2°C and 8°C (36°F and 46°F). DO NOT freeze.
	• Vials may be held up to 12 months upon removal from refrigeration to room temperature storage conditions (20°C to 25°C [68°F to 77°F]
	• Dilution –
	  ○ The 0.4 unit/mL and 0.6 unit/mL premixed solutions do not require further dilution prior to administration.
	  ○ Dilute the concentrated 20 units/mL solution to a concentration of 0.1 or 1 unit/mL in 0.9% Sodium Chloride Injection or 5% Dextrose Injection
	• Continuous IV Infusion –
	  ○ Administer through a central vein whenever possible; prolonged administration through a peripheral vein may result in extravasation and skin necrosis
	  ○ If peripheral administration is necessary, use a 20-gauge or larger catheter and assess the site frequently
	  ○ If extravasation occurs, administer 5 to 10 mg of phentolamine directly to the site	

CCT-F21 VASOPRESSIN

PEARLS	• N/A
Y-Site Compatibility	• N/A
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=3644

CCT-F22 VECURONIUM BROMIDE

Trade Name	Norcuron	
Class(es)	Muscle Relaxants, Peripherally Acting	
Action(s)	Muscle contraction is initiated by an action potential traveling from the central nervous system to the nerve terminal. At the nerve terminal, the action potential causes an influx of calcium, initiating release of acetylcholine (ACh) into the synaptic cleft. ACh binds to ACh receptors on the muscle fiber's motor end-plate causing a conformational change that briefly opens sodium ion channels. When an adequate number of ACh receptors are activated, membrane potential decreases and voltage-dependent sodium ion channels of adjacent muscle membranes activate, transmitting the action potential throughout the muscle fiber and resulting in muscle contraction. Nondepolarizing agents such as vecuronium produce skeletal muscle paralysis by competing with ACh for cholinergic receptor sites at the motor end-plate.	
Authorized Indication(s)	• CCT-AD1 Sapphire Infusion Pump Configuration	
Contraindication(s)	• Vecuronium bromide is contraindicated in patients known to have a hypersensitivity to it	
Warnings & Precaution(s)	• **Anaphylaxis**: Severe anaphylactic reactions to neuromuscular blocking agents, including vecuronium bromide • **Risk of Death due to Medication Errors**: Administration of Vecuronium Bromide for Injection results in paralysis, which may lead to respiratory arrest and death; this progression may be more likely to occur in a patient for whom it is not intended. Confirm proper selection of intended product and avoid confusion with other injectable solutions that are present in critical care and other clinical settings. If another healthcare provider is administering the product, ensure that the intended dose is clearly labeled and communicated	
Pharmacokinetics	**Onset:** within 1 minute	**Duration:** 25 – 40 minutes
Authorized Routes of Administration	• Intravenous and intraosseous **ONLY**	

CCT-F22 VECURONIUM BROMIDE

Technique for Administration	• Adequacy of respiration must be assured through assisted or controlled ventilation • To avoid distress to the patient, administer vecuronium only after unconsciousness has been induced • Adequate amnesia, sedation, and analgesia should accompany neuromuscular blockade
Handling	**Accidental administration of neuromuscular blocking agents can be fatal. Store vecuronium with the cap and ferrule intact, in a manner that minimizes the possibility of selecting the wrong product**
PEARLS	• Neuromuscular blockade progresses in a predictable order, beginning with muscles associated with fine movements (e.g., eyes, face, and neck), followed by muscles of the limbs, chest, and abdomen and, finally, the diaphragm • Larger doses increase the chance of respiratory depression associated with relaxation of the intercostal muscles and the diaphragm • Muscle tone returns in the reverse order. • Vecuronium produces minimal to no histamine release and no ganglion blockade; therefore, hypotension and bronchospasm are not associated with its use • Intensity and duration of action are affected by the dose, age of the patient, and the use of concurrent anesthetics and other neuromuscular blocking agents
Y-Site Compatibility	• DO NOT mix vecuronium with alkaline solutions (e.g., barbiturate solutions such as thiopental) in the same syringe or administer simultaneously during IV infusion through the same needle or through the same IV line; vecuronium has an acidic pH
Interactions	• See references
Reference	https://dailymed.nlm.nih.gov/dailymed/ https://www.pdr.net/drug-summary/?drugLabelId=804

CCT CLINICAL TOOLS

CCT CLINICAL TOOLS

CCT - CT1 VENTILATOR MANAGEMENT - DIFFUSE LUNG DISEASE

Disease State(s)

- Acute Respiratory Distress Syndrome (ARDS)
- Acute Lung Injury (ALI)

Overall Goals

- Improve oxygenation & alveolar recruitment
- Prevent alveolar collapse
- Minimize barotrauma
- Follow ARDSnet protocols

Inclusion Criteria

- PaO2/FiO2 less than or equal to 300
- Acute bilateral (patchy, diffuse, or homogenous) infiltrates consistent with pulmonary edema
- No clinical evidence of left atrial hypertrophy

Ventilator Set-up

- Calculate predicted body weight (Ref. CCT- CT6)
- Select preferred ventilator mode
- Set ventilator settings to Tidal Volume (Vt) 5 - 8 mL/kg (PBW)
  - Vt should be the highest to maintain Pplat less than 30 mmH_2O
- Set initial rate to the patient's baseline minute ventilation (not greater than 35 bpm)
- Adjust Vt and respiratory rate to achieve pH and plateau pressure goals

Oxygenation Goal

- PAO2 55 - 80 mmHg or SpO2 88 - 95%
- Use a minimum PEEP of 5 cmH_2O
- To improve oxygenation, increase PEEP and FiO2 incrementally
- Elevated PEEP of 20 cmH_2O may be needed
- Maintain awareness of blood pressure as vasopressor support may be needed

Plateau Pressure (Pplat) Goal

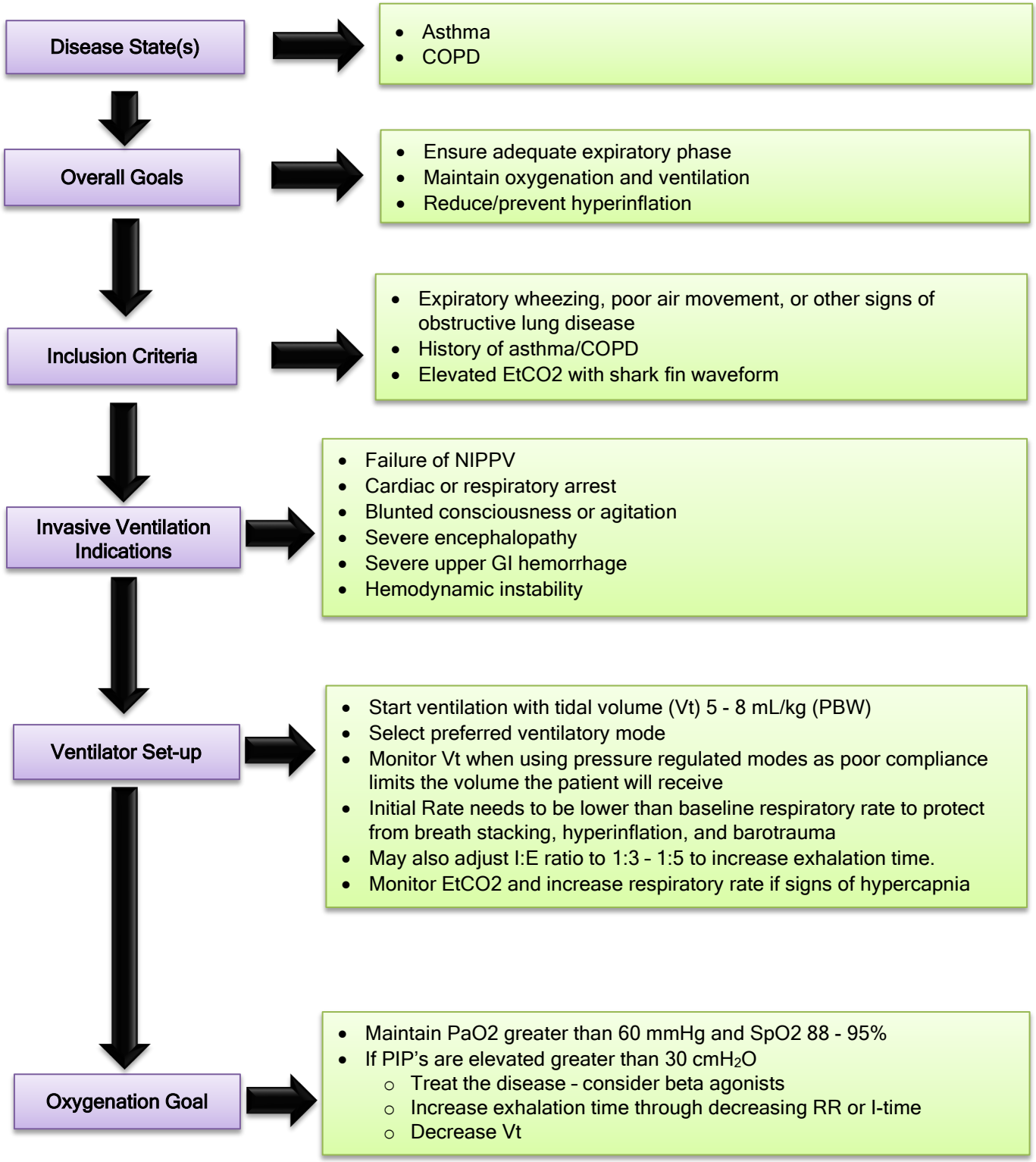
- If Pplat greater than 30 cmH_2O:
  - ensure adequate sedation, consider long term paralytics, decrease Vt by 1 mL/kg steps (minimum Vt 4 mL/kg)
- If Pplat less than 25 cmH_2O and Vt less than 6 mL/kg:
  - Increase Vt by 1 mL/kg until Pplat greater than 25 cmH_2O or Vt = 6 mL/kg
- If Pplat less than 30 and breath stacking or dyssynchrony occurs:
  - Increase Vt in 1 mL/kg increments to 7 or 8 mL/kg if Pplat remains less than or equal to 30 cmH_2O
- As tidal volume is adjusted, minute volume changes and the ventilatory rate may need to be inversely adjusted

CCT - CT1 VENTILATOR MANAGEMENT - DIFFUSE LUNG DISEASE

- Acidosis Management: (pH less than 7.30)
  - If pH 7.15 - 7.30: Increase RR until pH greater than 7.30 or PaCO2 less than 25 (Maximum set RR equals 35/min)
  - If pH less than 7.15: Increase RR to 35/min
    - If pH remains less than 7.15, Vt may be increased in 1 mL/kg steps until pH greater than 7.15. Pplat will increase - do not exceed 35 cmH2O
    - May give $NaHCO_3$
- Alkalosis Management: (pH greater than 7.45) - Decrease vent rate if possible

REFERENCES
• http://ardsnet.org/ • Ahmed SM, Athar M. Mechanical ventilation in patients with chronic obstructive pulmonary disease and bronchial asthma. Indian J Anaesth. 2015 Sep;59(9):589-98. doi: 10.4103/0019-5049.165856. PMID: 26556918; PMCID: PMC4613406. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4613406/

CCT – CT2 VENTILATOR MANAGEMENT – OBSTRUCTIVE LUNG DISEASE



REFERENCES

- http://ardsnet.org/
- Ahmed SM, Athar M. Mechanical ventilation in patients with chronic obstructive pulmonary disease and bronchial asthma. Indian J Anaesth. 2015 Sep;59(9):589-98. doi: 10.4103/0019-5049.165856. PMID: 26556918; PMCID: PMC4613406. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4613406/

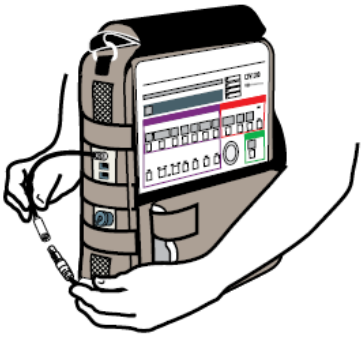
CCT - CT3 LTV 1200 VENTILATOR EMERGENCY SET-UP

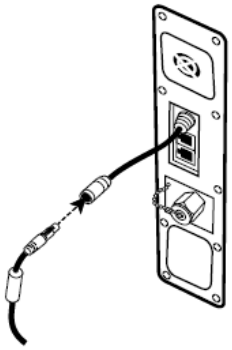
Step 1: Choose a power source.

AC adapter
(Use AC power when available).

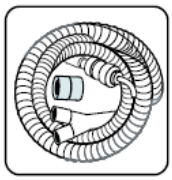
SprintPack Lithium-Ion
Power System

Step 2: Connect the LTV® 1200 ventilator to the power source.





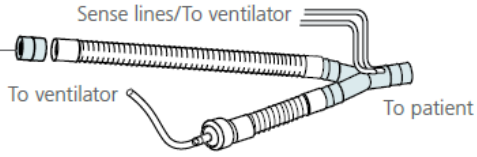
Step 3: Choose a circuit.



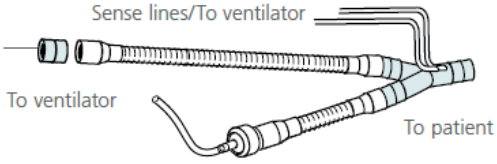
- Open bag.
- Remove patient circuit and **22 mm adapter** from bag.

Humidifier circuit *(optional)*

22 mm patient circuit, adult
>20 kg
>44 lb
22 mm adapter

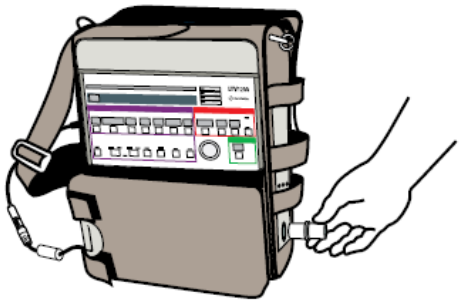


15 mm patient circuit, infant/pediatric
5 kg to ≤ 20 kg
11 lb ≤ 44 lb
22 mm adapter

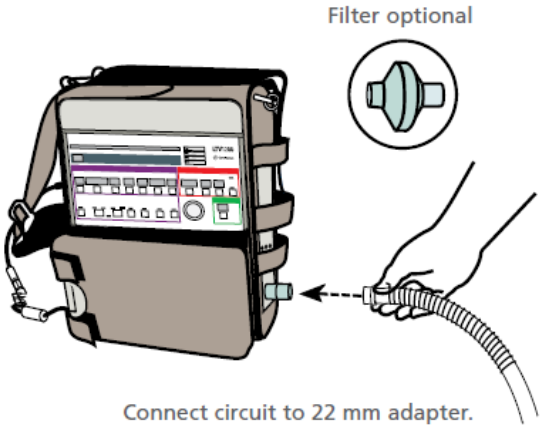


CCT - CT3 LTV 1200 VENTILATOR EMERGENCY SET-UP

Step 4: Connect the circuit to the LTV 1200 ventilator.

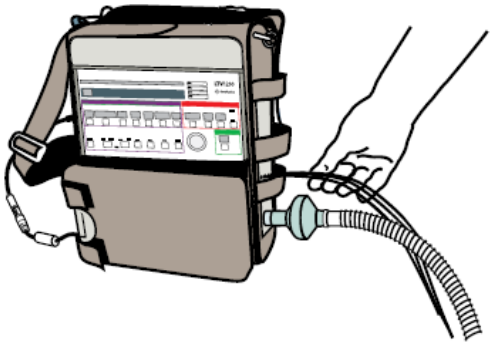


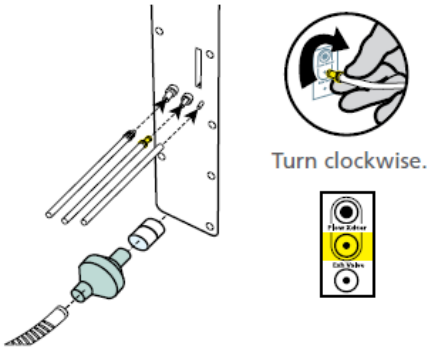
Attach 22 mm adapter
(found in circuit bag).



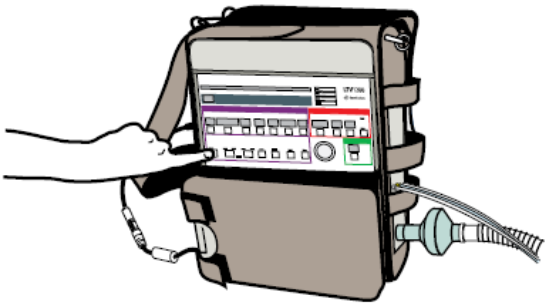
Connect circuit to 22 mm adapter.

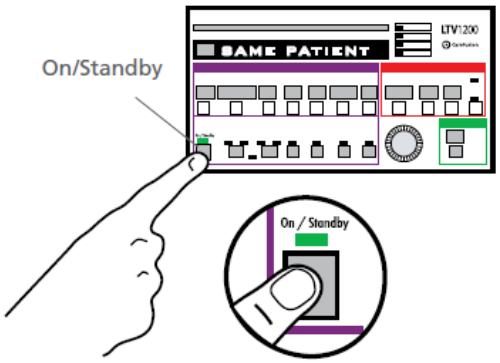
Step 5: Connect the sense lines to the LTV 1200 ventilator.





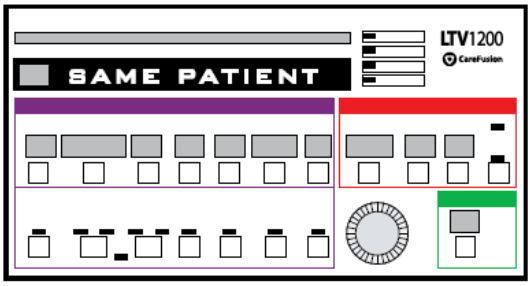
Step 6: Turn on the LTV 1200 ventilator.





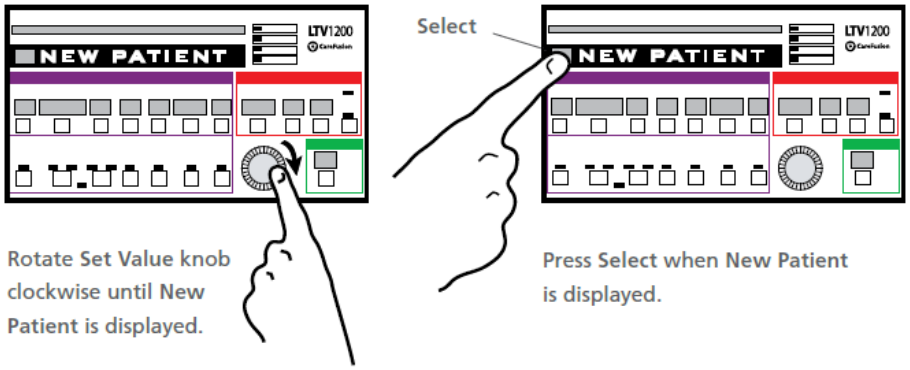
CCT - CT3 LTV 1200 VENTILATOR EMERGENCY SET-UP

Step 7: Patient setting displays.



Once the power is on, see Same Patient display.

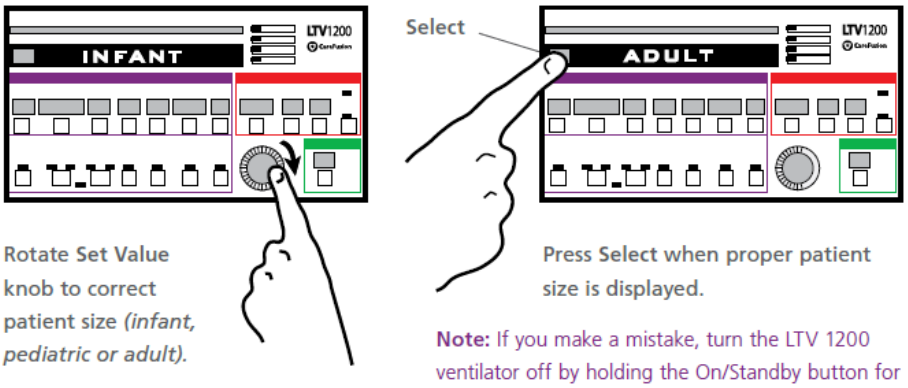
Step 8: Change display to the New Patient setting.



Rotate Set Value knob clockwise until New Patient is displayed.

Press Select when New Patient is displayed.

Step 9: Set patient size.



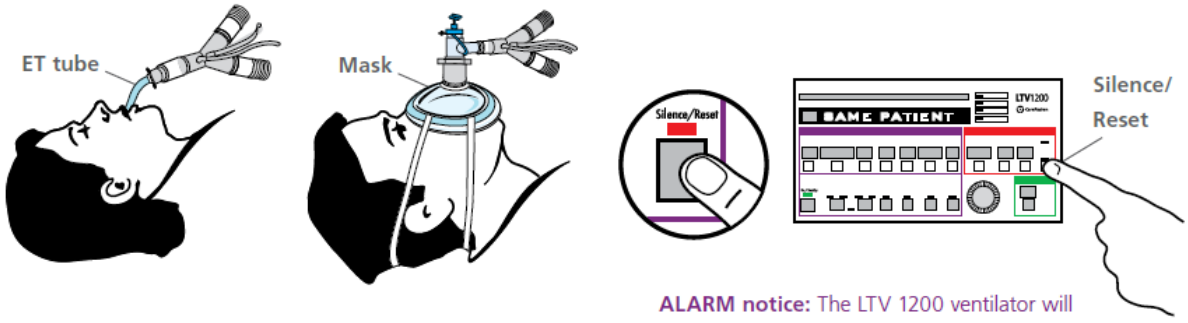
Rotate Set Value knob to correct patient size *(infant, pediatric or adult).*

Press Select when proper patient size is displayed.

Note: If you make a mistake, turn the LTV 1200 ventilator off by holding the On/Standby button for three seconds. Then return to Step 6.

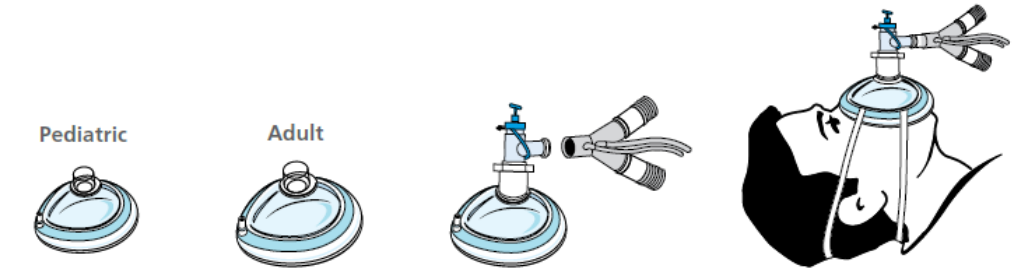
CCT - CT3 LTV 1200 VENTILATOR EMERGENCY SET-UP

Step 10: Connect circuit to ET tube or mask.



ALARM notice: The LTV 1200 ventilator will alarm until it is connected to the patient. To turn it off, you may press the **Silence/Reset** button.

Step 11: Optional: Use a mask.

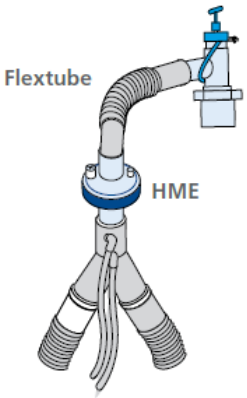


Choose a mask *(pediatric or adult).*

Connect elbow to mask.

Connect to patient.

Step 12: Optional: Use an HME and/or flextube as shown for patient comfort.



This emergency set-up card is intended to provide emergency instructions for initial LTV 1200 ventilator set-up. The initial settings may need to be adjusted based on the patient's clinical condition. For complete information regarding set-up and operation, refer to the LTV 1200 ventilator operator's manual.

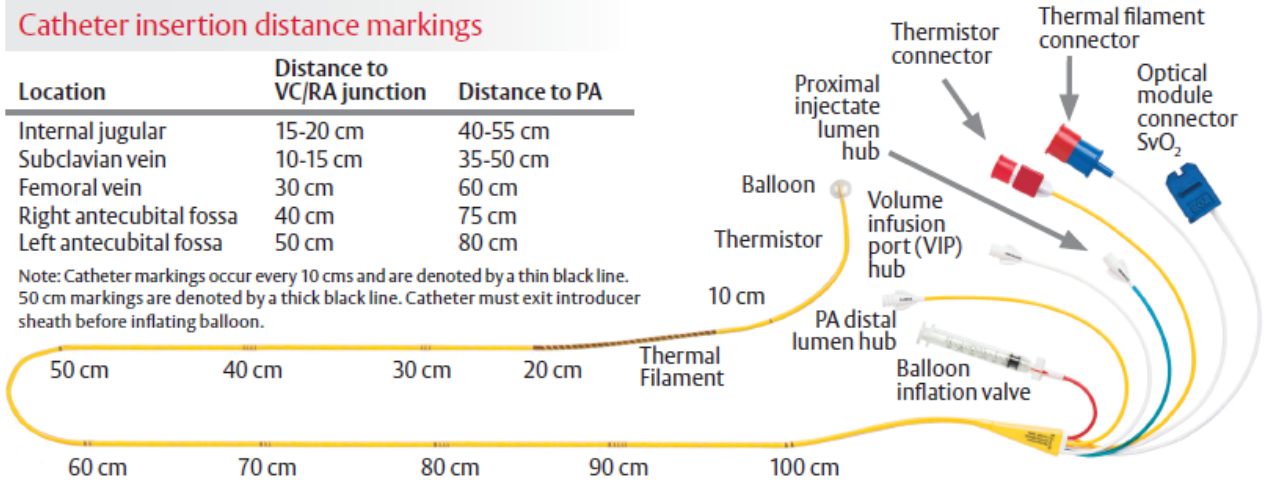
REFERENCES
• Vyaire LTV1200 Ventilator Emergency Set-up Card, 2013.
• https://www.youtube.com/watch?v=q8T6WN64SYI

CCT- CT4 HEMODYNAMIC MONITORING (SWAN GANZ OR CVP)

Catheter insertion distance markings

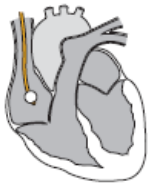
Location	Distance to VC/RA junction	Distance to PA
Internal jugular	15-20 cm	40-55 cm
Subclavian vein	10-15 cm	35-50 cm
Femoral vein	30 cm	60 cm
Right antecubital fossa	40 cm	75 cm
Left antecubital fossa	50 cm	80 cm

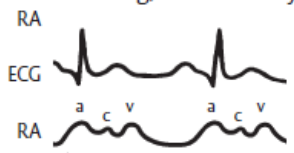
Note: Catheter markings occur every 10 cms and are denoted by a thin black line. 50 cm markings are denoted by a thick black line. Catheter must exit introducer sheath before inflating balloon.



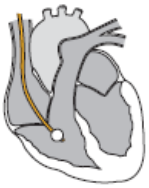
Swan-Ganz catheter insertion waveforms

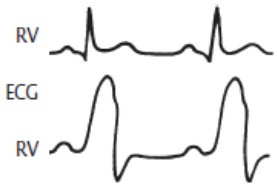
Right atrial/central venous pressure (RA/CVP)
2-6 mmHg
Mean 4 mmHg
- a = atrial systole
- c = backward bulging from tricuspid valve closure
- v = atrial filling, ventricular systole



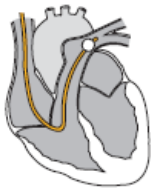


Right ventricle
- Systolic pressure (RVSP) 15-25 mmHg
- Diastolic pressure (RVDP) 0-8 mmHg

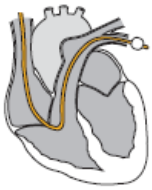


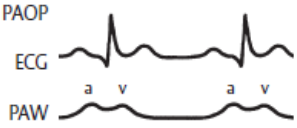


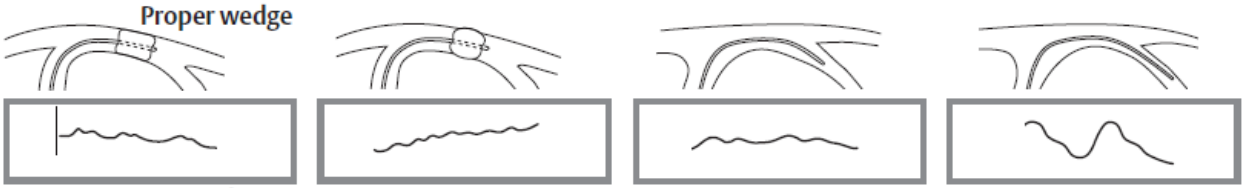
Pulmonary artery
- Systolic pressure (PASP) 15-25 mmHg
- Diastolic pressure (PADP) 8-15 mmHg
- Mean pressure (MPA) 10-20 mmHg



Pulmonary artery occlusion pressure (PAOP)
Mean 6-12 mmHg
- a = atrial systole
- v = atrial filling, ventricle systole







Appropriate "a" and "v" waves noted

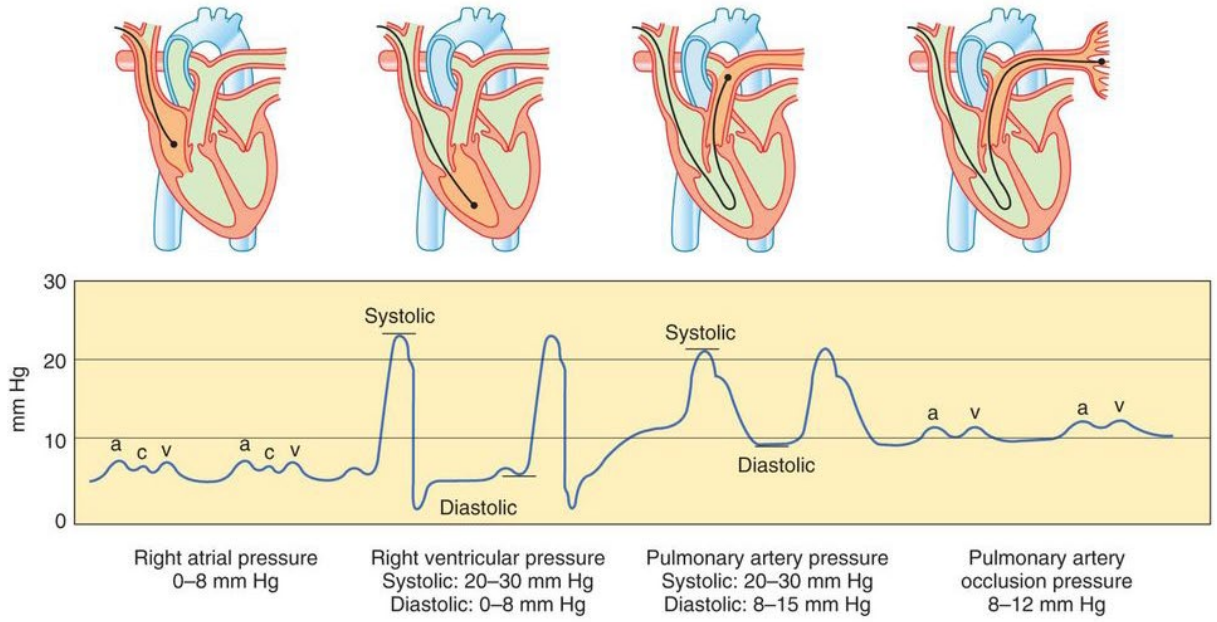
Over inflation of balloon
Note waveform rise

Catheter to distal
Overdamping of tracing

Catheter spontaneous wedging, wedge type tracing with balloon deflated

CCT- CT4 HEMODYNAMIC MONITORING (SWAN GANZ OR CVP)

PA Catheter Waveforms



Normal parameters

Parameter	Normal range	Parameter	Normal range
CO	4.0 - 8.0 L/min	PAOP	6-12 mmHg
CI	2.5 - 4.0 L/min/m^2	PADP	8-15 mmHg
SV	60 - 100 mL/beat	RVEF	40-60%
SVI	33 - 47 mL/beat/m^2	RVEDVI	60-100 mL/m^2
SVR	800 - 1200 dynes - sec/cm^{-5}	PVR	<250 dyne-sec/cm^5
SVRI	1970-2390 dynes - sec/cm^{-5} x m^2	RVSWI	5-10 g-m/m^2/beat
$SV0_2$	60-80%		

REFERENCES

- Critical Care Nursing: A Holistic Approach, 8th ed.
- https://educationgb.edwards.com/swan-ganztm-double-sided-brochure/347979#
- https://cpictures.homes/pulmonary-artery-catheter-waveforms

CCT - CT5 OBSTETRICS

CARDIOVASCULAR CHANGES IN NORMAL PREGNANCY		
	Non-Pregnant Patient	**Pregnant Patient**
Cardiac Output	5000 mL	6000 mL (20% - 40% increase)
Stroke Volume	80 mL	110 mL (approx. 30% increase)
Pulse Rate	80 beats/min	10% - 20% increase
Red blood cell	5 million mm^3	33% increase
Systemic Vascular Resistance	1500 dyne-sec/cm^{-5}	20% decrease
Mean Arterial Pressure	85 mmHg	No change
SBP	120 mmHg	120 mmHg
DBP	70 mmHg	80 mmHg
Data from Stillerman E. Prenatal Massage: A Textbook of Pregnancy, Labor, and Postpartum Bodywork, 1e. St. Louis: Mosby Elsevier. 2007		

Hemodynamic Parameter	Change During Normal Pregnancy	Change During Labor & Delivery	Change During Postpartum
Blood Volume	↑40-50%	↑	↓(auto diuresis)
Heart Rate	↑ 10-15 beats/min	↑	↓
Cardiac Output	↑ 30-50% above baseline	↑ additional 50%	↓
Blood Pressure	↓ 10 mmHg	↑	↓
Stroke Volume	↑ 1st & 2nd Trimester ↓ 3rd Trimester	↑ 300-500 ml/Contraction	↓
Systemic Vascular Resistance	↓	↑	↓
Reference: American Academy of Pediatrics			

Blood Gas Value	Non-Pregnant	Pregnant	Respiratory Failure in Pregnancy
pH	7.35-7.45	7.4-7.45	< 7.4
PCO2	34-45	27-32	>35
HCO3	21-27	↓to compensate for resp acidosis	Can ↑↑ in response to resp acidosis
PaO2	>80	100-110	< 70
SaO2	> 95%	> 95%	< 95%
Reference: American Academy of Pediatrics			

CCT - CT5 OBSTETRICS

Fetal Heart Rate Parameters	
Rate	**Beats per Minute**
Normal	120-160
Abnormal	
• Tachycardia	> 160
• Bradycardia	< 120
Critical Care Paramedic, Jones, and Bartlett 2nd Edition	

Conditions Associated with Fetal Distress	
Source	**Condition**
Umbilical Cord	Hematoma True knot in cord Nuchal cord Prolapsed cord Cord compression
Placenta	Infarction Abruption
Uterus	Tetanic contractions Hyperstimulation Tachysystole
Fetus	Anemia Infection
Maternal	Hypertension Hypotension Severe Anemia Seizures Fever Infection Diabetic mother
Critical Care Paramedic, Jones, and Bartlett 2nd Edition	

CCT - CT5 OBSTETRICS

Non-Reassuring FHR Patterns	Ominous FHR Patterns
Fetal Tachycardia	Persistent late decelerations with loss of beat-to-beat variability
Fetal Bradycardia	
Saltatory Variability	Non reassuring decelerations associated with loss of beat-to-beat variability
Variable decelerations associated with non-reassuring patterns	Prolonged severe bradycardia
Late decelerations with preserved beat to beat variability	Confirmed loss if beat to beat not associated with fetal quiescence, medications, or severed prematurity
Critical Care Paramedic, Jones, and Bartlett 2nd Edition	

CCT - CT6 PREDICTED (IDEAL) BODY WEIGHT AND TIDAL VOLUMES

FEMALES

Formula – 45.5 x 2.3 (height in inches – 60)

HEIGHT		*PBW (kg)*	*4 mL/kg*	*5 mL/kg*	*6 mL/kg*	*7 mL/kg*	*8 mL/kg*
4' 0"	48”	17.9	72	90	107	125	143
4' 1”	49”	20.2	81	101	121	141	162
4' 2"	50”	22.5	90	113	135	158	180
4' 3"	51”	24.8	99	124	149	174	198
4' 4"	52”	27.1	108	136	163	190	217
4' 5"	53”	29.4	118	147	176	206	235
4' 6"	54”	31.7	127	159	190	222	254
4' 7"	55”	34	136	170	204	238	272
4' 8"	56”	36.3	145	182	218	254	290
4' 9"	57”	38.6	154	193	232	270	309
4' 10"	58”	40.9	164	205	245	286	327
4' 11"	59”	43.2	173	216	259	302	346
5' 0"	60”	45.5	182	228	273	319	364
5' 1"	61”	47.8	191	239	287	335	382
5' 2"	62”	50.1	200	251	301	351	401
5' 3"	63”	52.4	210	262	314	367	419
5' 4"	64”	54.7	219	274	328	383	438
5' 5"	65”	57	228	285	342	399	456
5' 6"	66”	59.3	237	297	356	415	474
5' 7"	67”	61.6	246	308	370	431	493
5' 8"	68”	63.9	256	320	383	447	511
5' 9"	69”	66.2	265	331	397	463	530
5' 10"	70”	68.5	274	343	411	480	548
5' 11"	71”	70.8	283	354	425	496	566
6' 0"	72”	73.1	292	366	439	512	585
6' 1"	73”	75.4	302	377	452	528	603
6' 2"	74”	77.7	311	389	466	544	622
6' 3"	75”	80	320	400	480	560	640
6' 4"	76”	82.3	329	412	494	576	658
6' 5"	77”	84.6	338	423	508	592	677
6'6"	78”	86.9	348	435	521	608	695
6'7"	79”	89.2	357	446	535	624	714
6' 8"	80”	91.5	366	458	549	641	732
6' 9"	81”	93.8	375	469	563	657	750
6' 10"	82”	96.1	384	481	577	673	769
6' 11"	83”	98.4	394	492	590	689	787
7' 0"	84”	100.7	403	504	604	705	806

CCT - CT6 PREDICTED (IDEAL) BODY WEIGHT AND TIDAL VOLUMES

MALES

Formula for Males 50 x 2.3 (height in inches – 60)

HEIGHT		*PBW (kg)*	*4 mL/kg*	*5 mL/kg*	*6 mL/kg*	*7 mL/kg*	*8 mL/kg*
4' 0"	48”	22.4	90	112	134	157	179
4' 1"	49”	24.7	99	124	148	173	198
4' 2"	50”	27	108	135	162	189	216
4' 3"	51”	29.3	117	147	176	205	234
4' 4"	52”	31.6	126	158	190	221	253
4' 5"	53”	33.9	136	170	203	237	271
4' 6"	54”	36.2	145	181	217	253	290
4' 7"	55”	38.5	154	193	231	270	308
4' 8"	56”	40.8	163	204	245	286	326
4' 9"	57”	43.1	172	216	259	302	345
4' 10”	58”	45.4	182	227	272	318	363
4' 11"	59”	47.7	191	239	286	334	382
5' 0"	60”	50	200	250	300	350	400
5' 1"	61”	52.3	209	262	314	366	418
5' 2"	62”	54.6	218	273	328	382	437
5' 3"	63”	56.9	228	285	341	398	455
5' 4"	64”	59.2	237	296	355	414	474
5' 5"	65”	61.5	246	308	369	431	492
5' 6"	66”	63.8	255	319	383	447	510
5' 7"	67”	66.1	264	331	397	463	529
5' 8"	68”	68.4	274	342	410	479	547
5' 9"	69”	70.7	283	354	424	495	566
5' 10"	70”	73	292	365	438	511	584
5' 11"	71”	75.3	301	377	452	527	602
6' 0"	72”	77.6	310	388	466	543	621
6' 1"	73”	79.9	320	400	479	559	639
6' 2"	74”	82.2	329	411	493	575	658
6' 3"	75”	84.5	338	423	507	592	676
6' 4"	76”	86.8	347	434	521	608	694
6' 5"	77”	89.1	356	446	535	624	713
6' 6"	78”	91.4	366	457	548	640	731
6' 7"	79”	93.7	375	469	562	656	750
6' 8"	80”	96	384	480	576	672	768
6' 9"	81”	98.3	393	492	590	688	786
6' 10"	82”	100.6	402	503	604	704	805
6' 11"	83”	102.9	412	515	617	720	823
7' 0"	84”	105.2	421	526	631	736	842

REFERENCES

- http://www.ardsnet.org/tools.shtml

CCT - CT7 RICHMOND AGITATION-SEDATION SCALE (RASS)

Richmond Agitation-Sedation Scale

	Target RASS Value	RASS Description
+4	Combative	Combative, Violent, Immediate Danger to Staff
+3	Very Agitated	Pulls or Removes Tube(s) or Catheter(s); Aggressive
+2	Agitated	Frequent non-Purposeful Movement, Fights Ventilator
+1	Restless	Anxious, Apprehensive but Movements are not Aggressive or Vigorous
0	Alert and Calm	
-1	Drowsy	Not Fully Alert, but has Sustained Awakening to Voice (Eye Opening & Contact >10sec)
-2	Light Sedation	Briefly Awakens to Voice (Eye Opening & Contact <10sec)
-3	Moderate Sedation	Movements or Eye Opening to Voice (BUT NO Eye Contact)
-4	Deep Sedation	No Response to Voice, BUT has Movement or Eye Opening to Physical Stimulation
-5	Unarousable	No Response to Voice or Physical Stimulation

REBEL REVIEWS

0 - Alert and Calm >0 - Agitated <0 - Sedated

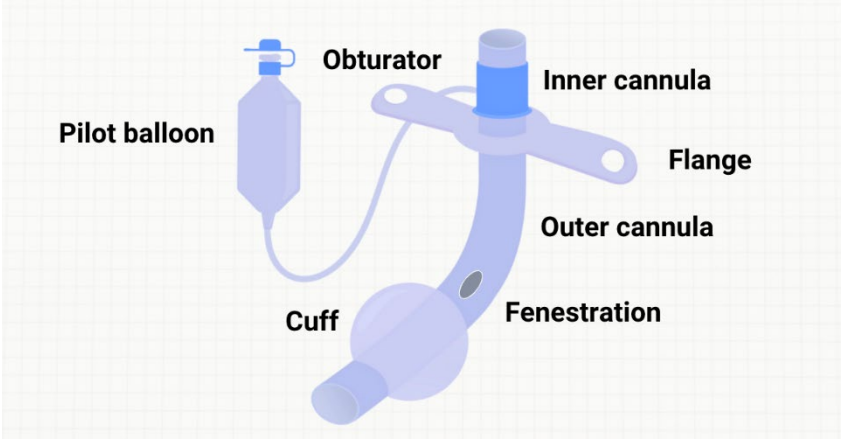
HOW TO USE THE RASS
1. Observe the patient. Is patient alert and calm (score 0)? a. Does the patient have behavior that is consistent with restlessness and or agitation (score +1 to +4 using the criteria listed above, under description? 2. If the patient is not alert, in a loud speaking voice state the patient's name and direct patient to open eyes and look at speaker. Repeat once if necessary. Can prompt patient to continue looking at speaker. a. Patient has eye opening and eye contact, which is sustained for more than 10 seconds (score −1). b. Patient has eye opening and eye contact, but this is not sustained for 10 seconds (score −2). c. Patient has any movement in response to voice, excluding eye contact (score −3). 3. If the patient does not respond to voice, physically stimulate the patient by shaking shoulder and then rubbing sternum if there is no response to shoulder shaking. a. Patient has any movement to physical stimulation (score -4) b. Patient has no response to voice or physical stimulation (score -5) **Unless a patient meets indication for deep sedation, a minimal sedation (RASS -2 to 0) should be used.** **A RASS score should be obtained for all mechanically ventilated patients.**

CCT - CT7 RICHMOND AGITATION-SEDATION SCALE (RASS)

REFERENCES
• https://www.atsjournals.org/doi/full/10.1164/rccm.2107138 • https://www.mdcalc.com/richmond-agitation-sedation-scale-rass • https://www.physio-pedia.com/Richmond_Agitation-Sedation_Scale_(RASS) • https://rebelem.com/rebel-review/rebel-review-101-richmond-agitation-sedation-scale-rass/rebel-review-101-richmond-agitation-sedation-scale-rass-rr/

CCT-CT8 TRACHEOSTOMY TROUBLESHOOTING

GENERAL TRACHEOSTOMY KIT

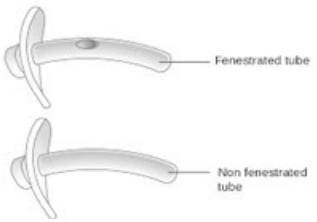


Disposable vs. Reusable

- Types of cannulas usually look very similar
- Reusable cannulas often have a blue dot or twist to lock in place

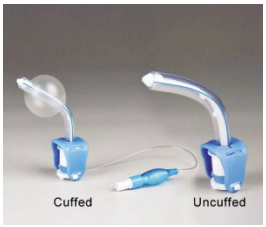
Fenestrated Tracheostomy Tubes

- Fenestrations allow for speech
- Increased risk of bleeding
- Some have to have non-fenestrated inner cannula removed to speak



Cuffed vs Uncuffed Tubes

- Cuffed – allow secretion clearance, some protection from aspiration. More effective PPV



CCT-CT8 TRACHEOSTOMY TROUBLESHOOTING

Shiley Brand Abbreviations

- DCT – Disposable (inner cannula) Cuffed Tracheostomy
- DCFS – Disposable (inner cannula) Cuffless
- DCFN – Disposable (inner cannula) Cuffless Fenestrated
- DFEN – Disposable (inner cannula) Fenestrated – Cuffed
- LPC – Low Pressure Cuff (softens with body temperature)
- LGT – Laryngectomy Tube (shorter than tracheostomy tube)
- PERC – Percutaneous tracheostomy

NOTE: The cuff size will be listed by the above abbreviation. For example, "8 DCT" means size 8 Disposable inner cannula cuffed tracheostomy). Many tracheostomy devices also list the inner and outer diameter elsewhere on the device.

TRACHEOSTOMY HEMORRHAGE

Causes of Tracheostomy Hemorrhage/bleeding

- Early (less than 72 hours)
  - Suction/manipulations of tube
  - Surgical site bleeding
  - Injury to vessel
- Late (greater than 72 hours)
  - Granulation tissue
  - Infection at the stoma site
  - Tracheo-innominate fistula
  - Erosion of adjacent vessel
- Any Time – bleeding diathesis, hemoptysis

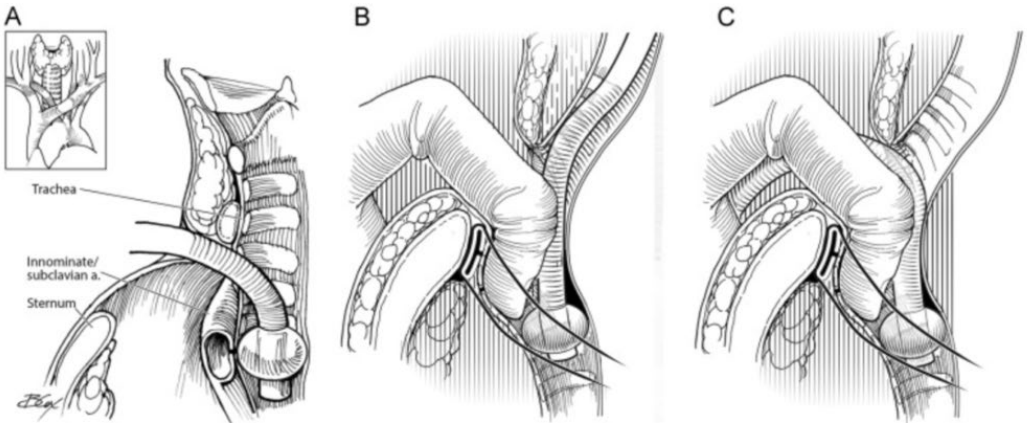
Management

- Assess ABCs
- Provide high flow oxygen
- Remove and clean the inner cannula and any speech devices.
  - Ensure tube is patent and clean with sterile 0.9% NS
- Suction patient
- If unable to clear obstruction or tube is displaced, remove tracheostomy tube and perform the following as necessary:
  - Attempt oxygenation and ventilation via mouth or stoma as able
  - Attempt endotracheal intubation
  - Intubate stoma if >7 days old
    - Use 6-0 ETT or smaller
    - May use bougie to assist

CCT-CT8 TRACHEOSTOMY TROUBLESHOOTING

TRACHEOSTOMY HEMORRHAGE (cont.)

- Bleeding management
  - Minor bleeding around trach – assess for ongoing bleeding and prepare to emergently intervene
  - Major bleeding (tracheo-innominate artery)
    - Apply finger pressure to the root of the neck in the sternal notch (external compression), or
    - Optimize cuff position over site of bleed and overinflate the cuff with air.
      - Inflate slowly so as not to bust balloon
      - May need to instill 10 to 35+ cc of air
    - If the above fails and patient can be orotracheally intubated, remove tracheostomy and place ETT with balloon distal to the bleed (photo B). Then, reach your index finger into the stoma and provide manual compression of bleeding site (photo C).



SAFETY ALERT

All bleeding from a tracheostomy should be considered a medical emergency and treated as a sentinel bleed

REFERENCES

- https://www.stgeorges.nhs.uk/gps-and-clinicians/clinical-resources/tracheostomy-guidelines/tracheostomy-tubes/
- https://litfl.com/bleeding-tracheostomy/