



Initial Resuscitation of Sepsis & Septic Shock

Dr. Fatema Ahmed

MD (Critical Care Medicine)

FCPS (Medicine)

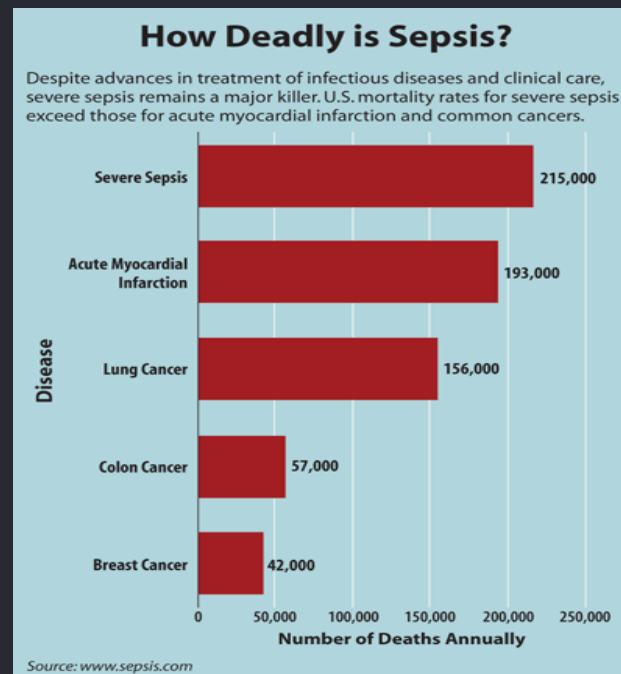
Associate professor

Dept. of Critical Care Medicine

BIRDEM General Hospital

Is Sepsis a known problem ?

It is more common than heart attack, and claims more lives than any cancer, yet even in the most developed countries fewer than half of the adult population have heard of it.



Sepsis

a global burden



~ 27 000 000
people per year develop sepsis



~ 19 000 000
people per
year survive



Survivors
may face
lifelong
complications



~ 8 000 000
people per
year die



~ 6 000 000
neonates and
children under
five die of sepsis¹



Maternal Death
Sepsis is one of
the most
common causes



Everybody
can develop
sepsis following
an infection



ANNUAL BURDEN

So it is incredibly common and serious problem.

In Bangladesh

95 out of 228 patient (total admission) in seven months from a ICU were suffering from sepsis(41%) and 58% of this study populations were in septic shock.

Ref: Spectrum of Severe Sepsis in Critically Ill Adult Patients of Bangladesh: A Prospective Observational study

Ahmed F et al. Bangladesh Crit Care J September 2015; 3 (2): 45-48



Sepsis is common and often deadly.

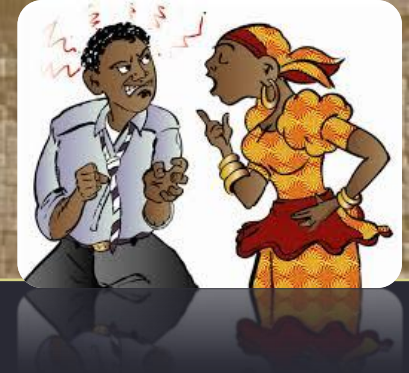
It remains the primary cause of death from infection, especially if not recognized and treated promptly despite modern Medicine

Septic shock hospital mortality is in excess of 40%

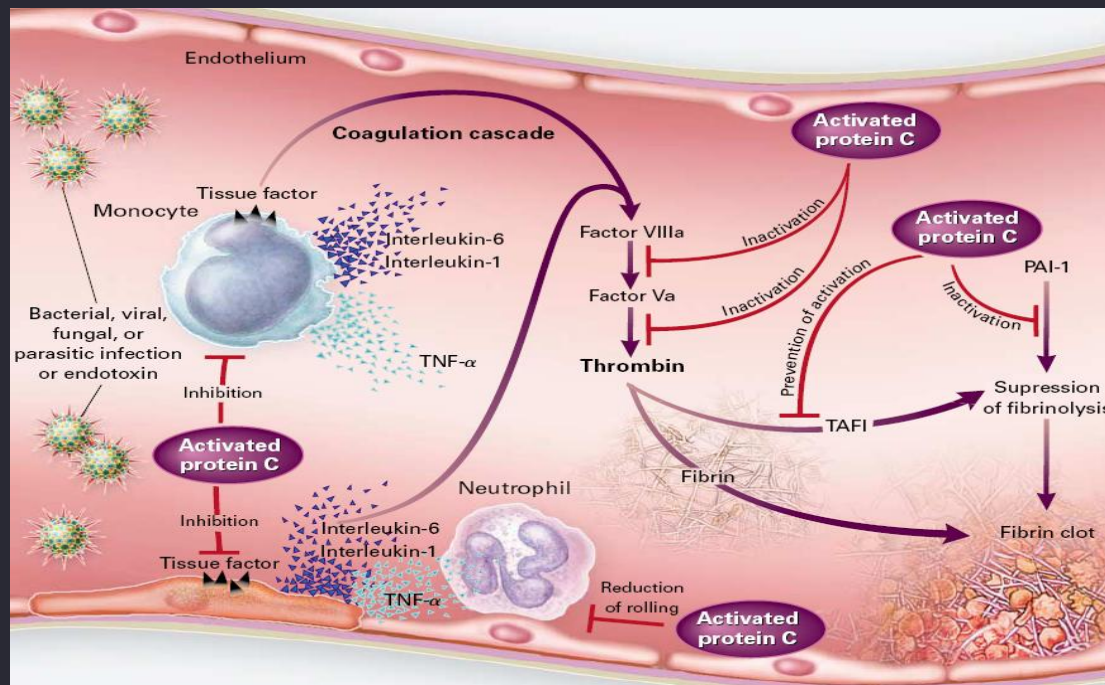




AN UNHAPPY MARRIAGE



Sepsis is a life threatening clinical syndrome that develops when the body's response to infection.....injures its own tissue & organ





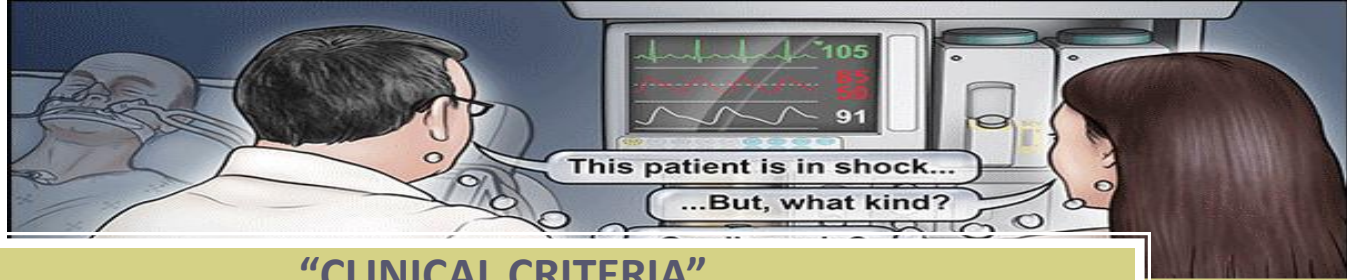
THE SEPSIS-3 Definition

Sepsis is “life-threatening organ dysfunction caused by a dysregulated host response to infection.”

Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality

These definitions reflect the most up-to-date scientific evidence available, but they are not especially useful clinically.

Sepsis= “Severe sepsis”



"CLINICAL CRITERIA" SEPSIS & SEPTIC SHOCK

Sepsis:

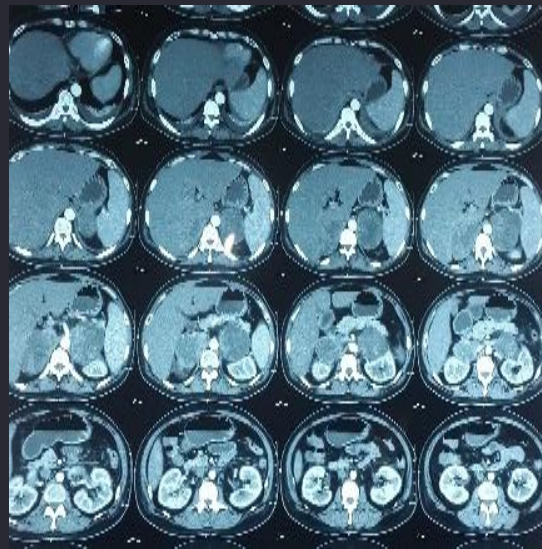
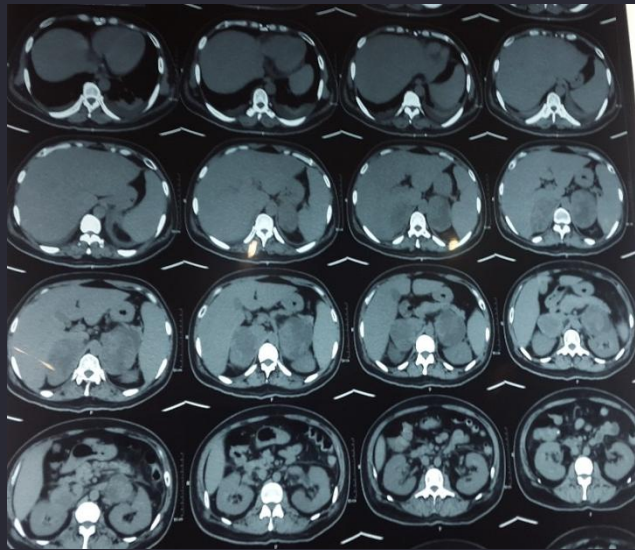
Organ dysfunction can be identified as an acute change in total SOFA score ≥ 2 points consequent to the infection.

Septic shock:

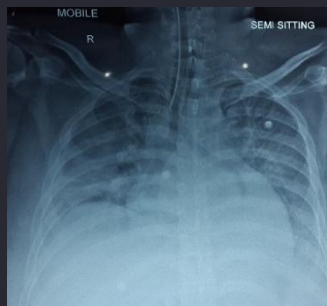
Sepsis with persisting hypotension **requiring vasopressors** to maintain MAP ≥ 65 mm Hg and having a serum lactate level **>2 mmol/L** (18mg/dL) despite adequate **volume resuscitation**.

Ref: The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) JAMA . 2016 February 23; 315(8): 801-810. doi:10.1001/jama.2016.0287.

CASE SCENARIO



Any unexplained acute organ dysfunction should raise the possibility of underlying infection





Sepsis- story of organ dysfunction

Six Components

1. Respiratory ($\text{PaO}_2/\text{FiO}_2$)
2. Coagulation (Platelet count)
3. Hepatic (Bilirubin)
4. Cardiovascular (MAP & Vasopressor type and dose)
5. CNS (GCS)
6. Renal (S creatinine or Urine Output)

The SOFA Score*

Organ System, Measurement	SOFA Score				
	0	1	2	3	4
<i>Respiration</i> $\text{PaO}_2/\text{FiO}_2$, mmHg	Normal	<400	<300	<200 (with respiratory support)	<100 (with respiratory support)
<i>Coagulation</i> Platelets $\times 10^3/\text{mm}^3$	Normal	<150	<100	<50	<20
<i>Liver</i> Bilirubin, mg/dL ($\mu\text{mol/l}$)	Normal	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (>204)
<i>Cardiovascular</i> Hypotension	Normal	MAP < 70 mmHg	Dopamine ≤ 5 or dobutamine (any dose)**	Dopamine > 5 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1	Dopamine > 15 or epinephrine > 0.1 or norepinephrine > 0.1
<i>Central Nervous System</i> Glasgow Coma Score	Normal	13-14	10-12	6-9	< 6
<i>Renal</i> Creatinine, mg/dL ($\mu\text{mol/l}$) or Urine output	Normal	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440) or < 500 mL/day	> 5.0 (> 440) or < 200 mL/day

Sequential Organ Failure
Assessment: SOFA

qSOFA- Suspect Infection Outside ICU

qSOFA score ≥ 2 ----Suspect infection.

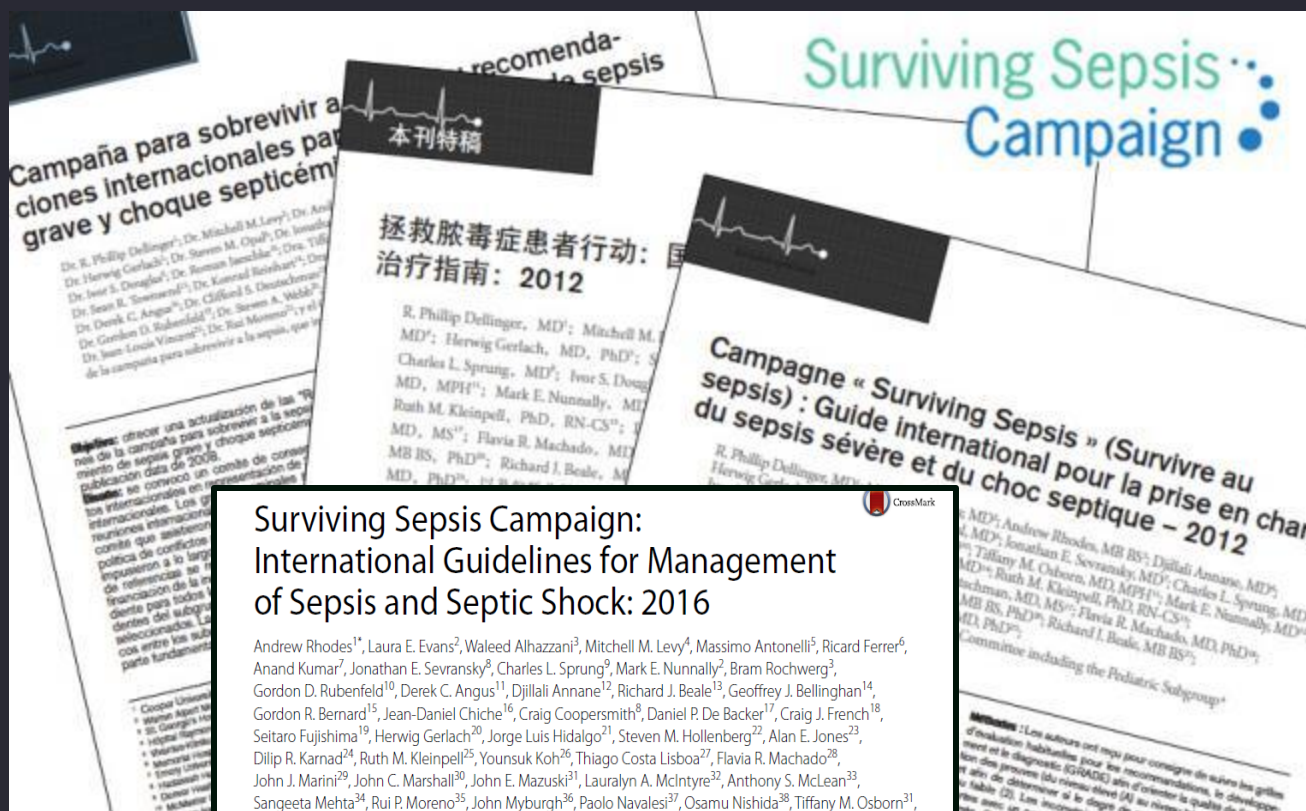
qSOFA criteria's are :

1. Respiratory rate ≥ 22 beats/min
2. Altered mental status or
3. Systolic blood pressure [SBP] of ≤ 100 mm Hg

Ref: The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) JAMA . 2016 February 23; 315(8): 801–810. doi:10.1001/jama.2016.0287.



“SSC GUIDELINES” FOR SEPSIS AND SEPTIC SHOCK



Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016

Andrew Rhodes^{1*}, Laura E. Evans², Waleed Alhazzani³, Mitchell M. Levy⁴, Massimo Antonelli⁵, Ricard Ferrer⁶, Anand Kumar⁷, Jonathan E. Sevransky⁸, Charles L. Sprung⁹, Mark E. Nunnally², Bram Rochberg³, Gordon D. Rubenfeld¹⁰, Derek C. Angus¹¹, Djillali Annane¹², Richard J. Beale¹³, Geoffrey J. Bellomo¹⁴, Gordon R. Bernard¹⁵, Jean-Daniel Chiche¹⁶, Craig Coopersmith⁸, Daniel P. De Backer¹⁷, Craig J. French¹⁸, Seitaro Fujishima¹⁹, Herwig Gerlach²⁰, Jorge Luis Hidalgo²¹, Steven M. Hollenberg²², Alan E. Jones²³, Dilip R. Karnad²⁴, Ruth M. Kleinpell²⁵, Younsuk Koh²⁶, Thiago Costa Lisboa²⁷, Flavia R. Machado²⁸, John J. Marin²⁹, John C. Marshall³⁰, John E. Mazuski³¹, Lauralyn A. McIntyre³², Anthony S. McLean³³, Sangeeta Mehta³⁴, Rui P. Moreno³⁵, John Myburgh³⁶, Paolo Navales³⁷, Osamu Nishida³⁸, Tiffany M. Osborn³¹, Anders Perner³⁹, Colleen M. Plunkett²⁵, Marco Ranieri⁴⁰, Christa A. Schorr²², Maureen A. Seckel⁴¹, Christopher W. Seymour⁴², Lisa Shieh⁴³, Khalid A. Shukri⁴⁴, Steven Q. Simpson⁴⁵, Mervyn Singer⁴⁶, B. Taylor Thompson⁴⁷, Sean R. Townsend⁴⁸, Thomas Van der Poll⁴⁹, Jean-Louis Vincent⁵⁰, W. Joost Wiersinga⁴⁹, Janice L. Zimmerman⁵¹ and R. Phillip Dellinger²²

CASE SCENARIO

Four days after
abortion.
Febrile, disoriented,
BP.100/40 (MAP?)
with dark urine
and bedside lactate
> 4mmol/L

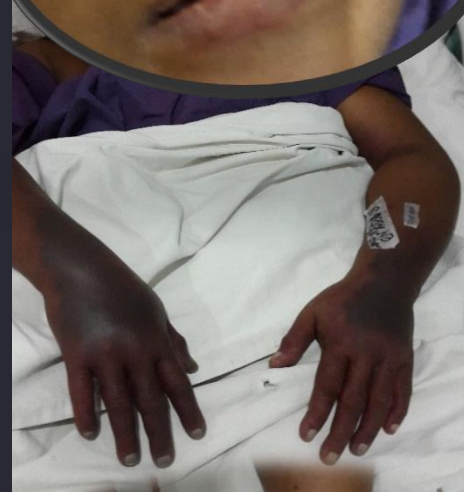


Fig: Purpura Fulminant

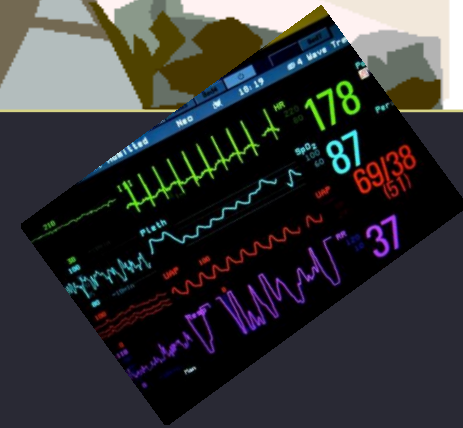
CASE SCENARIO

Young diabetic patient with septic arthritis with high fever with tachycardia and RR-40/min, lactate 3 mmol/L with, BP 110/50mm of Hg



Fig: Septic emboli

SEPSIS & SEPTIC SHOCK



Sepsis and septic shock are **medical emergencies**.

Treatment and resuscitation **begin immediately**.

ANTIMICROBIAL THERAPY

☀️ **Microbiologic cultures** (including two sample blood) before starting antimicrobial therapy. (Aerobic and anaerobic)

☀️ Cultures can be **sterile** within minutes to hours after the **first dose of an appropriate antimicrobial**.

ANTIMICROBIAL THERAPY

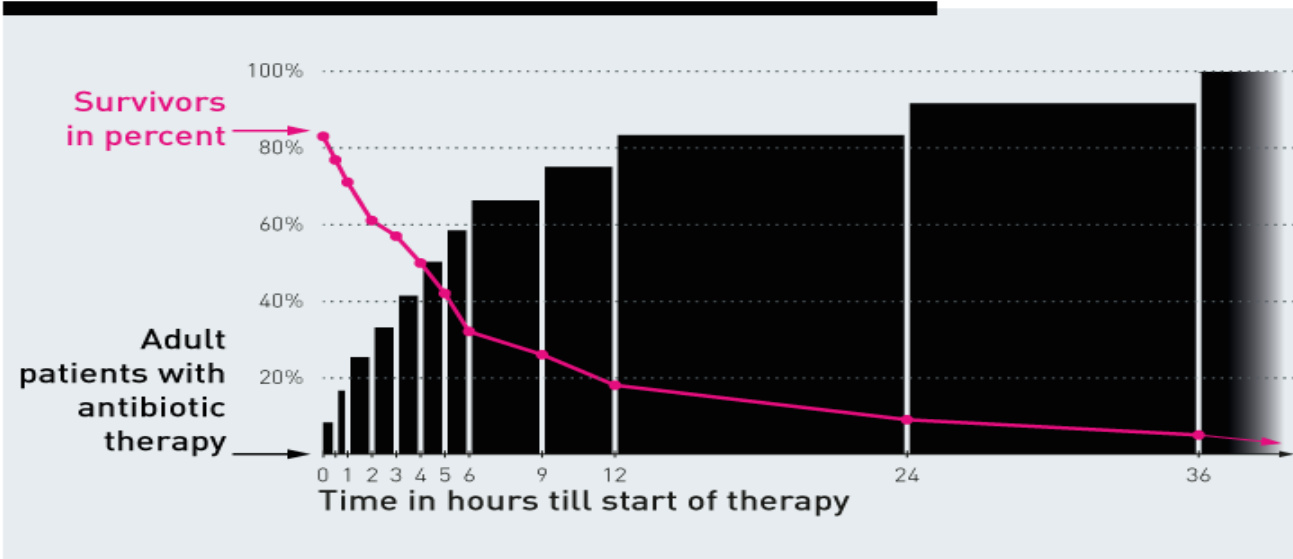
✱ IV antimicrobials **as soon as** after recognition and **within 1 h (first dose)**.

✱ Empiric broad-spectrum therapy with one or more antimicrobials (β -lactams).

Delay in every hour –mortality increases 4%

Sepsis

is an emergency¹



Optimized Antimicrobials dosing - prevent clinical failure

- Dosing should be optimized based on **pharmacokinetic/ pharmacodynamic** principles.
- **Trough plasma concentrations** (Vancomycin)
- Minimum inhibitory concentration **[MIC]** (fluoroquinolones & aminoglycosides, β -lactams)

DURATION-ANTIMICROBIAL THERAPY

- ☀ Antimicrobial treatment duration of 7–10 days.
- ☀ Shorter courses particularly those with rapid clinical resolution.
- ☀ Longer courses in patients who have a
 - 📈 Slow clinical response
 - 📈 Undrainable foci of infection
 - 📈 Bacteremia with *S. Aureus*
 - 📈 Invasive fungal
 - 📈 Viral infections
 - 📈 Immunologic deficiencies, including neutropenia

Antimicrobial stewardship

Daily assessment for de-escalation

- Clinical improvement (shock resolution, decrease in vasopressor requirement, etc.)
- Evidence of infection resolution
- For culture-positive to culture-negative infections
- Procalcitonin

ANTIMICROBIAL THERAPY BIOMARKER

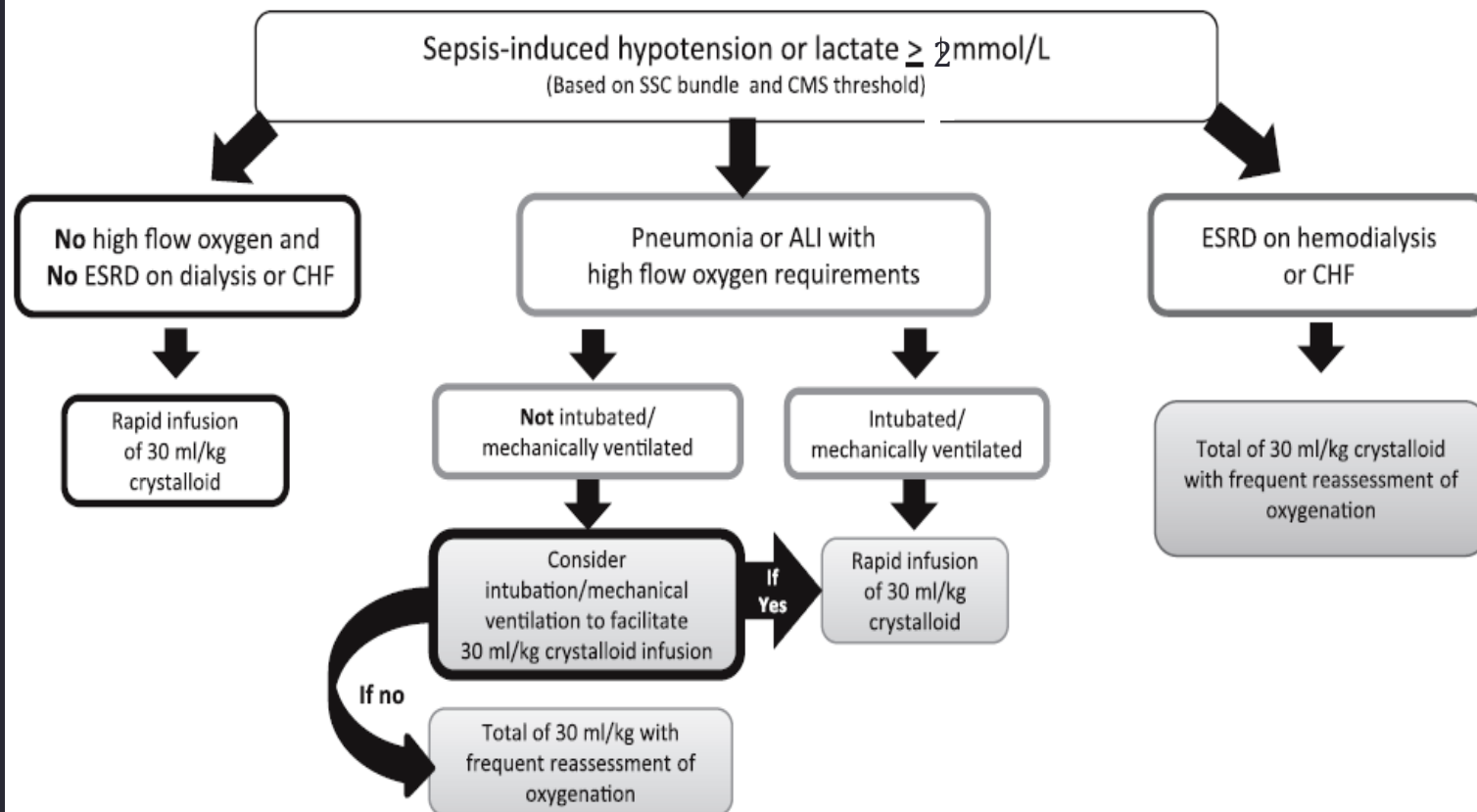
- ❁ **Procalcitonin** levels can be used to support shortening the duration of antimicrobial therapy (only in Bacterial Infection)
- ❁ β -d-glucan and Galactomannan for Invasive fungal infection

INFECTION SOURCE CONTROL

- ✿ Specific anatomic diagnosis of infection requiring emergent source control(empyema GB, septic arthritis, emphysematous pyelonephritis, Liver abscess, infected wound).
- ✿ Prompt removal of intravascular access devices that are a possible source of sepsis or septic shock

FLUID RESUSCITATION

Application of Fluid Resuscitation in Adult Septic Shock



Management of Sepsis is complex and need for a detailed initial assessment and ongoing reevaluation of the response to treatment



Fluid Resuscitation

🌻 Crystalloids

Lactated ringer solution

Normal saline

Typically, an infusion of 300 to 500 ml of fluid

🌻 Albumin

🌻 Colloids

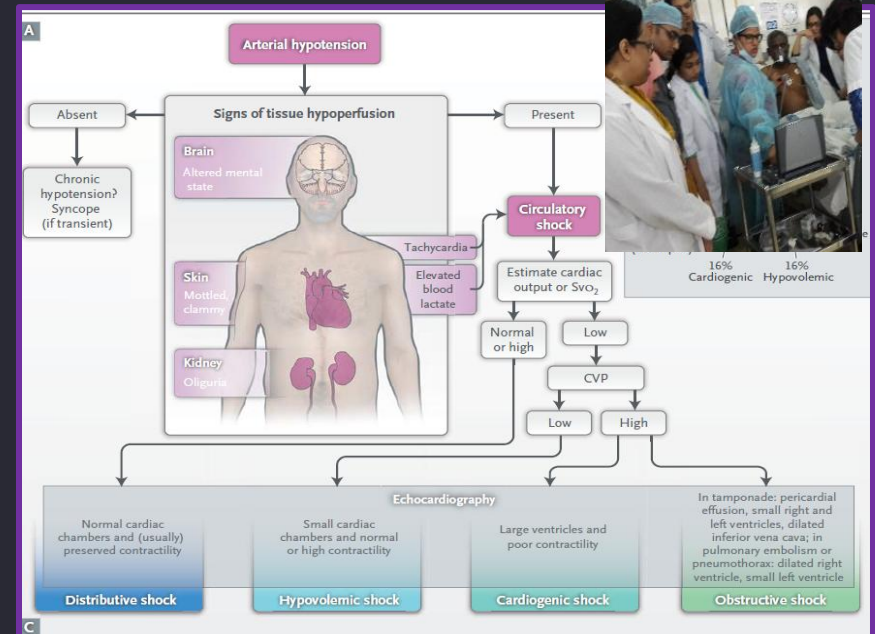
🌻 Blood Products

“balanced” or “physiologic” solutions and are derivatives of the original Hartmann’s and Ringer’s solutions.

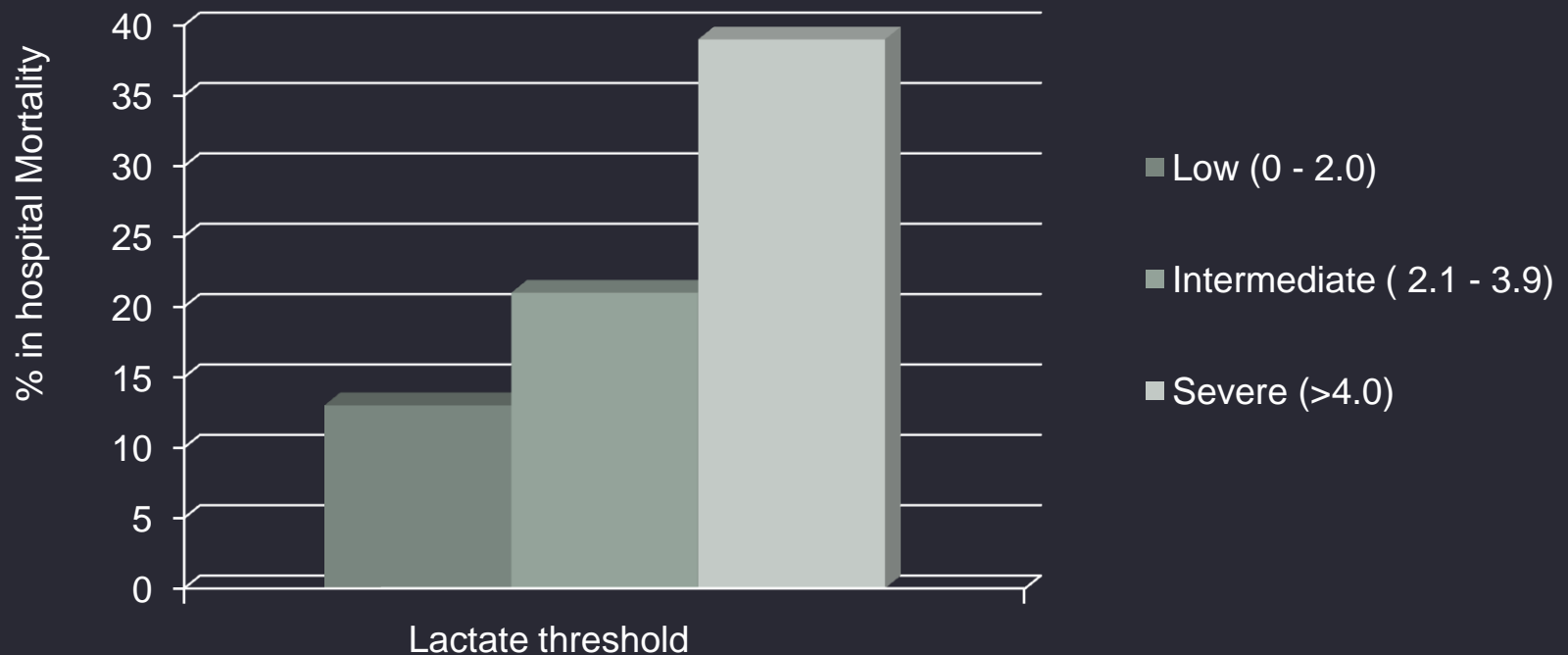
SEPTIC SHOCK- FLUID RESUSCITATION

1. Crystalloid fluid infusion should be completed within the **first 3 h** (30 mL/kg of IV)
2. Additional fluids may be given **by frequent reassessment**
3. Reassessment should include

- Heart rate
- Blood pressure (NIBP, ABP)
- ABG
- Respiratory rate
- Temperature
- Urine output
- lactate 2 hourly to check lactate clearance** (should be at least 10%)



RISK STRATIFICATION BY LACTATE
Lactate- POINT OF CARE TESTING



With tissue hypoperfusion associated elevated lactate levels NEEDS **normalize lactate level** as early as possible.

FLUID RESUSCITATION- RESPONSIVENESS

- ☀ CVP(Central venous pressure)- serial monitoring
- ☀ ScVO₂ (Central venous O₂ saturation)
- ☀ Passive leg raised test
- ☀ Pulse pressure variation (PPV)
- ☀ Stroke volume variation (SVV)
- ☀ Bedside serial -**Echocardiography**
- ☀ Bedside repeated- **lung USG**

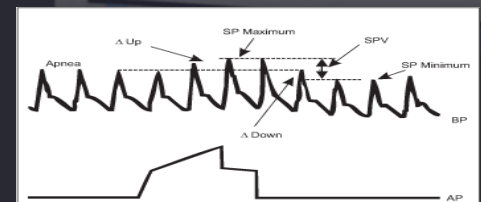
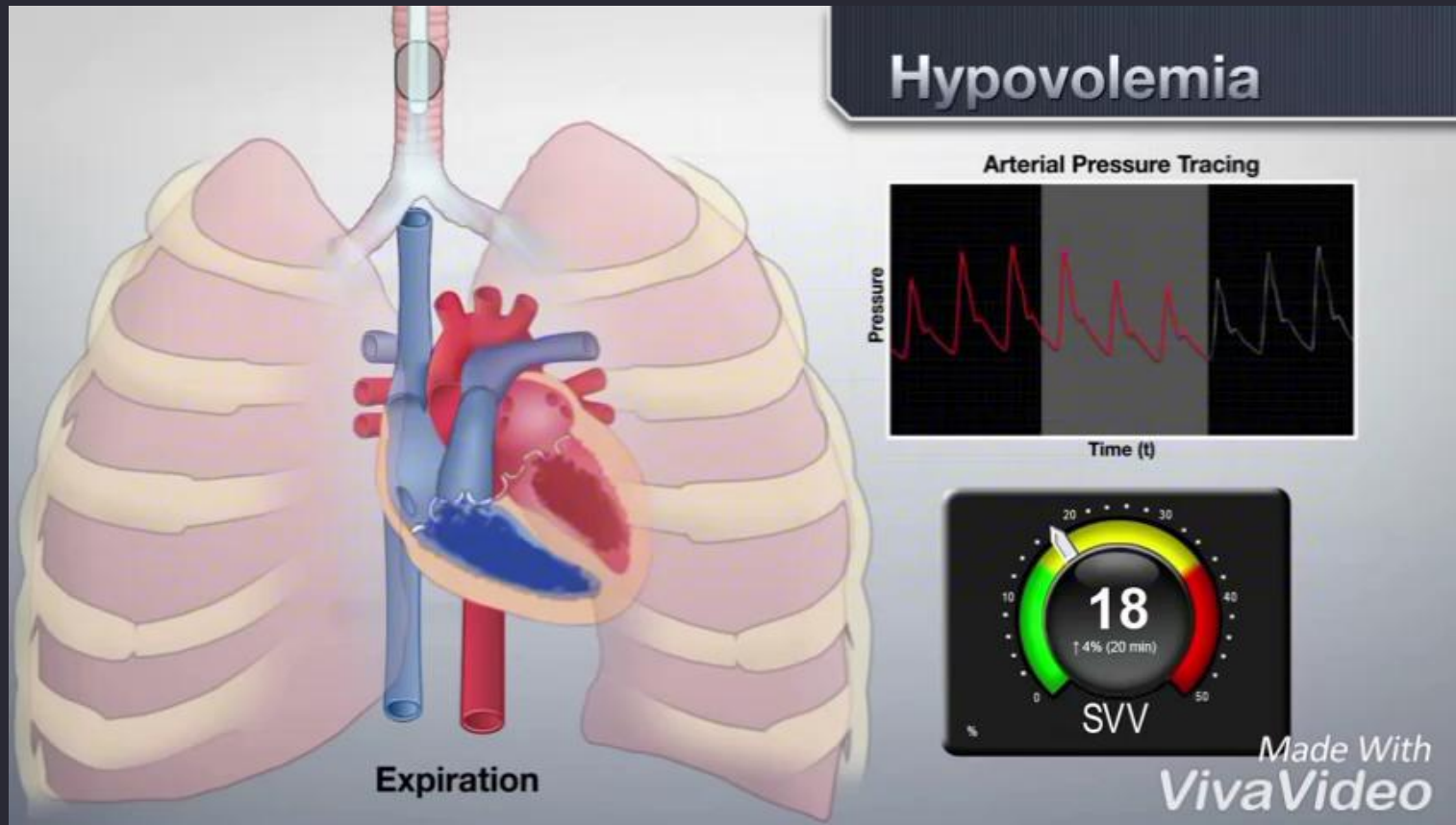


Figure 1 - Schematic of Blood Pressure (BP) and Airway Pressure (AP) Tracing during Positive Pressure Ventilation and in Apnea. Systolic Pressure Variation (SPV) is divided into its components delta Down ($d\text{Down}$) representing systolic pressure decrease, and delta Up ($d\text{Up}$) representing systolic pressure increase immediately after positive pressure ventilation. SP maximum: maximum systolic pressure after inspiratory peak. SP minimum: minimum systolic pressure after positive pressure respiratory cycle; SPV: represents the difference between SP maximum and SP minimum or the total of $d\text{Up}$ plus $d\text{Down}$.

FLUID RESUSCITATION STROKE VOLUME VARIATION





FLUID VS INOTROPES



Figure 2. Image shows inspiratory (minimal) diameter of the IVC.



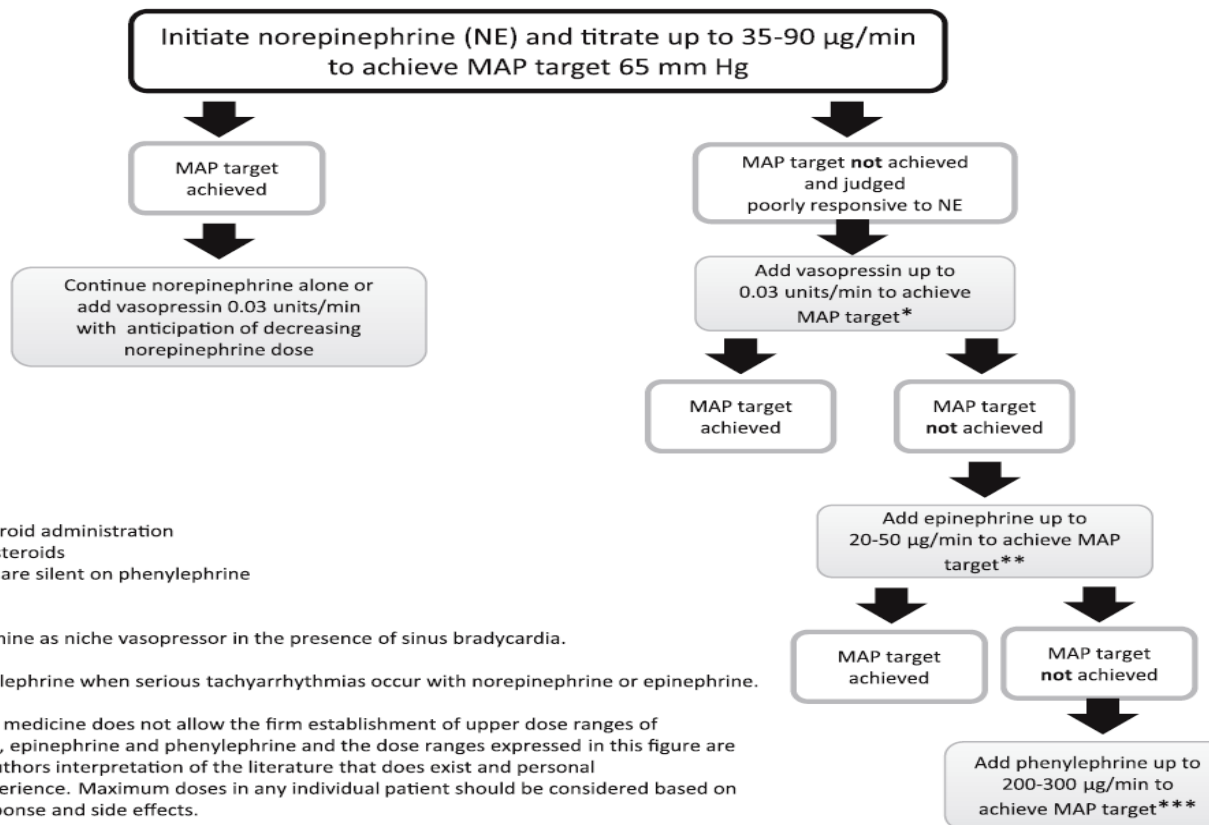
Figure 3

Fluid administration should be discontinued when the response to fluids is no longer beneficial.

VASOPRESSOR IN SEPTIC SHOCK

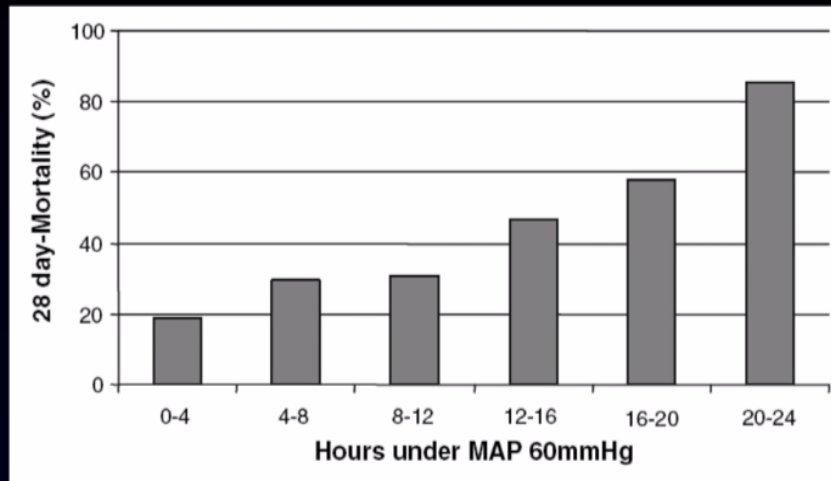


Vasopressor Use for Adult Septic Shock (with guidance for steroid administration)



**Time spent with hypotension is associated
with a poor outcome**

Dunser M et al
ICM 35:1225;2009

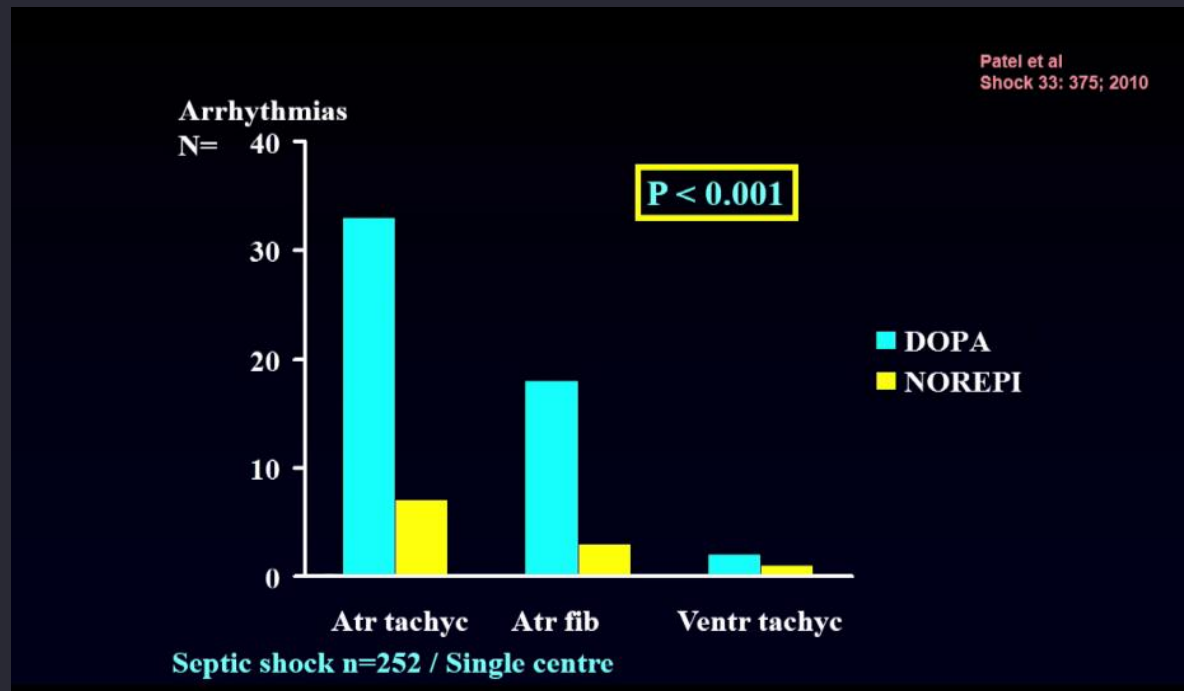


274 pts with sepsis in ICU

Both severity and duration of hypotension are associated with poor outcome.

It sounds to correct hypotension without delay

Dopamine IS OUT



Dopamine group, was associated with more arrhythmias and with an increased rate of death in the subgroup of patients with cardiogenic shock.

END POINTS OF RESUSCITATION

Return to normal tissue perfusion.

- ♥ Vital signs: Return to normal
- ♥ MAP > 65 mm of Hg
- ♥ Normalization of **lactate**
- ♥ Renal: ↑ **urinary output**
- ♥ Skin: Warm, capillary refill
- ♥ Respirations: Improved rate and depth
- ♥ CNS: Improved level of consciousness





Sepsis survival rates increased by faster hospital action.

If Antisepsis protocol was not implemented, mortality rose by almost 4% every hour.

“It can be lifesaving.”



THANK YOU ALL