Updates on pediatric sepsis and septic shock in PICU

Dr.A.Saeed, ped.intensivist

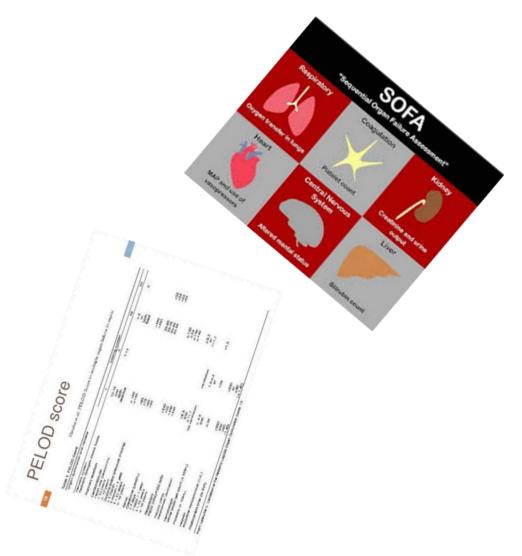
Case presentation

- A 6 months old boy that was previously well, was taken to ER due to fever, lethargy and diarrhea.
- P/E:GCS:10/15,capi.refill:5 sec. BP:55/20,HR:182,RR:58
- Lab:WBC:3400(neut:88%, lymph:11%) CRP:>150,CXR:bilat. Infiltration and effusion in RT. Side,what is ur next step:
- 1) transfer to PICU
- 2)hydration and norepinehrine
- 3) hydration, norepinephrine, chest ct
- 4) hydration, re-evaluate the pt

Case presentation (continue)



Definition



		SEVERE SEPSIS	SHOC
SIRS 1>100.47 <90.87 RR >20 HR >90 WBC>22,000 <4,000 >105 bands PC02 < 32 motilg	SEPSIS 2 SIRS + Confirmed or suspected infection	SEPSIS Sepain * Signs of End Organ Damage Hypotension (SRP <90) Lactate >4 memi	tenth permitte Septe et Hall Cogan Darroy Hypotensen (2021-200 Larlahi 24 me





Physicians think they do a lot for a patient when they give his disease a name.

- Immanuel Kant

AZ QUOTES

Definition

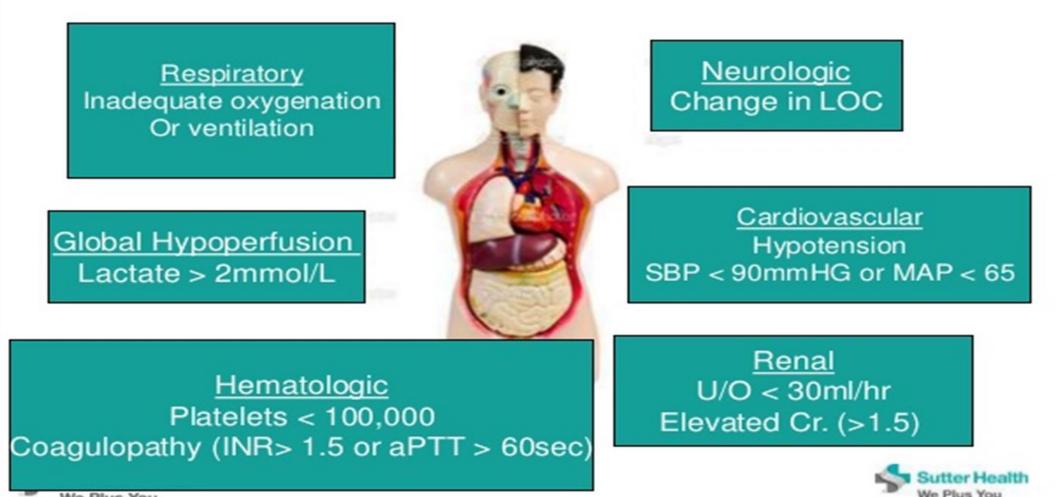
- Shock :body'inability to deliver inadequate oxygen to meet metabolic demands of vital organs and tissue
- **sepsis :** "life-threatening <u>organ dysfunction</u> caused by a dysregulated host response to infection"
- Septic shock :"subset of sepsis in which particularly profound circulatory, cellular, and metabolic abnormalities are associated with a greater risk of mortality than with sepsis alone

William Osler...

"Except for a few occasions patients' appear to die from the body's response to infection rather than from it"



Signs of Organ Dysfunction



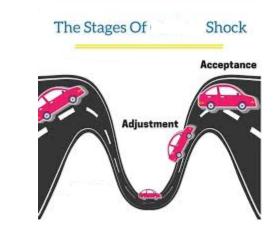
Stages of Shock

Compensated

- Maintains end organ perfusion
- BP is maintained usually by \uparrow HR
- Uncompensated
- Decreases micro-vascular perfusion
- Sign/symptoms of end organ dysfunction
- Hypotensive

Irreversible

- Progressive end-organ dysfunction
- Cellular acidosis results in cell death



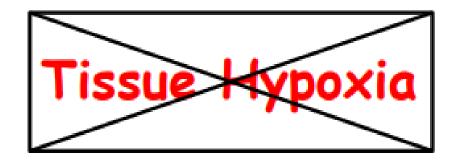
Biomarkers of Sepsis

Dysregulated Inflammation

WBC	Inflammation					S
CRP PCT	RP		Perfusion			SEPSIS
Heart rate			Coagulation			S
Respiratory rate	WBC			Organ failure		
/T ratio	CRP	BP				
Absolute Neutrophils	IL6	pН				
count Sedimentation rate	IL8	Blood gas	Platelet count	Lactate		
Blood culture	IL10	PaO2	Anti-thrombin	Creatinine		
_BP	IL12	PaCO2	D-dimers	Bilirubin		
Angiopoietin	CD14	HCO3	Fibrin	GGT		
ProADM	CD64	Lactate	PAI-1	ANP		



Cellular Bioenergetic (Metabolic) Failure



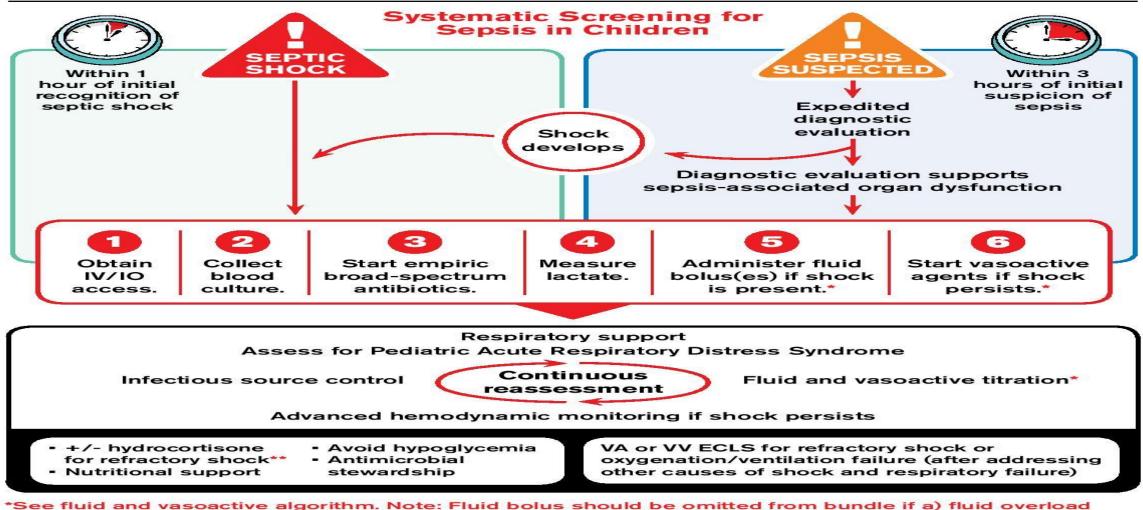
Surviving Sepsis ··· Campaign ··

Surviving Sepsis ··· Campaign



Initial Resuscitation Algorithm for Children

Surviving Sepsis ··· Campaign



*See fluid and vasoactive algorithm. Note: Fluid bolus should be omitted from bundle if a) fluid overload is present or b) it is a low-resource setting without hypotension. Fluid in mL/kg should be dosed as ideal body weight.

**Hydrocortisone may produce benefit or harm.

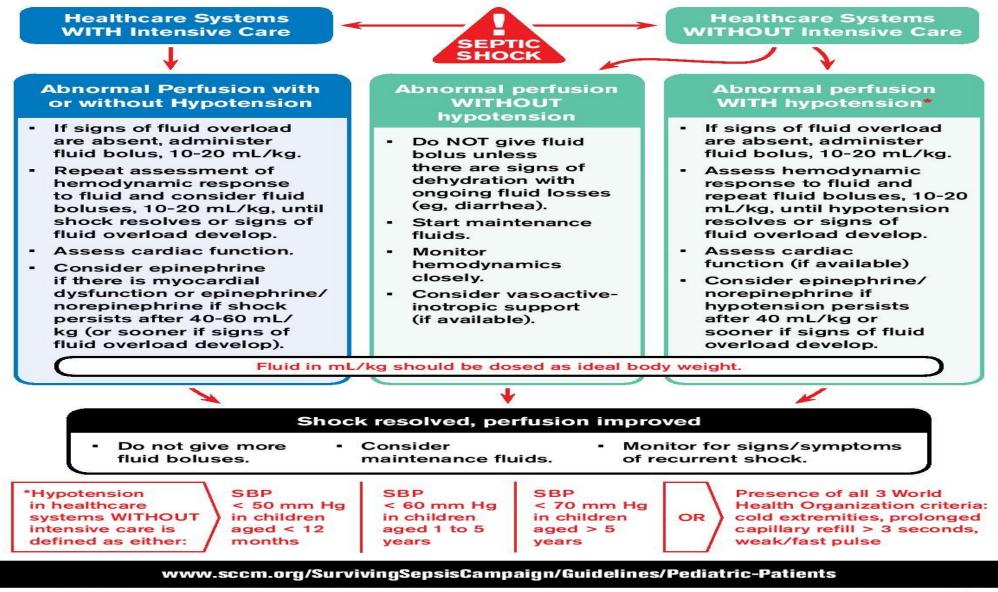
www.sccm.org/SurvivingSepsisCampaign/Guidelines/Pediatric-Patients

Society of Critical Care Medicine



Fluid and Vasoactive-Inotrope Management Algorithm For Children

Surviving Sepsis ··· Campaign •



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Fluid



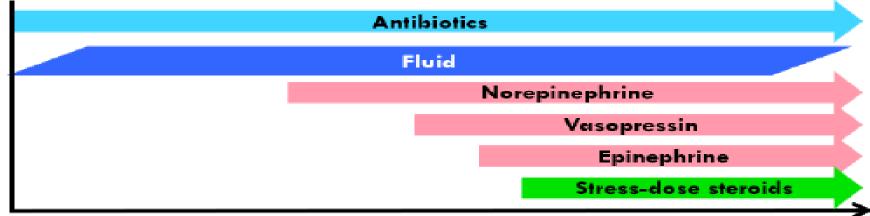
Type of fluid in initial resuscitation

- Crystalloids vs albumin
 - Starches
- Gelatin
- balanced/buffered crystalloids

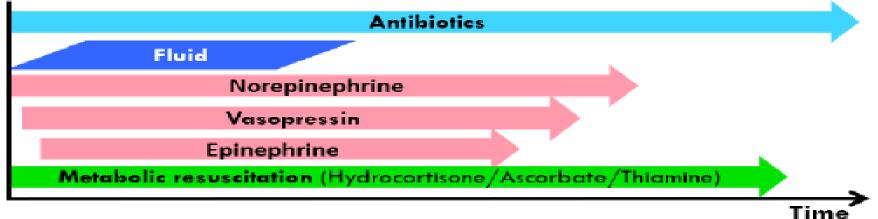
- administering up to 40–60mL/kg in bolus fluid (10–20mL/kg per bolus) over the first hour, titrated to clinical markers of cardiac output and discontinued
- In healthcare systems with no availability of intensive care and in the absence of hypotension, we recommend against bolus fluid administration while starting maintenance fluids.
- In healthcare systems with no availability of intensive care, if hypotension is present, we suggest administering up to 40mL/kg in bolus fluid (10–20mL/kg per bolus) over the first hour with titration to clinical markers of cardiac output and discontinued if signs of fluid overload develop

The changing paradigm of Sepsis: Early diagnosis, Early antibiotics, Early pressors and Early adjuvant treatment

Traditional time-course of therapies

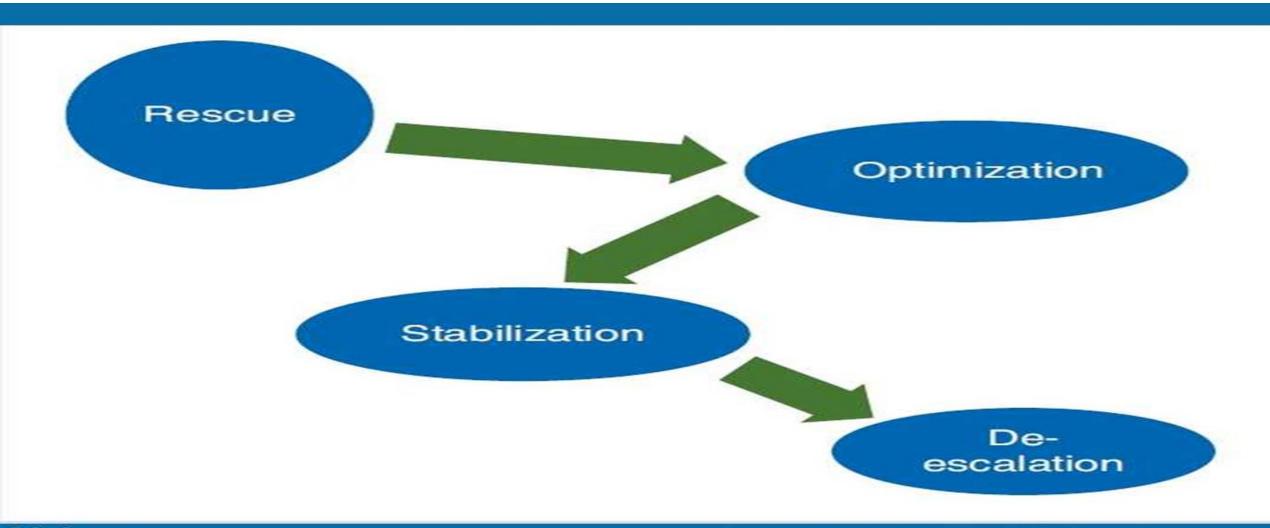


Escalation-deescalation strategy



Marik & Fargas, Crit Care Med 2018;46:1690

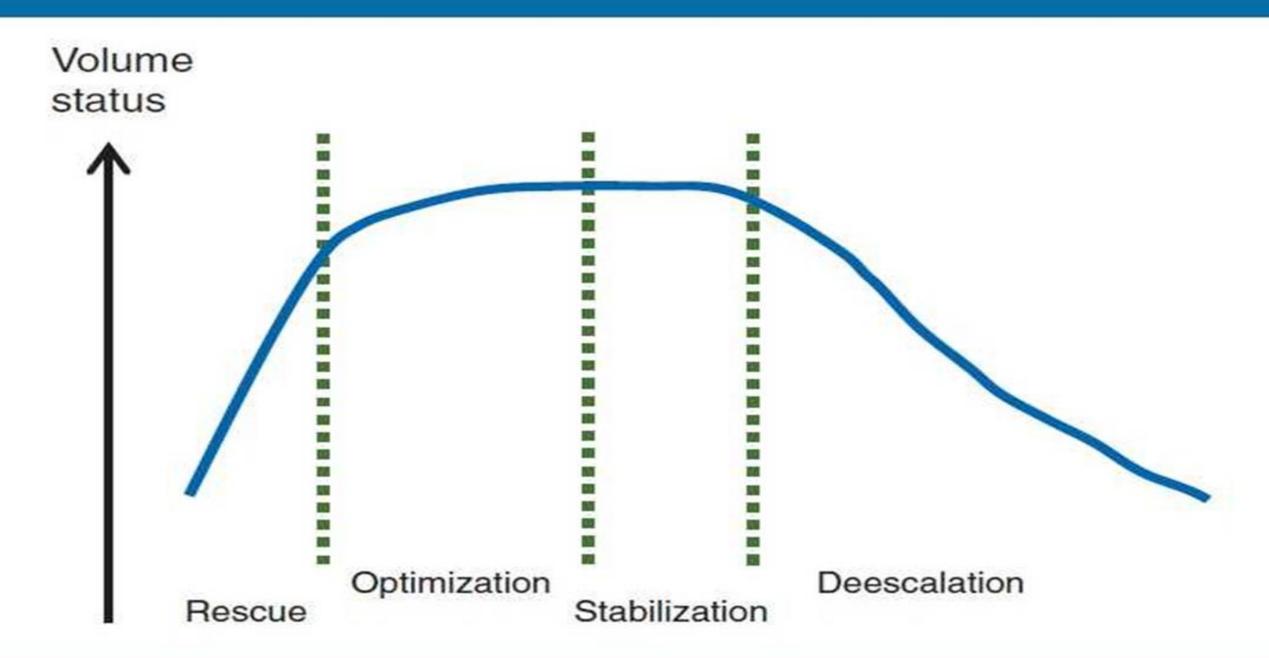
Different stages of fluid resuscitation



Medscape

Source: Br J Anaesth © 2014 Oxford University Press

	Rescue	Optimization	Stabilization	De-escalation	
Principles	Lifesaving	Organ rescue	Organ support	Organ recovery	
Goals	Correct shock		Aim for zero or negative fluid balance	Mobilize fluid accumulated	
Time (usual)	Minutes		Days	Days to weeks	
Phenotype	Severe shock		Stable	Recovering	
Fluid therapy	Rapid boluses		Minimal maintenance infusion only if oral intake inadequate	Oral intake if possible Avoid unnecessary i.v. fluids	
Typical clinical scenario	– Septic shock – Major trauma		– NPO postoperative patient – 'Drip and suck' management of pancreatitis	 Patient on full enteral feed in recovery phase of critical illness Recovering ATN 	

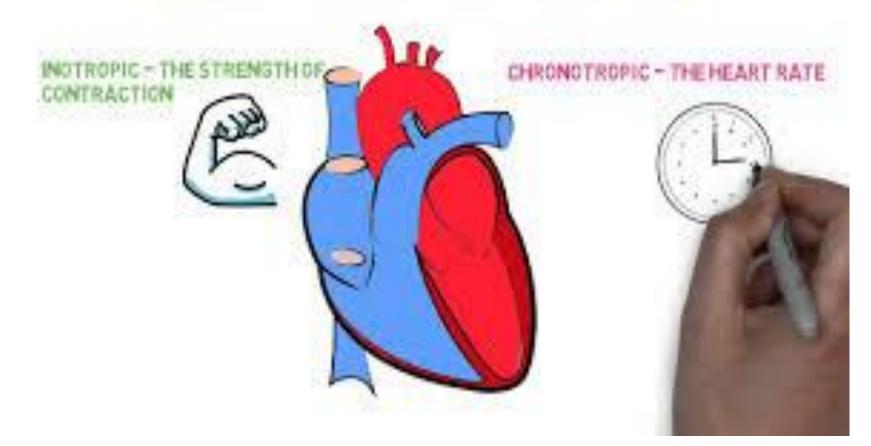


Medscape

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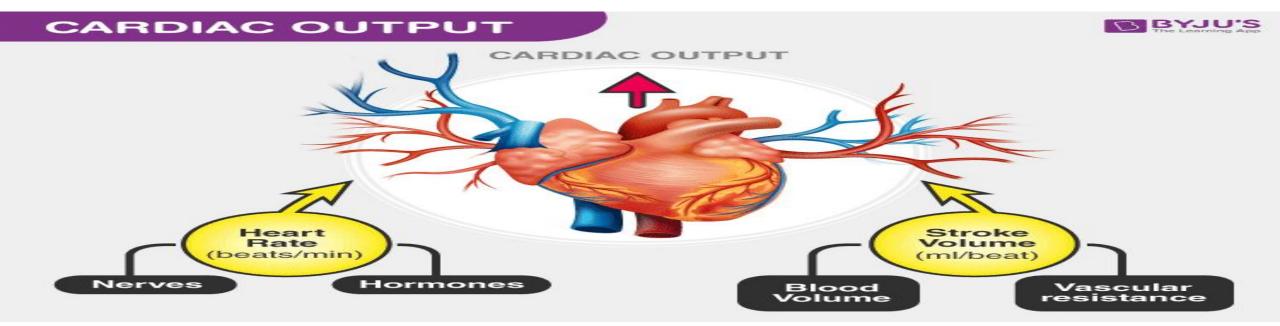
Inotrope vs vasopressor

INOTROPIC, CHRONOTROPIC, DROMOTROPIC



Clinical markers of cardiac output

- heart rate, blood pressure, capillary refill time, level of consciousness, and urine output.
- <u>frequent reassessment</u>



How to categorize septic shock in children

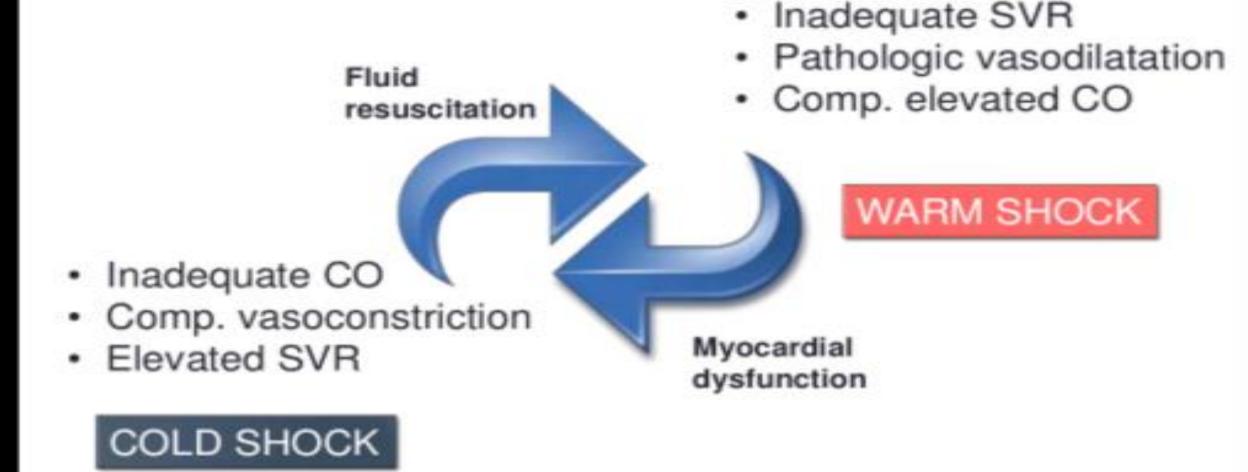
Cold Shock vs. Warm Shock

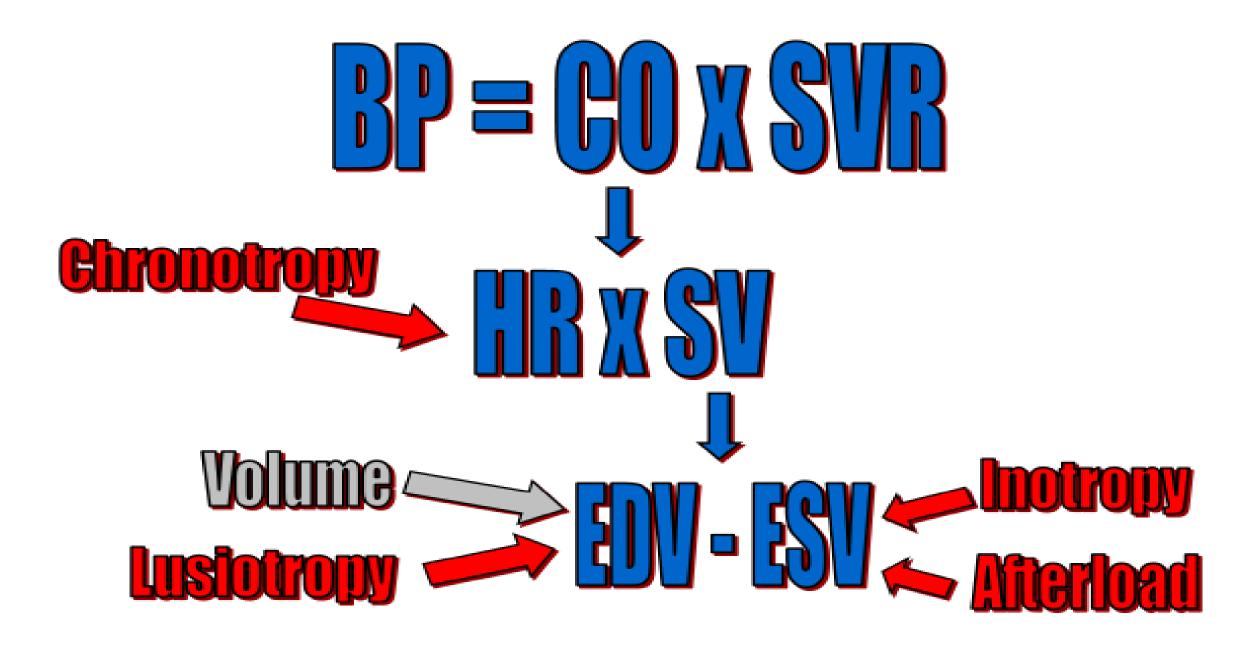




Etiology: Decreased Stroke Volume Impairment: Preload, Afterload, & Contractility Etiology: Decreased Vascular Tone(SVR) Pulse pressure: Wide

Hemodynamics in Shock





PRELOAD AND AFTERLOAD

Preload

Volume of blood in ventricles at end of diastole (end diastolic pressure)

Increased in: Hypervolemia Regurgitation of cardiac valves Heart Failure

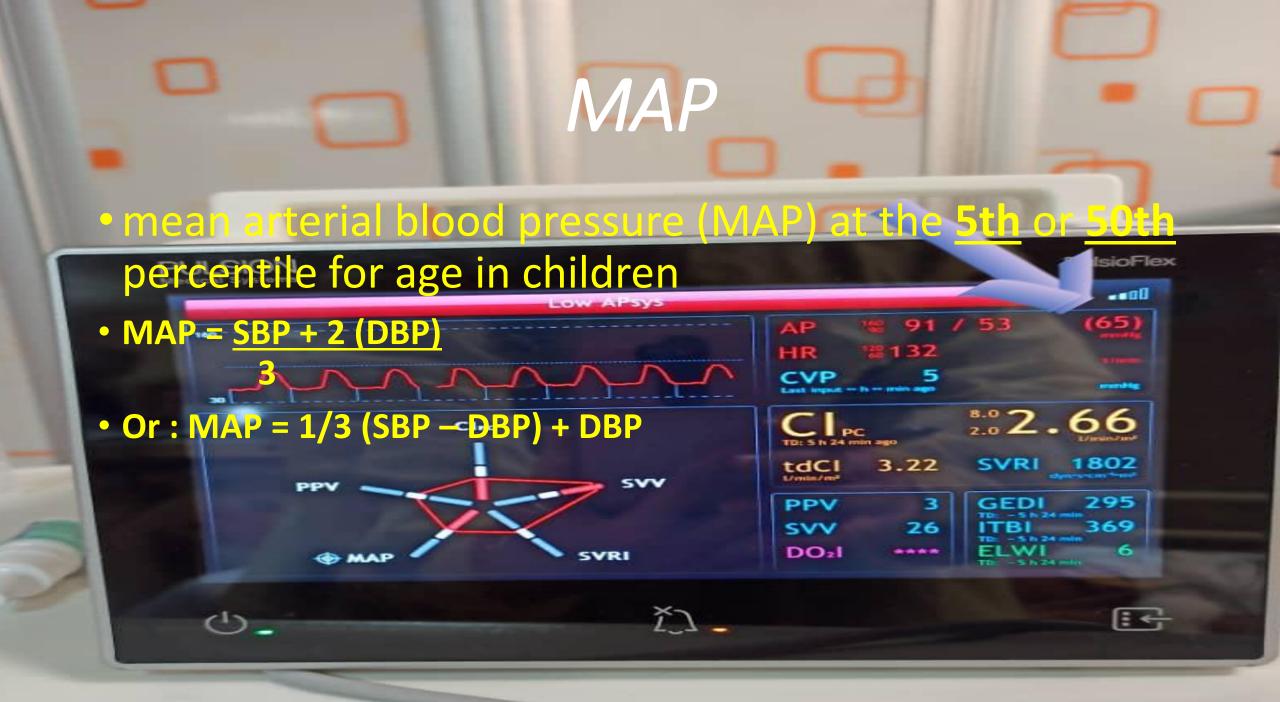
Afterload

Resistance left ventricle must overcome to circulate blood

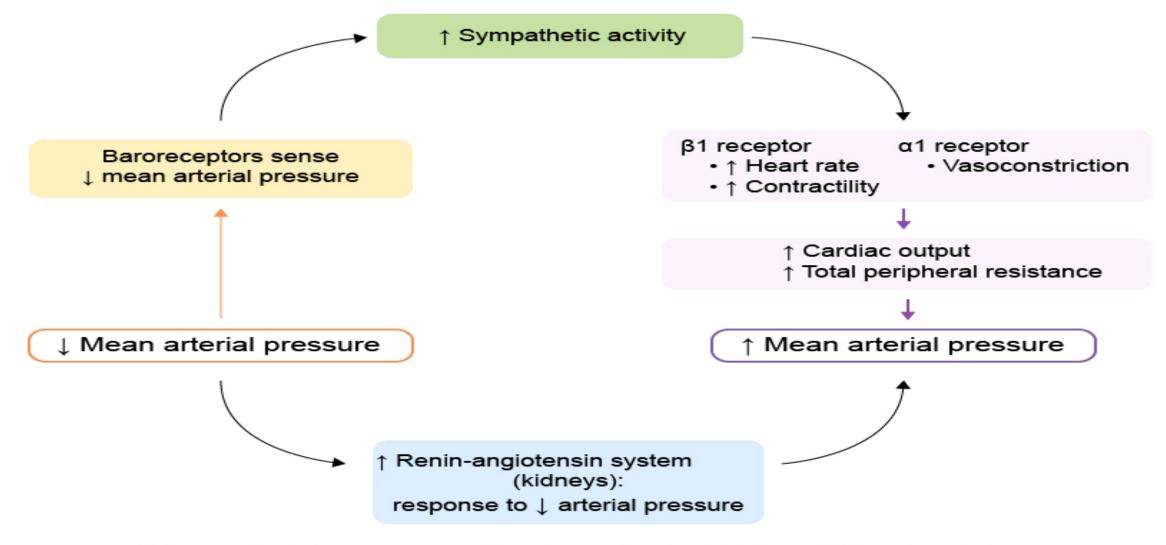
Increased in: Hypertension Vasoconstriction

Afterload =
 Cardiac workload

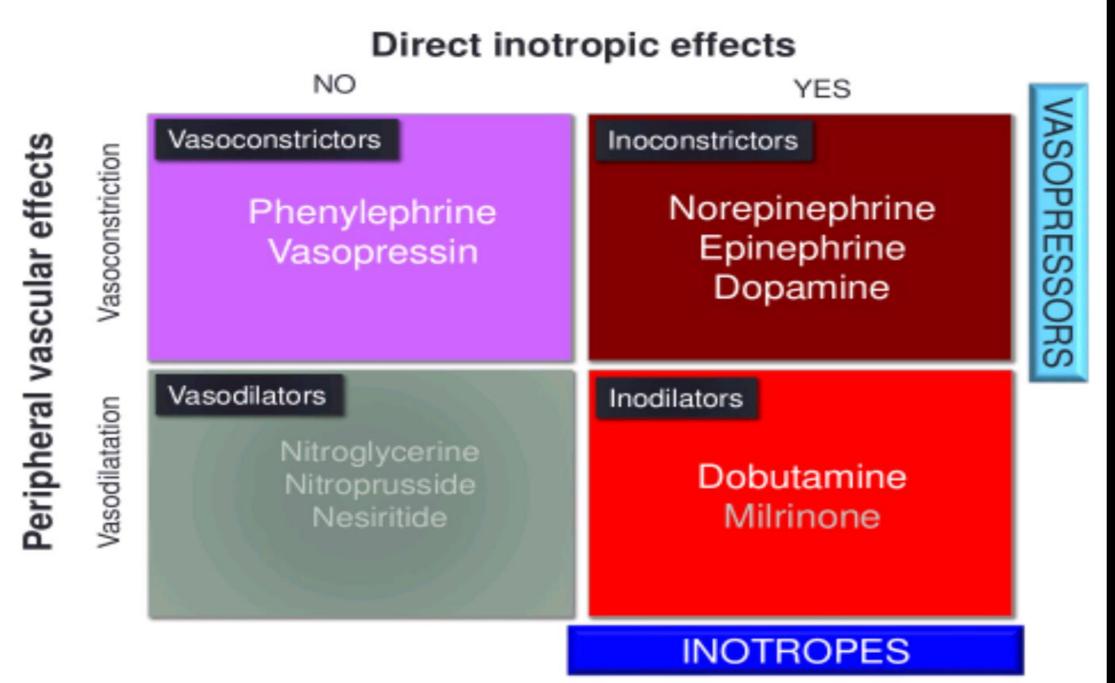
THALER



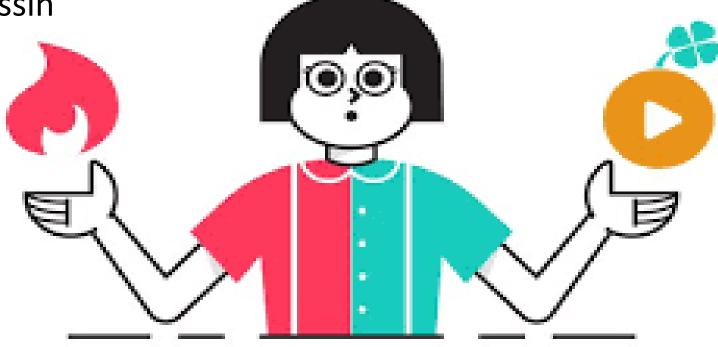
Maintanence of Mean Arterial Pressure

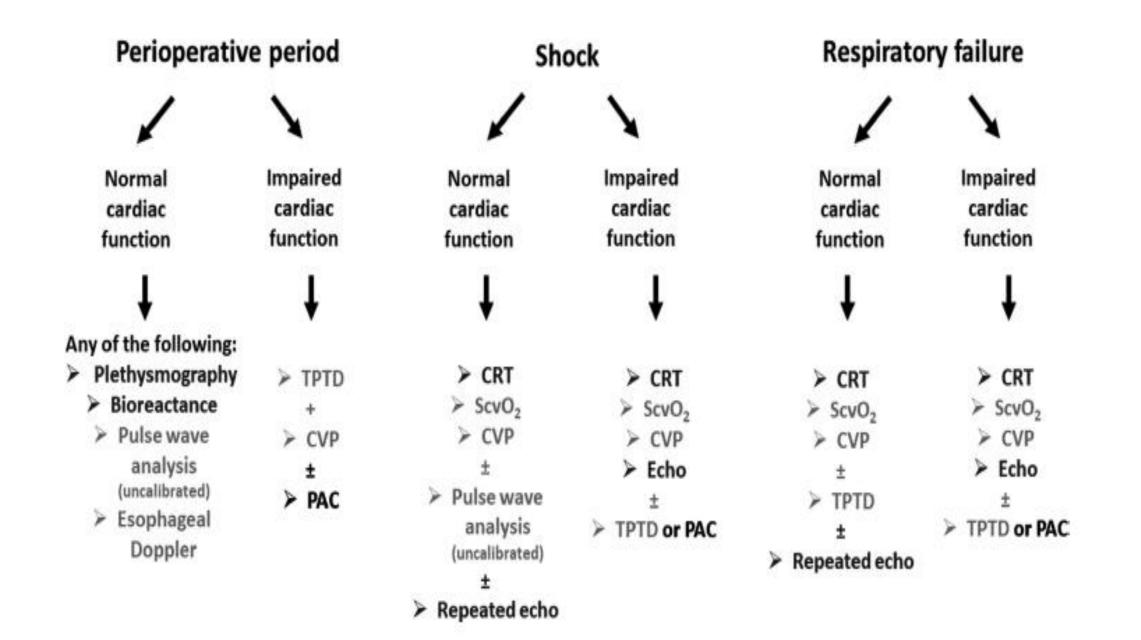


Mean arterial pressure = Cardiac output x Total peripheral resistance



- Dopamine /epinephrine/norepinephrine
- Vasopressin





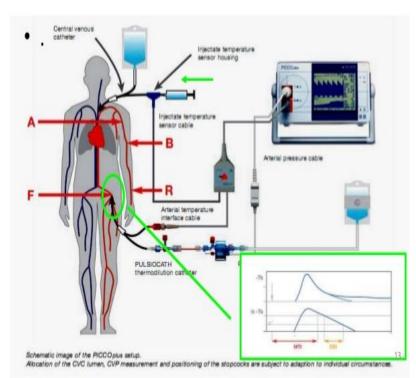
BEDSIDE ECHOCARDIOGRAM

10.00



Invasive hemodynamic monitoring

Transpulmonary thermodilution-PICCO and Edward / Volume ViewTM



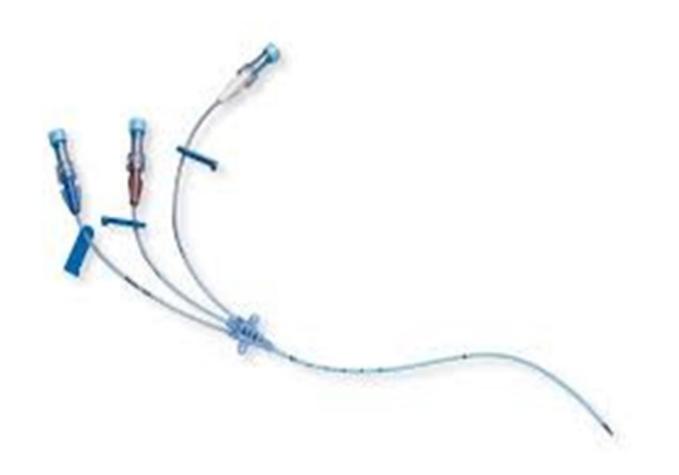




Intubation



Central venous catheter



S.S.C suggest against the routine use

- IV immune globulin (IVIG)
- stress ulcer prophylaxis
- deep vein thrombosis (DVT) prophylaxis (mechanical or pharmacologic)

- insulin therapy
- normal calcium levels for children with septic shock requiring vasoactive infusion support.
- levothyroxine

blood lactate

- serial blood lactate measurement
- to guide resuscitation
- persistent elevation in blood lactate may indicate incomplete hemodynamic resuscitation and should prompt efforts, as needed, to further promote hemodynamic stability.



THANKS