


**ThinkAskLearn**  
Health Professional Education

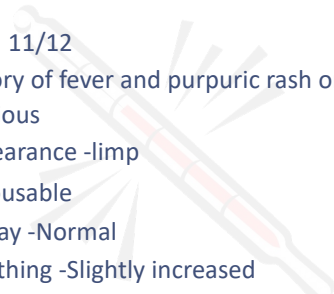
## Avoiding the Pitfalls of Septic Shock

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[www.thinkasklearn.com.au](http://www.thinkasklearn.com.au)




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## Case Study




- Child 11/12
- History of fever and purpuric rash onset 6 hrs previous
- Appearance -limp
- Unrousable
- Airway -Normal
- Breathing -Slightly increased




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## Case Study




- Pulse -180
- Capillary refill - delayed
- Hypotensive
- SaO<sub>2</sub> 85%
- Rash -arms, legs, face
- Lethargic



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## WARNING GRAPHIC PICTURE AHEAD



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## Diagnosis?

- Meningococcaemia- Presence of meningococci (N. Meningitidis) in the circulating blood.

## Treatment?

- 5 tubes
- Aggressive supportive measures
- Fluid load



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## Poor Prognostic Signs

- Rapid onset of rash
- Hypotension
- Low WCC
- Not meningitis - so rapid onset of disease has not had time to localise



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## Sepsis in Children

- 70% pneumococcal and 20% Haemophilus influenzae B - pre Hib immunisation
- 90% pneumococcal post Hib immunisation
- Salmonella - 6%
- N.meningitidis - 1%



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## Pneumococcal Vaccine

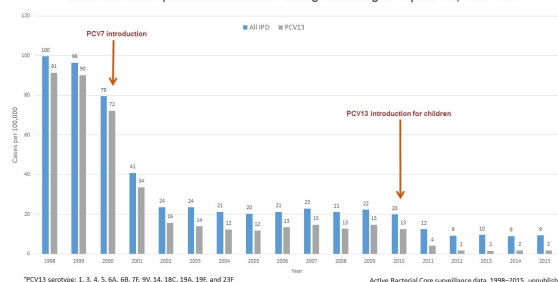
- Pneumococcal pneumonia begins with a high fever, cough, and stabbing chest pains,
- Pneumococcal vaccine is 60% to 70% effective in preventing bacteremic pneumococcal infections
- Now on immunisation schedule

Not what is the WCC but has the child been vaccinated?



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Trends in invasive pneumococcal disease among children aged <5 years old, 1998–2015



CDC Sept 2017



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## Surviving Sepsis Campaign

- Guidelines for Managing Sepsis
  - First developed in 2004
  - Reviewed and updated in 2008
  - 2012 version with April 2015 update
  - 2016 version Published in 2017
    - 2018 – ‘Hour 1’ update
  - 2021 version
- Focused on the evidence for the treatment of sepsis
- Developed guidelines, bundles, and resources



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## The Numbers....

- 750,000 new sepsis cases each year in the US, with at least 210,000 fatalities
- Severe sepsis – 30-50% mortality
- Sepsis with shock – 50-60% mortality
- “organized process that guarantees the early recognition of severe sepsis along with the uniform and consistent application of evidence-based practices”
- 20% reduction in mortality (Daniels 2011)



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### Who is at risk?

- High risk groups include:
- Extremes of age
- Burns patients
- Alcoholics
- Chronic renal failure
- Diabetics
- Immunosuppressed patients
- Patients with chronic cardiorespiratory illness
- Malnourished patients
- Multiply injured patients



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### Systemic Inflammatory Response Syndrome (SIRS) criteria

- 2 or more of the following
  - HR > 90 bpm
  - T > 38.3°C or < 36°C
  - RR > 20 bpm or PACO<sub>2</sub> < 32mmHg
  - WCC > 12,000/mm<sup>3</sup>
- Multiple reasons for the above criteria
- Documented or suspected infection



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### Surviving Sepsis Campaign

- Some of the following.....
- Fever (> 38.3°C)
- Hypothermia (core temperature < 36°C)
- Heart rate > 90/min
- Tachypnea
- Altered mental status
- Significant edema or positive fluid balance (> 20 mL/kg over 24 hr)
- Hyperglycemia (glucose > 7.7 mmol/L) in the absence of diabetes



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#### Inflammatory variables

- Leukocytosis (WBC count > 12,000  $\mu$ L<sup>-1</sup>)
- Leukopenia (WBC count < 4000  $\mu$ L<sup>-1</sup>)
- Normal WBC count with greater than 10% immature forms
- Plasma C-reactive protein more than two SD above the normal value
- Plasma procalcitonin more than two SD above the normal value

#### Hemodynamic variables

- Arterial hypotension (SBP < 90mm Hg, MAP < 70mm Hg, or an SBP decrease > 40mm Hg in adults or less than two SD below normal for age)



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#### Organ dysfunction variables

- Arterial hypoxemia (Pao<sub>2</sub>/FIO<sub>2</sub> < 300)
- Acute oliguria (urine output < 0.5 mL/kg/hr for at least 2 hrs despite adequate fluid resuscitation)
- Creatinine increase > 0.5mg/dL or 44.2  $\mu$ mol/L
- Coagulation abnormalities (INR > 1.5 or aPTT > 60 s)
- Ileus (absent bowel sounds)
- Thrombocytopenia (platelet count < 100,000  $\mu$ L<sup>-1</sup>)
- Hyperbilirubinemia (plasma total bilirubin > 4mg/dL or 70  $\mu$ mol/L)

#### Tissue perfusion variables

- Hyperlactatemia (> 1 mmol/L)
- Decreased capillary refill or mottling



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Special Communication | February 23, 2016

CARING FOR THE CRITICALLY ILL PATIENT

### The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) FREE

Mervyn Singer, MD, FRCP<sup>1</sup>; Clifford S. Deutschman, MD, MS<sup>2</sup>; Christopher Warren Seymour, MD, MSc<sup>3</sup>; Manu Shankar-Hari, MSc, MD, FRCM<sup>4</sup>; Djillali Annane, MD, PhD<sup>5</sup>; Michael Bauer, MD<sup>6</sup>; Rinaldo Bellomo, MD<sup>7</sup>; Gordon R. Bernard, MD<sup>8</sup>; Jean-Daniel Chiche, MD, PhD<sup>9</sup>; Craig M. Coopersmith, MD<sup>10</sup>; Richard S. Hotchkiss, MD<sup>11</sup>; Mitchell M. Levy, MD<sup>12</sup>; John C. Marshall, MD<sup>13</sup>; Greg S. Martin, MD, MSc<sup>14</sup>; Steven M. Opal, MD<sup>15</sup>; Gordon D. Rubenfeld, MD, MS<sup>15,16</sup>; Tom van der Poll, MD, PhD<sup>17</sup>; Jean-Louis Vincent, MD, PhD<sup>18</sup>; Derek C. Angus, MD, MPH<sup>19,20</sup>

JAMA February 23, 2016 Volume 315, Number 8



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Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score*					
System	Score	1	2	3	4
<b>Respiration</b>					
PaO <sub>2</sub> /F <sub>IO<sub>2</sub></sub> , mm Hg	≥400 (3,3)	<400 (5,3)	<300 (4b)	<200 (26,7) with respiratory support	<100 (13,3) with respiratory support
CPAP					
<b>Coagulation</b>					
Platelets, ×10 <sup>3</sup> /μL	≥150	<150	<100	<50	<20
<b>Liver</b>					
Bilirubin, mg/dL (μmol/L)	<1.2 (20)	1.2–1.9 (20–32)	2.0–5.9 (33–101)	6.0–11.9 (102–204)	>12.0 (204)
<b>Cardiovascular</b>					
MAP ≥70 mm Hg	MAP ≥70 mm Hg		Dopamine ≤1.5 or dobutamine (any dose) <sup>b</sup>	Dopamine 1.5–11.5 or epinephrine 0.1–3.1 or norepinephrine 0.1–3.1	Dopamine >1.5 or epinephrine >0.1 or norepinephrine >0.1 <sup>b</sup>
<b>Central nervous system</b>					
Glasgow Coma Scale score <sup>c</sup>	15	13–14	10–12	6–9	<6
<b>Renal</b>					
Creatinine, mg/dL (μmol/L)	<1.2 (110)	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440)	>5.0 (440)
<b>Urine output, mL/d</b>					
				<500	<200

Abbreviations: F<sub>IO<sub>2</sub></sub>, fraction of inspired oxygen; MAP, mean arterial pressure. <sup>a</sup>Catecholamine doses are given in μg/kg/min for at least 1 hour.

<sup>b</sup>Partial pressure of oxygen. <sup>c</sup>Glasgow Coma Scale scores range from 3–15; higher score indicates better neurological function.

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qSOFA Calculator

Is the patient in the ICU?

☐ Yes ☐ No

Altered Mentation

☐ Yes ☐ No


Respiratory rate (breaths per minute)

(0 to 60)

Systolic blood pressure (mmHg)

(0 to 300)

Submit



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### qSOFA Calculator

Is the patient in the ICU?	No
Altered Mentation	Yes
Respiratory rate (breaths per minute)	35
Systolic blood pressure (mmHg)	90

---

**Total Score**
**3**

qSOFA points	Risk of a bad outcome (%)
0	~2
1	~4
2	~6
3	~21

Your patient with suspected infection not in the intensive care unit has a **23% risk** of a bad outcome. This is a prompt to consider that sepsis is **very likely**.

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The image displays two side-by-side screenshots of the ScyMed mobile application interface.

**Left Screenshot (Main Screen):**

- At the top, status bar information shows "vodafone AU", signal strength, 89% battery, and time "13:53".
- The ScyMed logo is at the top left.
- Below the logo, the text "mobile | online | cloud" is displayed.
- A large icon of a skull and crossbones inside a yellow square is centered.
- Below the icon, the text "Sepsis 3" is prominently displayed, followed by "Sepsis Calculators & Data™".
- At the bottom, the text "A. Arturo Rodriguez, MD, MBA" and "ScyMed Inc. Houston, Tx" are visible.
- The bottom dock contains icons for home, app drawer, back, and other functions.


**Right Screenshot (quickSOFA Screen):**

- At the top, status bar information shows "vodafone AU", signal strength, 90% battery, and time "13:53".
- The ScyMed logo is at the top left.
- Below the logo, the text "mobile | online | cloud" is displayed.
- A large icon of a skull and crossbones inside a yellow square is centered.
- Below the icon, the text "Sepsis 3" is prominently displayed, followed by "Sepsis Calculators & Data™".
- At the bottom, the text "A. Arturo Rodriguez, MD, MBA" and "ScyMed Inc. Houston, Tx" are visible.
- The bottom dock contains icons for home, app drawer, back, and other functions.

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## What are you doing for the next 3 days?

- Pathological mechanisms are extremely complex
- Over 100 mediators have been discovered
- Peripheral venous and arteriole vasodilation
- Endpoint:
  - Direct organ injury
  - Increased vascular permeability
  - Endothelial and leucocyte cell dysfunction




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## Bundle of Care

## Surviving Sepsis Campaign

- 'A "bundle" is a group of interventions related to a disease process that, when executed together, result in better outcomes than when implemented individually

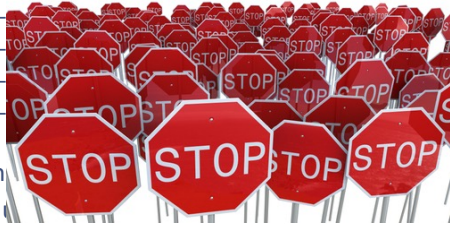


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## Early Goal Directed Therapy

- In hypotensive patients or lactate  $>4\text{mmol/L}$

- In
- No (life saved)



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**Sepsis**  
Australia



**SURVIVING SEPSIS GUIDELINES 2024**

PDF DOWNLOAD FILE →

ONLINE SPECIAL ARTICLE

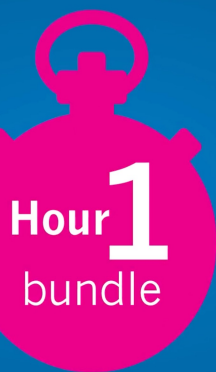
## Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021

**KEY WORDS:** adults; evidence-based medicine; guidelines; sepsis; septic shock

Laure Evans<sup>1</sup>  
Andrew Rhodes<sup>2</sup>  
Waleed Alhazzani<sup>3</sup>  
Massimo Antonelli<sup>4</sup>  
Cristian M. Pannocchia<sup>5</sup>



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## Initial resuscitation for sepsis and septic shock (begin immediately)

**Hour 1 bundle**

- 1 Measure lactate level\*
- 2 Obtain blood cultures before administering antibiotics
- 3 Administer broad-spectrum antibiotics
- 4 Begin to rapidly administer 30mL/kg crystalloid for hypotension or lactate  $\geq 4\text{ mmol/L}$
- 5 Apply vasopressors if hypotensive during or after fluid resuscitation to maintain a mean arterial pressure  $\geq 65\text{ mm Hg}$

\*Remeasure lactate if initial lactate elevated ( $>2\text{ mmol/L}$ )

<http://www.survivingsepsis.org>



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## What is with the lactate?

- Formed from anaerobic cellular production
- Early marker of inadequate tissue oxygen supply
- May rise before hypotension,  $\text{O}_2$  saturations show signs
- Can be gotten from some blood gas analysers
- Range 0.5-2.2mmol
- Due to high risk of septic shock - Start treatment when lactate  $>4\text{mmol}$  regardless of BP



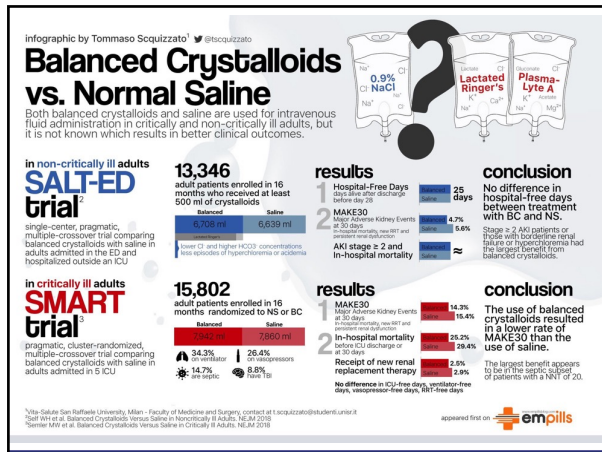
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## What Fluid and How Much?

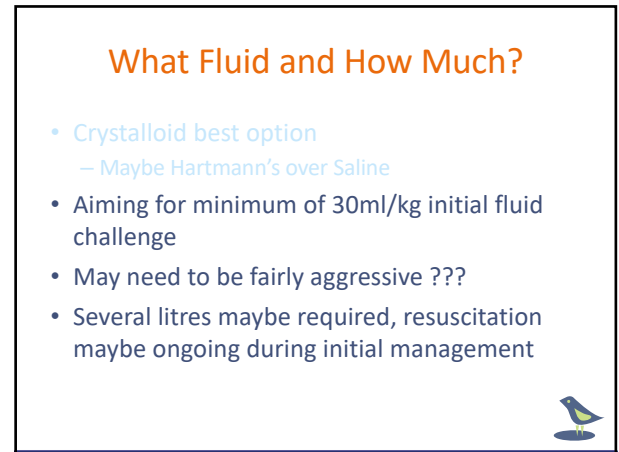
- Crystalloid best option
  - Maybe Hartmann's over Saline



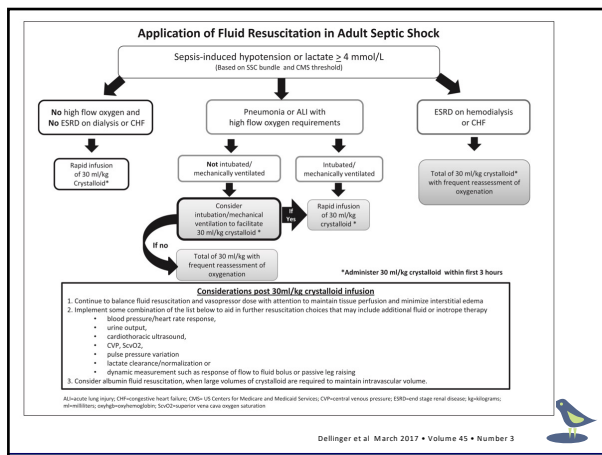
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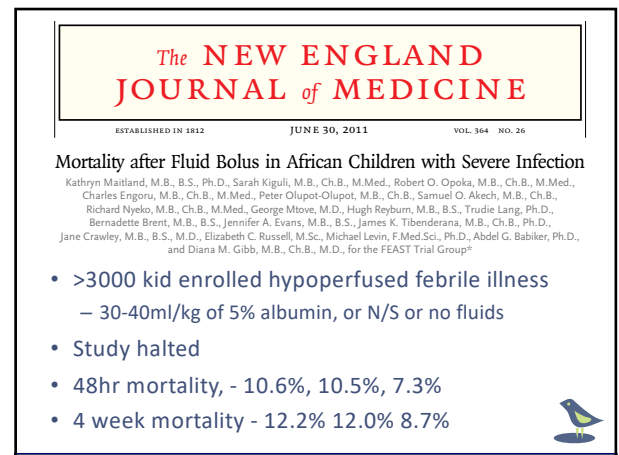
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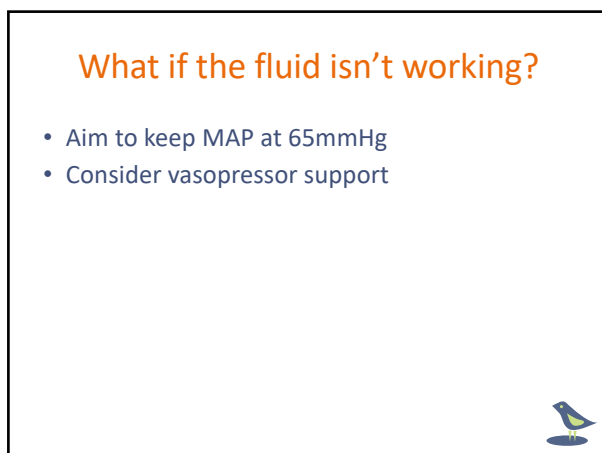
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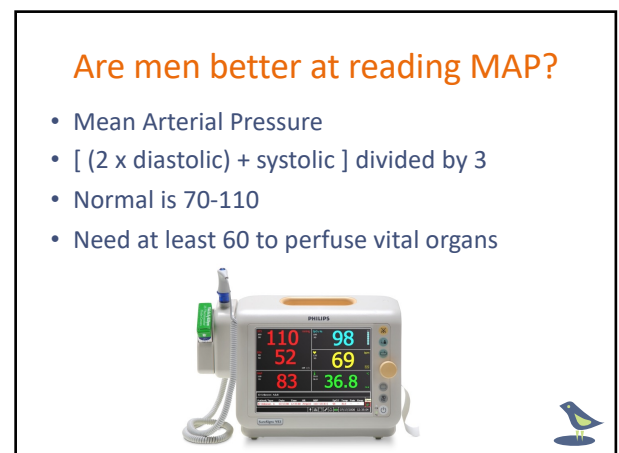
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## What Vasopressor?

- Aim to keep MAP at 65mmHg
- This maybe too low for some people – HT,
- Low may be tolerated by the younger patient
- Noradrenaline first line recommended
- Vasoconstrictive effects with little effect on HR
- Dopamine 2<sup>nd</sup> choice – increase HR, Stroke volume



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## How to give noradrenaline?

- Department specific protocol\*\*\*\*\*
- Available in 2mg ampoules
- 6mg in 100ml NS
- Usually 0-20ml/hr- titrate to effect
- CVL preferred
- Low concentrations may be given via a large bore cannula (6mg in 500mls)(MIMS 2013)
- Obviously Critical Care Environment
- 2 minutely BP till BP at req level then 5 min after



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## Vasoactive Agent Management

	<input checked="" type="checkbox"/> Use norepinephrine as first-line vasopressor. <input checked="" type="checkbox"/> Target a MAP of 65 mm Hg.
For patients with septic shock on vasopressors	<input type="checkbox"/> Consider invasive monitoring of arterial blood pressure.
If central access is not yet available	<input type="checkbox"/> Consider initiating vasopressors peripherally*.
If MAP is inadequate despite low-to-moderate norepinephrine	<input type="checkbox"/> Consider adding vasopressin.
If cardiac dysfunction with persistent hypotension is present despite adequate volume status and blood pressure	<input type="checkbox"/> Consider adding dobutamine or switching to epinephrine.

\* Strong recommendations are displayed in green  
Weak recommendations are displayed in yellow  
\*When vasopressors are used peripherally, they should be administered only for a short period of time and in a way prepared to the individual tissue.

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## CENSER: Early use of Noradrenaline in Septic Shock Resuscitation

- Shows promise
- Septic patients given noradrenaline
- Better outcomes\*
- Move to inotropes early

Permpikul C, AJRCCM, 2019. Published online February 1. doi:10.1164/rccm.201806-1034OC

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## Should we wait for med reg review to start Antibiotics?

- No – evidence is clear
- Aim for AB's within 1 hour
- Rapidly treat underlying infection
- Get blood cultures prior to AB's
- Bacteraemia present in 30-50% of severe sepsis
- Empirical therapy- to start Flucloxacillin and Gentamicin (therapeutic guidelines)
- Focused once results return



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Time to Antibiotics in Sepsis: A Metric Not Supported by Evidence



www.rebelem.com

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The 2018 Surviving Sepsis Campaign's Treatment Bundle: When Guidelines Outpace the Evidence Supporting Their Use

Rory Spiegel, MD\*; Joshua D. Farkas, MD; Philippe Rola, MD; Jon-Emile Kenny, MD; Segun Olusanya, MD; Paul E. Marik, MD; Scott D. Weingart, MD

In press

- Not attacking importance of sepsis recognition
- Timing of AB evidence – very poor
  - Obvious patients are obvious/ Best study –no benefit
- Fluids for everyone!
- Bundled care is better than individualized care???
- Concern over quality indicator - Pneumonia
  - Concern that to meet targets that everyone gets AB's/Massive fluid rehydration
  - Worried ED's will be beaten up!



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Surely there must be more...

- Low dose steroids maybe considered if fluids and vasopressor not effective
  - Recommend against routine use
- Ventilate for hypoxia/ARDS
  - Low volume, High PEEP,  $P_{plat} < 30 \text{ cmH}_2\text{O}$
- Treat for DVT
  - What is best?
- Get glucose control 2<sup>nd</sup> hrly BSL



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The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

JUNE 6, 2013

VOL. 368 NO. 23

Prone Positioning in Severe Acute Respiratory Distress Syndrome

Claude Guérin, M.D., Ph.D., Jean Reignier, M.D., Ph.D., Jean-Christophe Richard, M.D., Ph.D., Pascal Beuret, M.D., Arnaud Gacouin, M.D., Thierry Boulain, M.D., Emmanuelle Mercier, M.D., Michel Badet, M.D., Alain Mercat, M.D., Ph.D., Olivier Baudin, M.D., Marc Clavel, M.D., Delphine Chatellier, M.D., Samir Jaber, M.D., Ph.D., Sylvène Rosselli, M.D., Jordi Mancebo, M.D., Ph.D., Michel Sirodot, M.D., Gilles Hilbert, M.D., Ph.D., Christian Bengler, M.D., Jack Richecœur, M.D., Marc Gannier, M.D., Ph.D., Frédérique Bayle, M.D., Gael Bourdin, M.D., Véronique Leray, M.D., Raphaële Girard, M.D., Loredana Baboi, Ph.D., and Louis Ayzac, M.D., for the PROSEVA Study Group\*



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Prone Position for ARDS

- RCT multi centre of Adult ARDS –
  - $\text{FiO}_2 .6$ , PEEP of at least 5, TV 6ml/kg
- 237 prone, 229 supine
  - Av Age 60, Main cause of ARDS – Pneumonia 60%
- 28 day mortality 90 day mortality
  - Prone – 16.0% 23.6%
  - Supine – 32.8% 41.0%
  - $p < 0.001$   $p < 0.001$



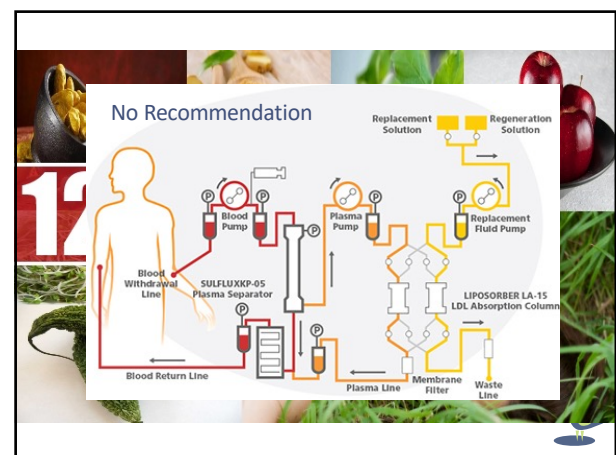
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Why Prone Works



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No Recommendation



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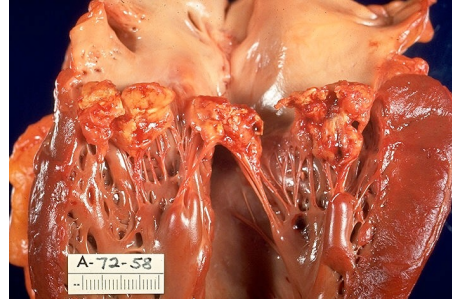
### A quick case to finish?

- 24 year old male presents ALOC
- Found this am, ?length of time
- Doesn't seem to be moving left side/ facial droop, difficulty speaking
- Unkempt, malnourished
- Probable track marks
- Febrile, Hypotensive



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### Bacterial Endocarditis



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### Take Home Message

- Consider sepsis to find sepsis
- Use sepsis bundle/Consider 'Hour 1'
- Plan for fluid resuscitation (30ml/kg)
- Give Antibiotics early but after cultures



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