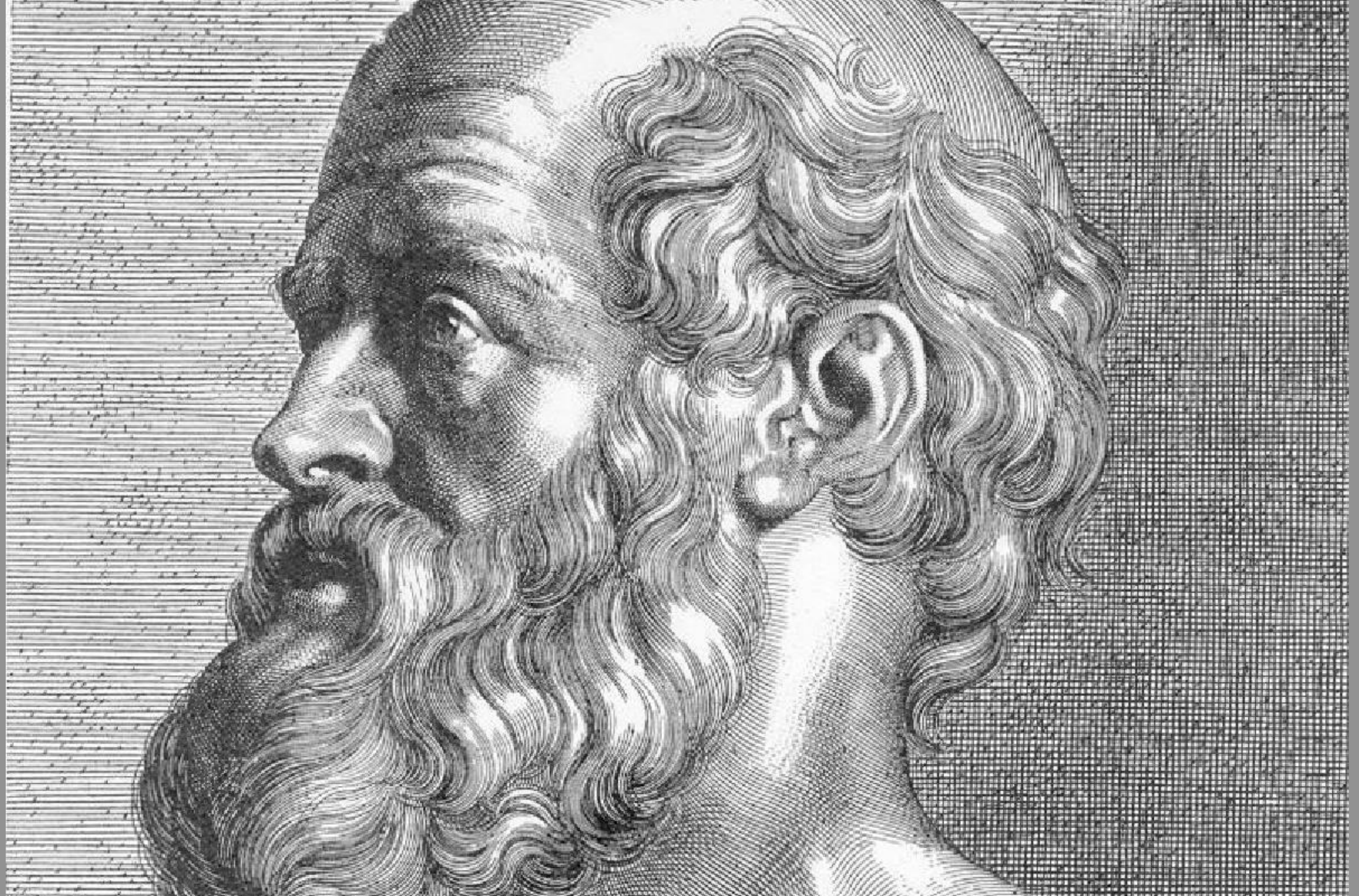
Sepsis & SOFA: Understanding early recognition


START



Sepsis Construct

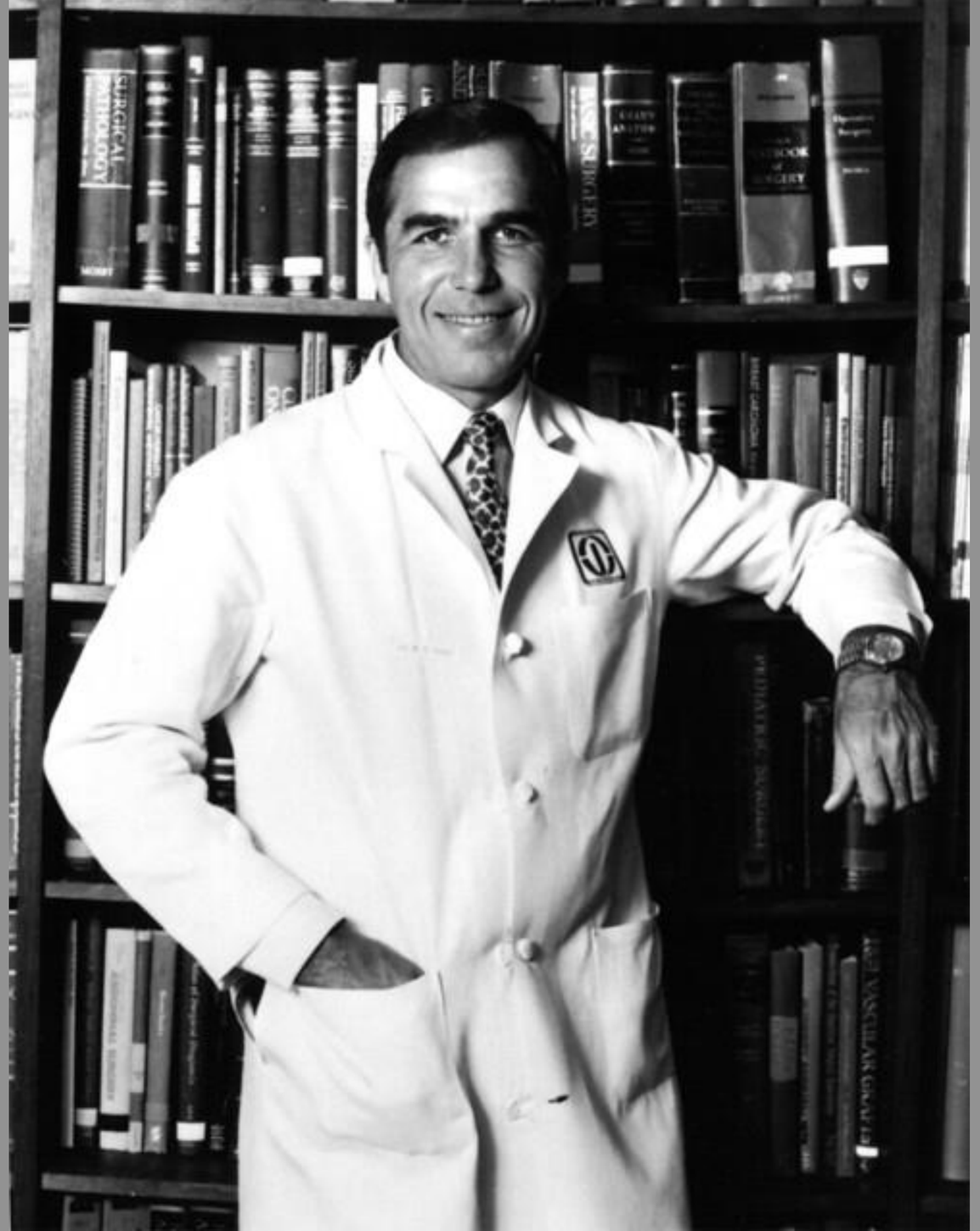
Sepsis Construct

Pathophysiology – Dysregulated host response

Sepsis Construct

Pathophysiology – Dysregulated host response

Clinical – Infection + Organ Dysfunction


SURGICAL PATHOLOGY

Society of Critical Care Medicine

The Intensive Care Professionals

6th leading cause of hospitalization

1.7 million people annually

300,000 deaths

Most expensive condition treated

How to we screen for sepsis in primary care?

General Appearance – 94.1%

Gut Feeling – 92.1%

Physical Exam – 89.3%

Unable to Stand

Failed Previous Treatment

Decreased Urinary Output

Altered Mental Status

Systolic BP <100 mmHg

Respiratory Rate >22

Immunosuppression – 96.8%

Multimorbidity – 83.6%

EOS – Early Onset Neonatal Sepsis

LOS – Late Onset Neonatal Sepsis

Risk Factors for EOS neonatal sepsis:

No intrapartum antibiotics

Very Low Birth Weight

Premature Rupture of Membranes

EOS Infectious Causes:

E. Coli – most common
GBS

Staph aureus
Enterococcus

Common Causes for LOS neonatal sepsis:

Prematurity
Low Birth Weight
Parental Feedings
Central Catheters
Empirical Antibiotic Use

LOS Infectious Causes:

Coagulase negative staph
Klebsiella
Acinetobacter
Viral

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old

Eligibility

Well-Appearing

Age >37 weeks

Documented Fever

8-60 days old

Exclusion Criteria

Preterm Infant

Maternal Infection

Focal Infection

Immunosuppressed

Surgery

Congenital Condition

High suspicion for HSV

8-21 days

Urinalysis
Blood Culture
Lumbar Puncture

Admit to Hospital

8-21 days

Treat Empirically

E. Coli and GBS

8-21 days

UTI → Ampicillin 150mg/kg/d q 8hrs + Gentamicin 4mg/kg q 24hrs

Meningitis → Ampicillin 300mg/kg/d q 6hrs + Ceftazidime 150mg/kg/d q 8hrs

22-28 days

Urinalysis
Blood Culture
Inflammatory Markers

Likely Admission to Hospital

22-28 days

Fever
WBC >15,000
ANC >10,000
CRP >20mg/L
Procalcitonin >0.5ng/mL

22-28 days

If elevated inflammatory makers, perform lumbar puncture

22-28 days

Clinicians SHOULD administer parenteral antimicrobials if either:

1) CSF analysis suggests bacteria
2) Urinalysis is positive

22-28 days

UTI → Ceftriaxone 50mg/kg q 24hrs

Meningitis → Ampicillin 300mg/kg/d q 6hrs + Ceftazidime 150mg/kg/d q 8hrs

22-28 days

Clinicians SHOULD administer parenteral antimicrobials if:

1) **CSF analysis is normal**
2) **Urinalysis is normal**
3) **Positive Inflammatory Markers**

22-28 days

Clinicians MAY administer parenteral antimicrobials and admission if:

1) **CSF analysis is normal**
2) **Urinalysis is normal**
3) **Negative Inflammatory Markers**

22-28 days

Clinicians SHOULD administer parenteral antimicrobials to those managed at home even if:

1) **CSF analysis is normal**
2) **Urinalysis is normal**
3) **Negative Inflammatory Markers**

22-28 days

Clinicians SHOULD hospitalize infants in a facility with nurses and staff experienced in the care of infants when CSF cannot be obtained

22-28 days

Return Precautions:

Change in general appearance
Irritability
Difficulty feeding
Vomiting
Decreased urine output

29-60 days

Urinalysis
Blood Culture
Inflammatory Markers

29-60 days

May Obtain CSF if any IM obtained is abnormal

29-60 days

Clinicians NEED NOT obtain CSF if all inflammatory markers are normal

29-60 days

Clinicians SHOULD use parenteral antimicrobial therapy if CSF unavailable

29-60 days

Clinicians SHOULD initiate ORAL antimicrobial therapy if:

1) **CSF is normal**
2) **Urinalysis results are positive**
3) **No elevated inflammatory markers**

29-60 days

Clinicians NEED NOT initiate antimicrobial therapy if:

1) **CSF is normal**
2) **Urinalysis results are negative**
3) **No elevated inflammatory markers**

Signs/Symptoms

Tachycardia/Bradycardia
Tachypnea/Grunting
Decreased feeding
Vomiting
Seizures
Hypothermia

PEWS

Behavior

Cardiovascular

Respiratory

Other

PEWS

Behavior

Playing Appropriately	-	0
Irritable but consolable	-	1
Irritable and inconsolable	-	2
Lethargic/confused	-	3

PEWS

Cardiovascular

Pink/Cap refill <2	-	0
Pale/Cap refill 3 seconds	-	1
HR > +20 over baseline	-	2
Mottled/HR > +30	-	3

PEWS

Respiratory

Room Air/No retractions	-	0
RR >10 baseline/oxygen	-	1
RR >20 baseline/+4L O2	-	2
RR >30 baseline/grunting	-	3

PEWS

Other - +1 points/each

Quarterly nebulized treatments

Persistent vomiting post surgery

PEWS

0-1 - continue to monitor

2-4 - condition may be worsening

5 - deterioration, may require change in treatment plan

Pediatric Sepsis

CBC
CRP
Procalcitonin
Renal/Liver function panel
Blood Culture
Lactic Acid

Time to Antibiotics

Children with >3 hr from recognition had 4x increase in mortality

Each additional hour is associated with 2x increased odds of mortality

Pediatric Fluids

With no cardiovascular compromise:

Fluid bolus therapy should NOT be given

Maintenance fluid therapy should be started

Pediatric Fluids

With cardiovascular compromise:

Fluid bolus of 10-20mL/kg up to 60mL/kg

Lactated Ringer

Pediatric Vasopressors

The initiation of vasoactive medication should NOT be delayed and should be instituted independent of volume resuscitation

Pediatric Vasopressors

Norepinephrine – 0.05– 0.1 mcg/kg/min

Epinephrine – 0.05-0.1mcg/kg/min

Surviving Sepsis Algorithm

Within 3 hrs of Sepsis:

Expedited diagnostic evaluation
Administer fluids if shock is present

Surviving Sepsis Algorithm

Within 1 hr of Septic Shock:

Blood Cultures
Broad-Spectrum Antibiotics
Lactate Level

Med Mal Cases #1

15 day old

Decreased Feeding, Vomiting, Difficulty Breathing

Discharged home with colic

Med Mal Cases #1

Returned 3 hours later

Suspected GBS bacteremia

Admitted --> eventually made DNR

Med Mal Cases #2

4 y/o with recent strep infection

Hip pain and fever after falling off swing

Admitted with no antibiotics

Med Mal Cases #2

Blood culture positive the next day – Strep

Ortho consulted and MRI ordered

MRI performed 2 days later

Med Mal Cases #3

Full term infant born in case of prolonged rupture of membranes

Born with respiratory distress

CXR – tachypnea of newborn, placed on CPAP

Med Mal Cases #3

Trending elevated CRPs

No blood culture ordered

Discharged home on day 3

Med Mal Cases #3

Day 5 – F/u with peds

Dropped 11.2% of birth weight

Parents report difficulty feeding

Med Mal Cases #3

Day 11 – Return to ED

Severe respiratory distress --> intubated

Dx: Meningitis and Septic Shock

Med Mal Cases #4

10 year old male with fever and headache

Sleepy

No cough, runny nose, or abdominal pain

Med Mal Cases #4

Temp - 102.2 F
Pulse - 130
R - 22
BP - 110/80

Med Mal Cases #4

WBC 3.8 with bandemia

CSF: No WBC and normal protein/glucose

Med Mal Cases #4

Dx: Meningococcemia

Med Mal Cases #5

17 year old female

Chills, Nausea, Body aches, L Arm Pain

Med Mal Cases #5

Temp – 100.0 F
Pulse – 94
R – 18
BP – 97/63

Med Mal Cases #5

Physical Exam:

Pain with palpation of left biceps tendon

Med Mal Cases #5

WBC 4.4 with 15% bands

Sodium 132

Sed Rate 34

Med Mal Cases #5

Dx: Necrotizing fasciitis

Med Mal Cases #6

21 month old

Fever x 5 days

Rash on hands and feet, bumps on neck

Med Mal Cases #6

WBC 19.6 with neutrophilia

CRP 12.9 ESR 83

Med Mal Cases #6

Dx: Kawaski’s Disease

Goal-Oriented

Oxygen Deprivation

Resuscitation Strategy


Balance Oxygen Delivery

Golden Hour of Sepsis

Inclusion Criteria

2 of 4 SIRS

AND

SBP ≤ 90mmHg

OR

Lactate ≥ 4

Early Goal-Directed Therapy

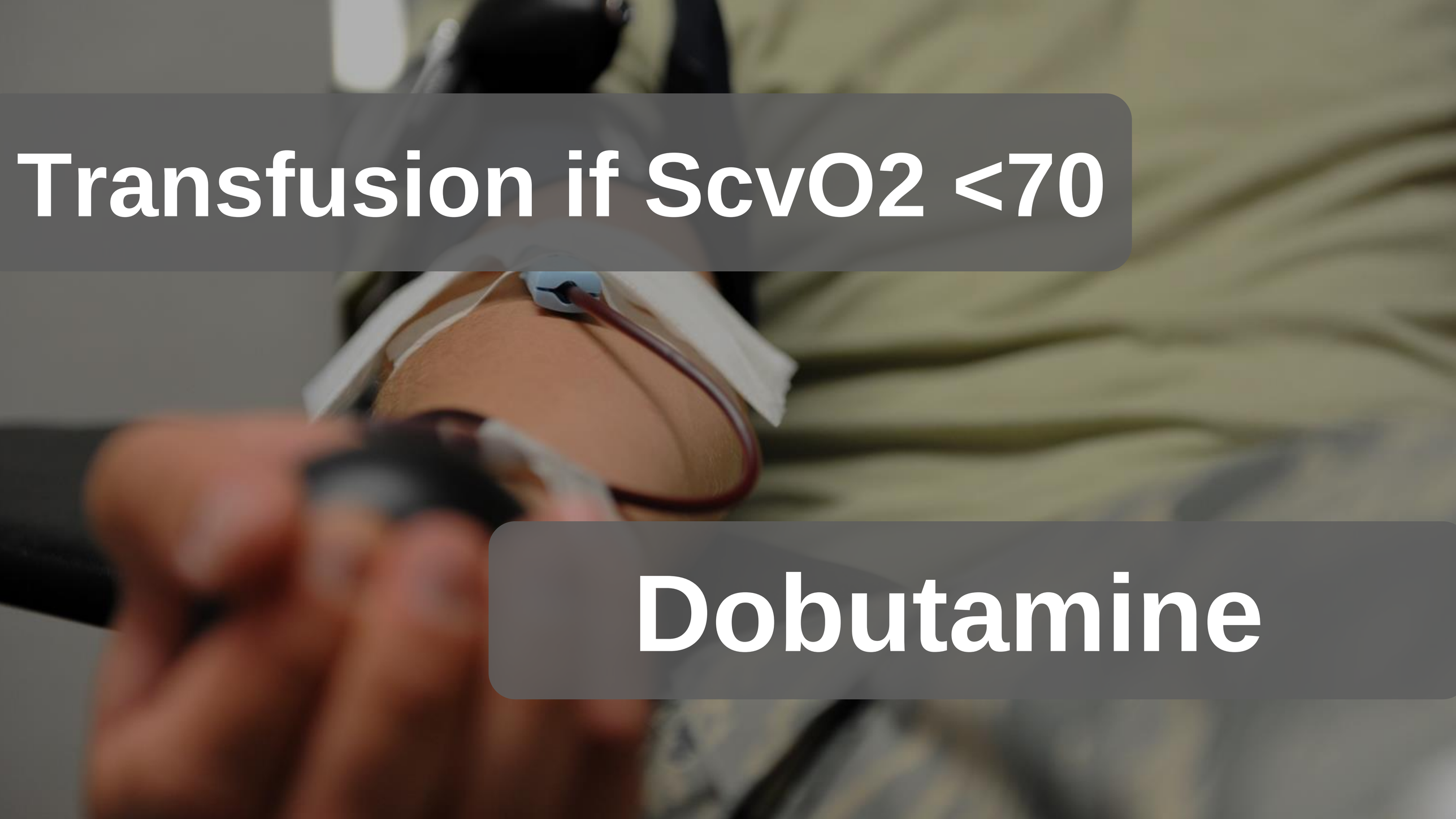
Kept in ED for 6 hours

500mL q30min CVP >8

Early Goal-Directed Therapy

MAP < 65mmHg - vasopressors

MAP > 90mmHg - venodilators


Transfusion if ScvO2 <70
Dobutamine

Mortality in Septic Shock

56.8% → Standard

43.3% → EGDT

EGDT

Mortality

- In-Hospital
- 28 days
- 60 days

No Difference

Severe Sepsis

Sepsis Syndrome

Standard Therapy

- ⬆ Vasopressors
- ⬆ Ventilators
- ⬇ Transfusion

Single Center Study

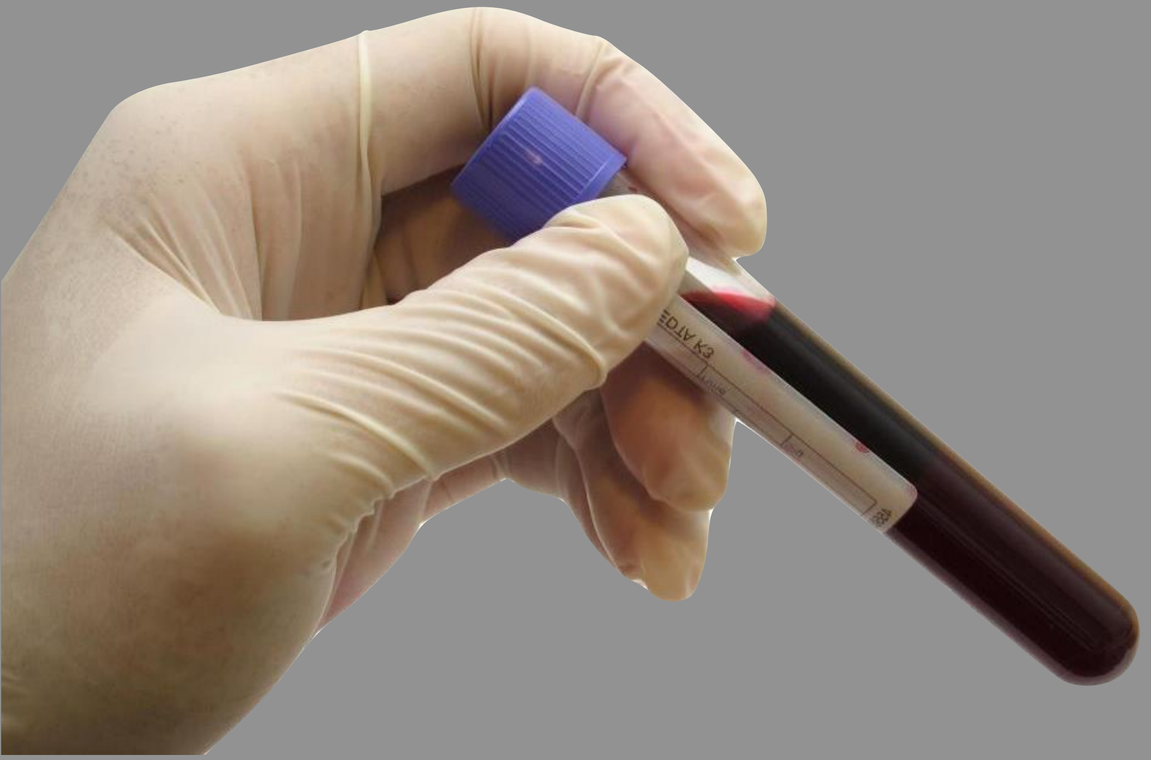
40% Mortality

ScvO2 problems

BIG Protocols

Critical Point #1

Rivers trial became the foundation of sepsis management



VS

Lactate

ScvO2

No Difference in Mortality

Only 10% Ionotropes/PRBCs

20% Mortality

Two Ways Lactate Used in Sepsis

1) Risk Stratification

2) Guide Resuscitation

Lactate clearance ≥ 10% not predictor of mortality

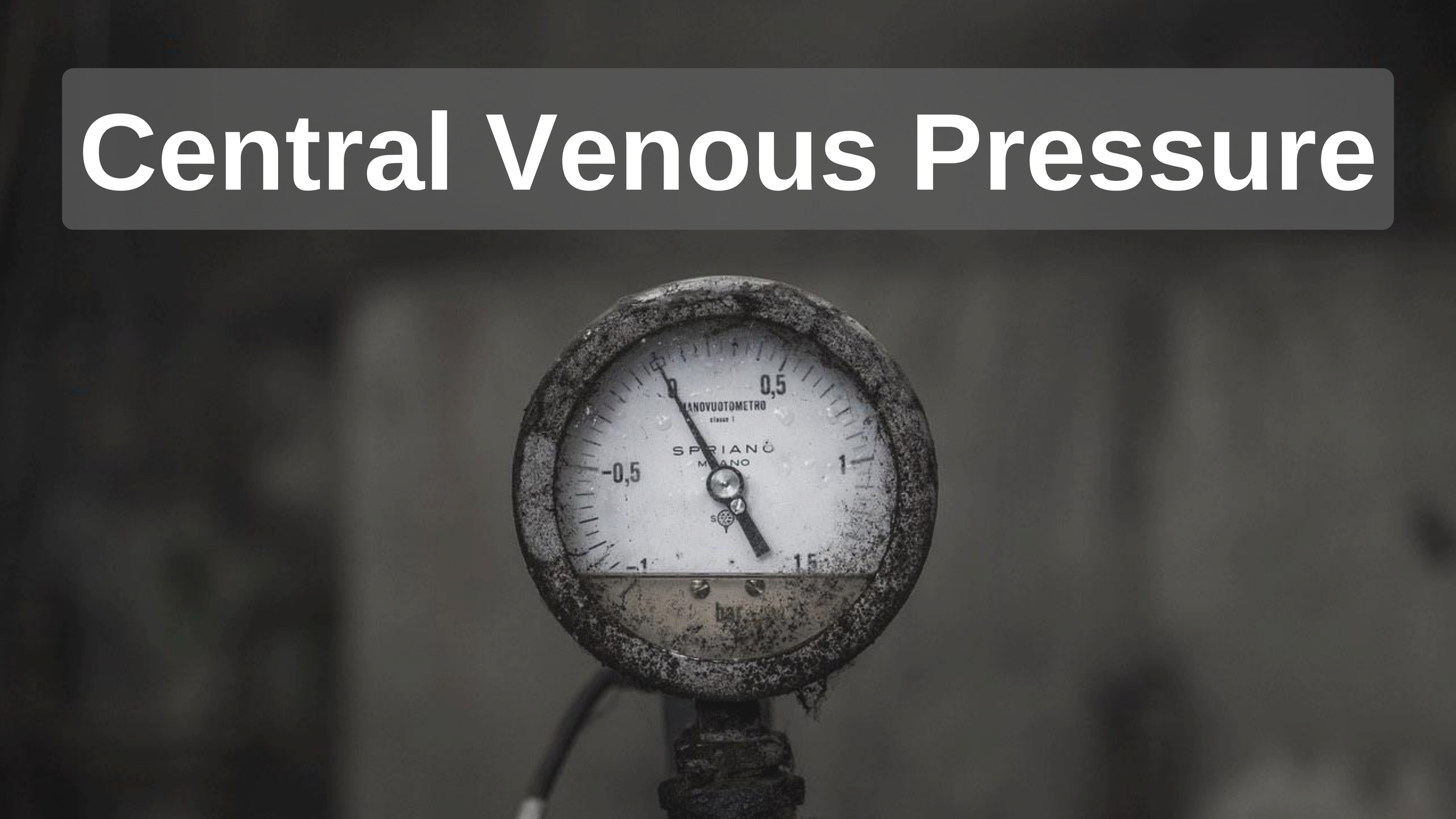
Physiologic Stress

Not Oxygen Depletion

Critical Point #2

Lactate does NOT guide resuscitation

Central Venous Pressure




No Data To Support Use

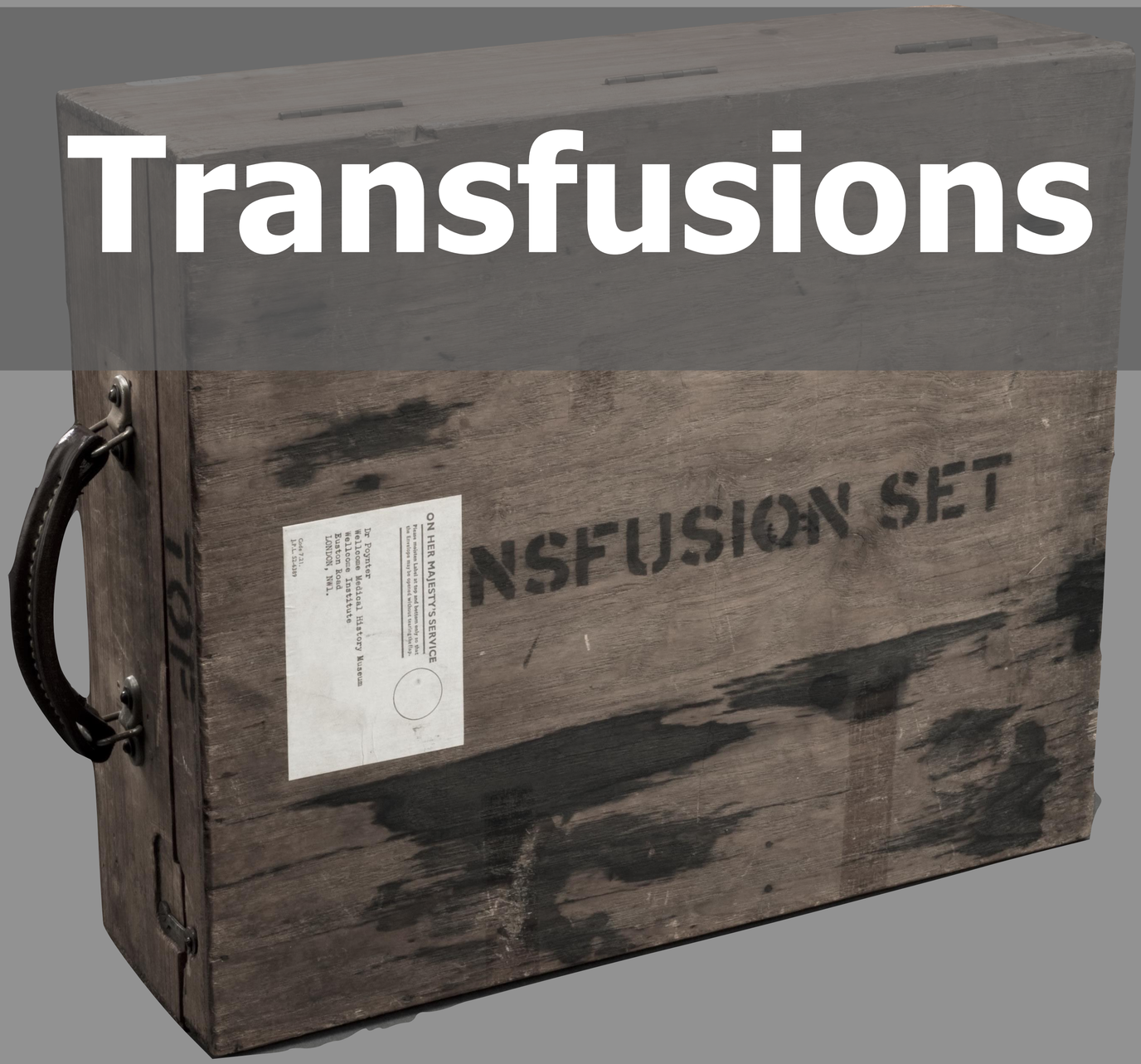
“It’s at best of limited value and at worst, seriously misleading”

Dr. James Forrester 1971

Critical Point #3

CVP should NOT be used to guide resuscitation

Transfusions



TRICC

Liberal	10
Restrictive	7

TRICC

Similar Mortality

Higher Cost

Transfusion Reactions

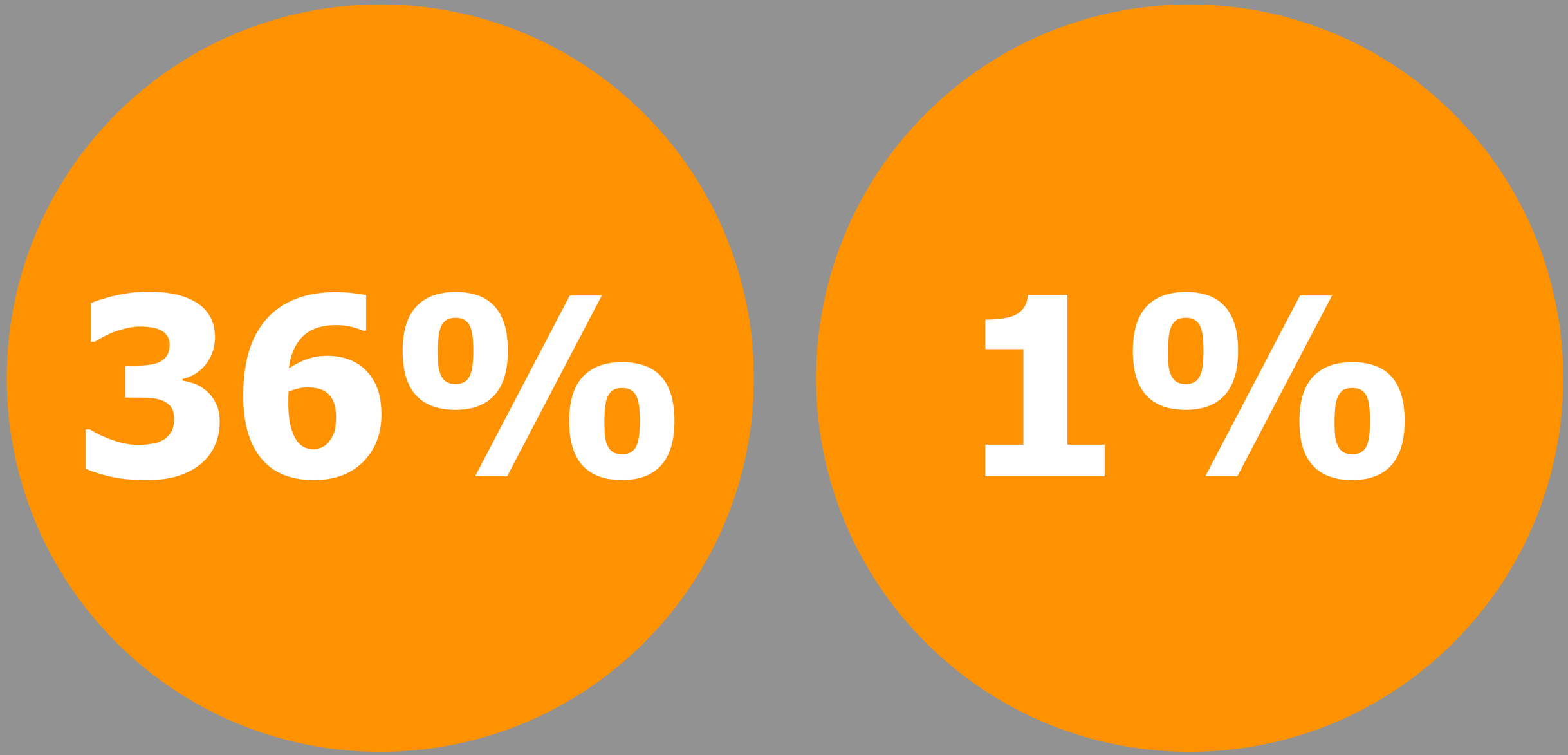
TRALI

TACO

Higher Versus Lower Threshold

No Difference

Trend Toward Lower


36%
1%

Critical Point #4

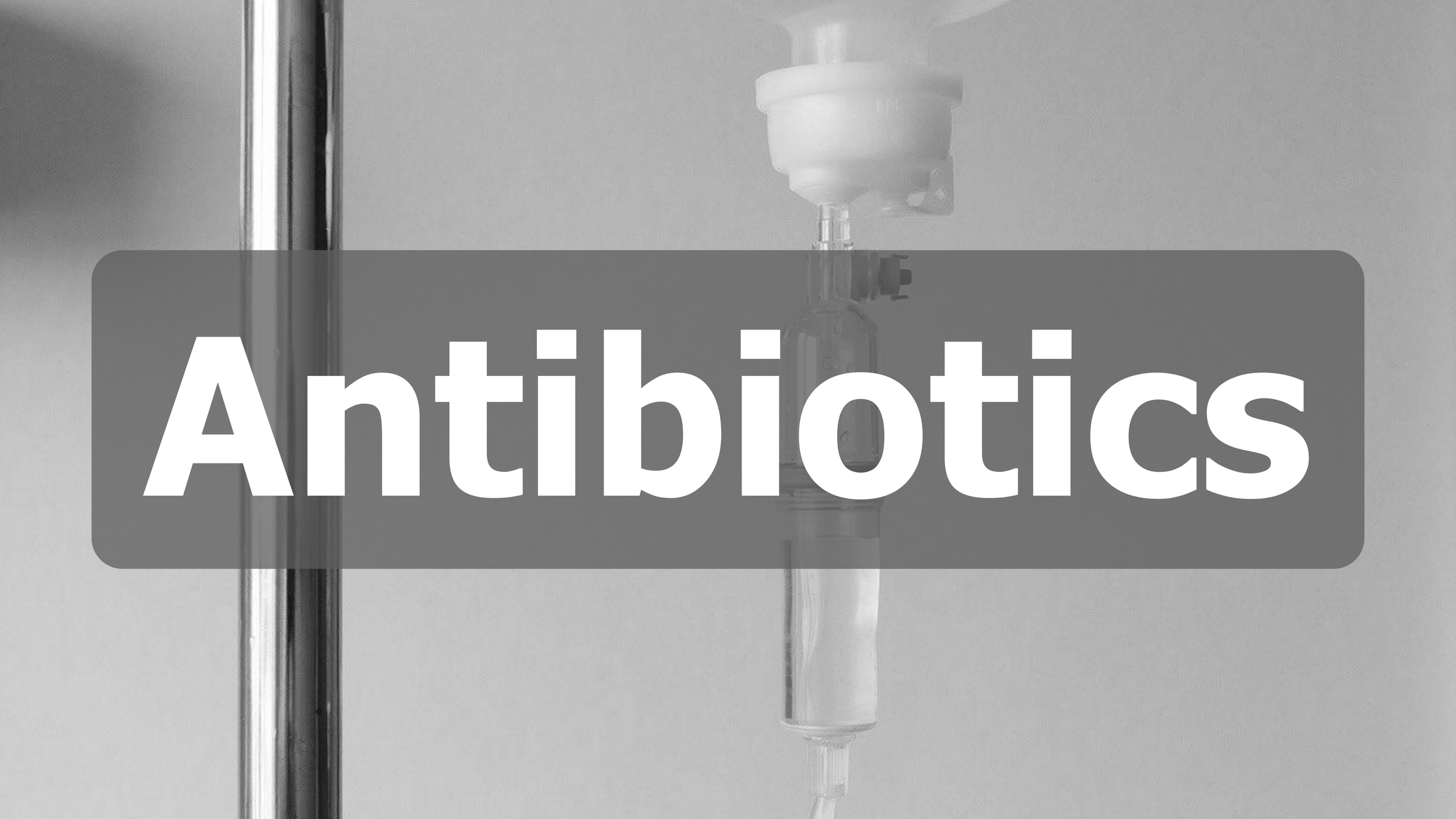
Restrictive Strategy Recommended

Vasopressors


24.1%
12.4%

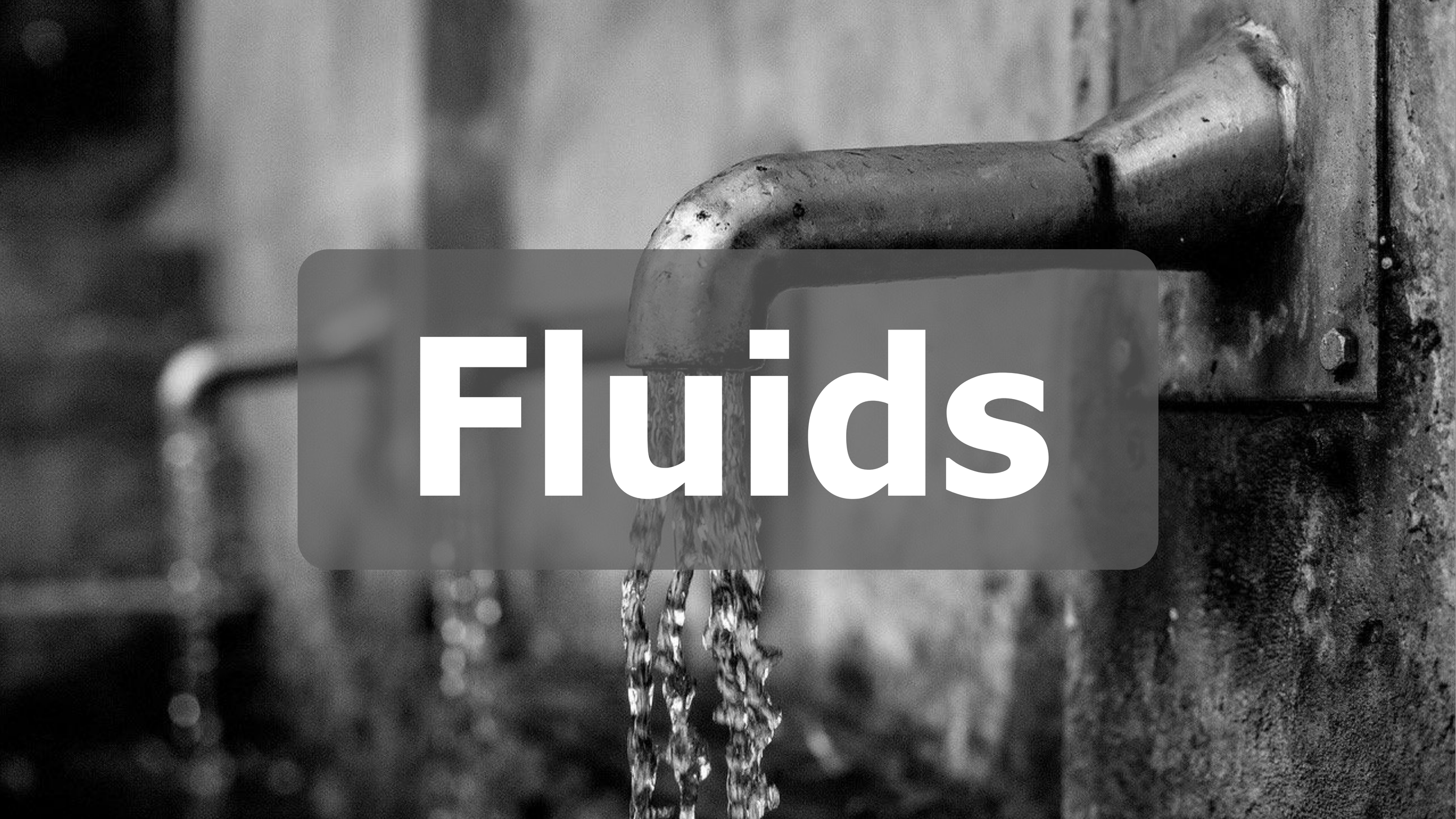
Critical Point #5

Norepinephrine is FIRST line vasopressor


Antibiotics

Critical Point #6

Time to antibiotics measures not supported by literature


Fluids

FACCT Trial

Conservative	-136mL
Liberal	+6226mL

FEAST Trial

Albumin Bolus

NS Bolus

No Bolus

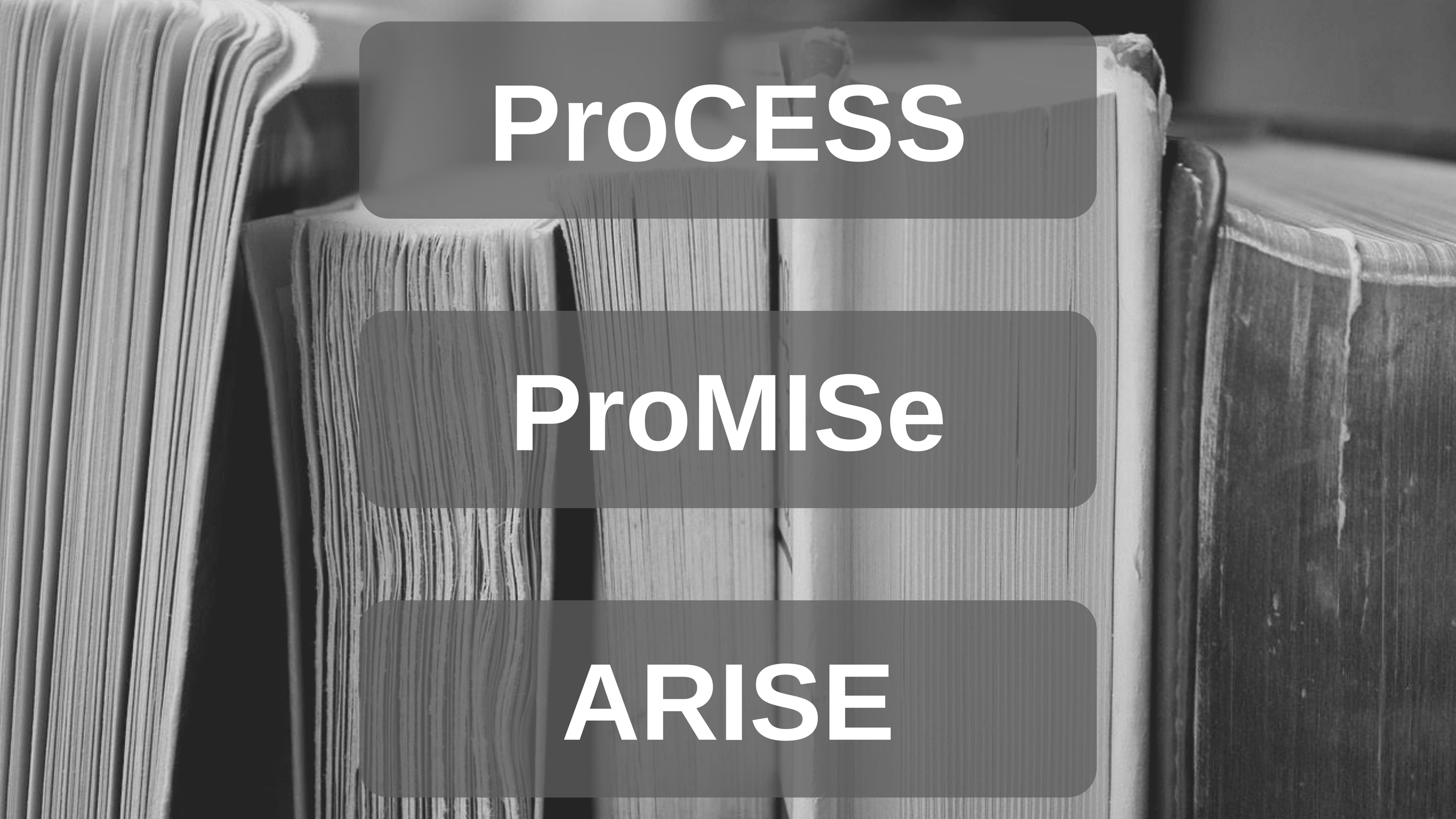
CLASSIC Trial

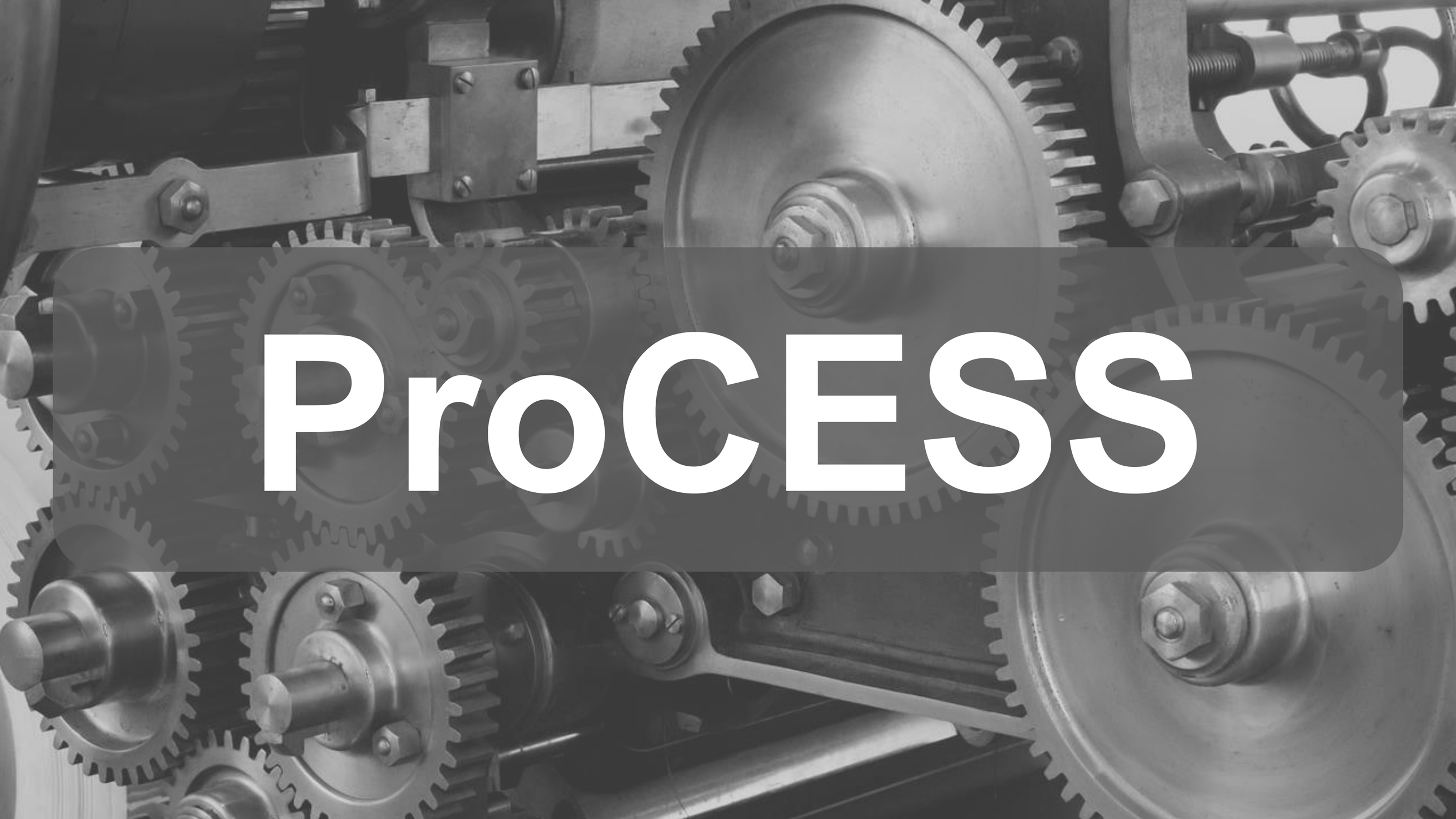
Fluid Restriction

Standard Care

Critical Point #7

Fluids should be used judiciously


ProCESS
ProMISe
ARISE


ProCESS

ProCESS

Primary Endpoint - 60 day in hospital mortality

31 Hospitals → **1342 Patients**

EGDT

Protocol

Usual

ProCESS

EGDT	21%
Protocol Based	18.2%
Usual Care	18.9%


ARISE

ARISE

51 Hospitals → 1600 Patients

EGDT

Usual

ARISE

90 Day Mortality

EGDT	18.6%
Usual Care	18.8%

ARISE

No Signifiant Difference:

- Survival Time
- In-Hospital Mortality
- Duration of Organ Support
- Length Of Hospital Stay


ProMISe

ProMISe

56 Hospitals → 1260 Patients

EGDT

Usual

ProMISe

90 Day Mortality

EGDT	29.5%
Usual Care	29.2%

ProMISe

Increased utilization of resources without improvement in outcome

Meta-Analysis

138 Hospitals → **3723 Patients**

Synchronized Entry Criteria

Meta-Analysis

No Difference

Early Goal-Directed Therapy is DEAD

Where Do We Go From Here?

3rd International Consensus

Rise in SOFA score by ≥ 2 points

SOFA Score

- A series of parameters scored on a 0-4 scale
- Mortality calculated by higher score

PaO2/FiO2

>400 - 0

<400 - 1

<300 - 2

<200 - 3

<100 - 4

GCS

15	-	0
13-14	-	1
10-12	-	2
6-9	-	3
<6	-	4

Creatinine

<1.2	-	0
1.2-1.9	-	1
2.0-3.4	-	2
3.5-4.9	-	3
>5	-	4

Hypotension

No hypotension - 0

MAP <70mmHg - 1

Dopamine ≤ 5
Dobutamine - 2

Norepinephrine ≤ 0.1 - 3

Norepinephrine ≥ 0.1 - 4

Mortality

Score 0-1	-	0%
Score 2-3	-	7%
Score 4-5	-	20%
Score 6-7	-	22%
Score 8-9	-	33%
Score 10-11	-	50%

3rd International Consensus

H

H A

H A T

H Hypotension

A AMS

T Tachypnea

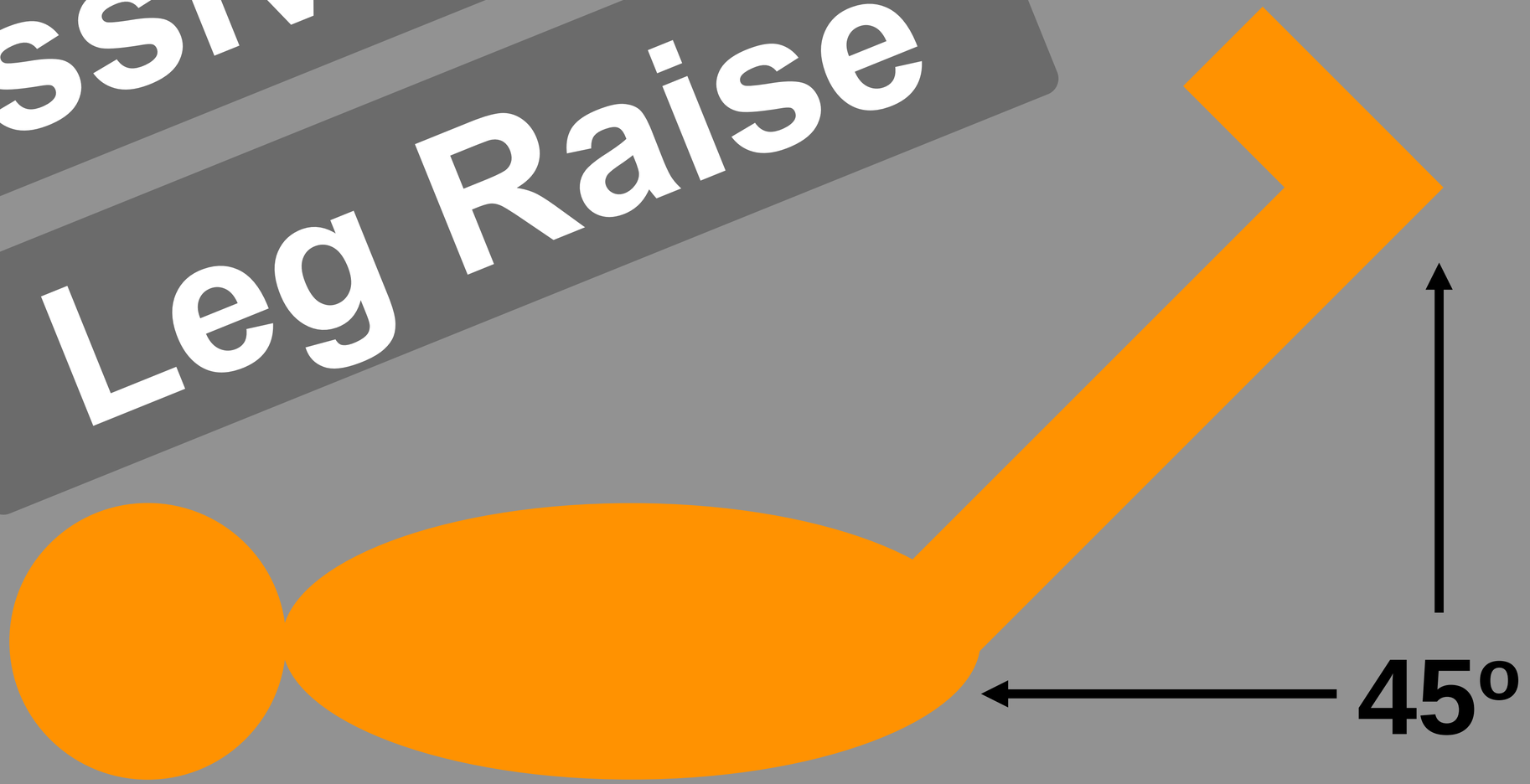
H A T

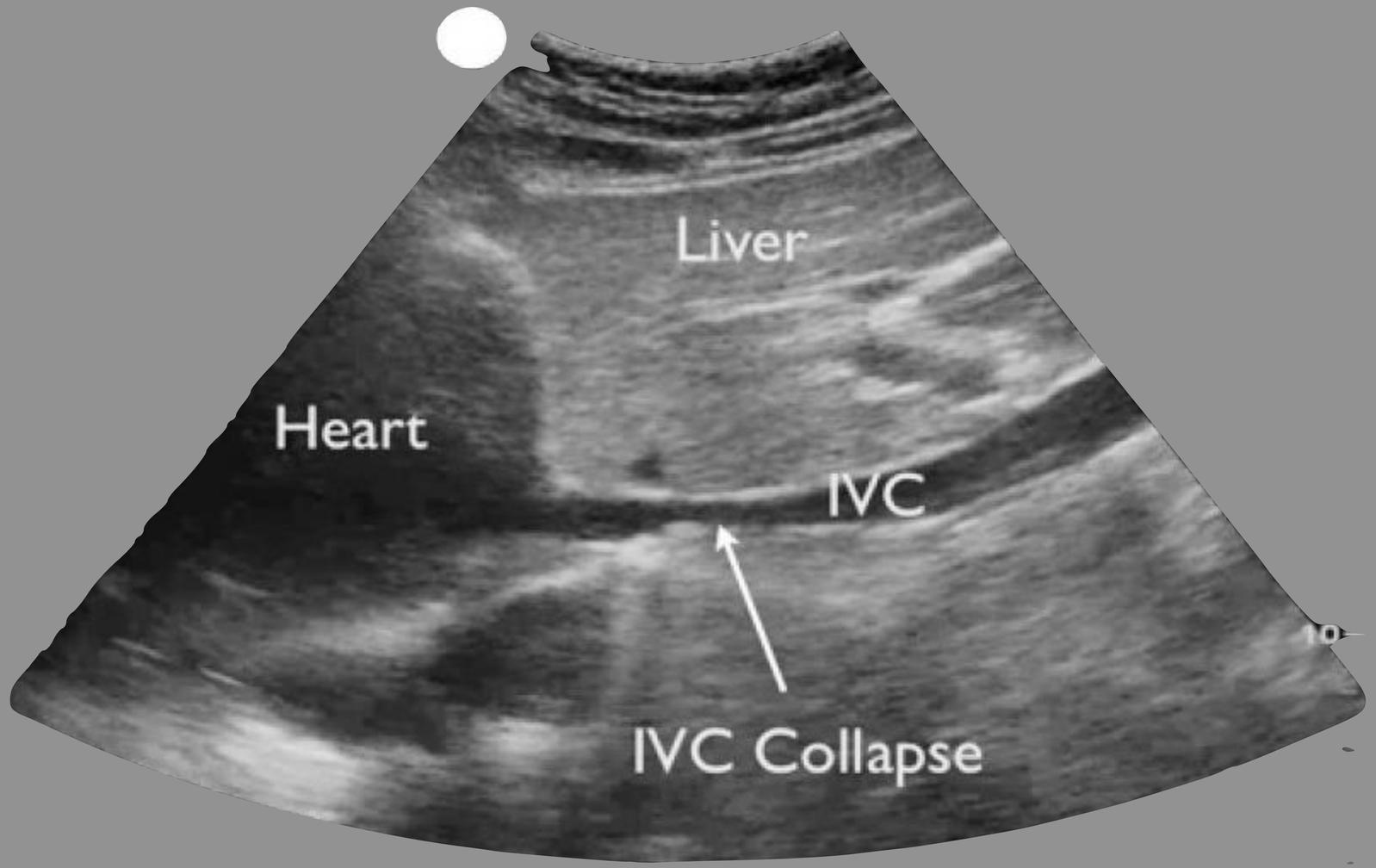
SHOCK

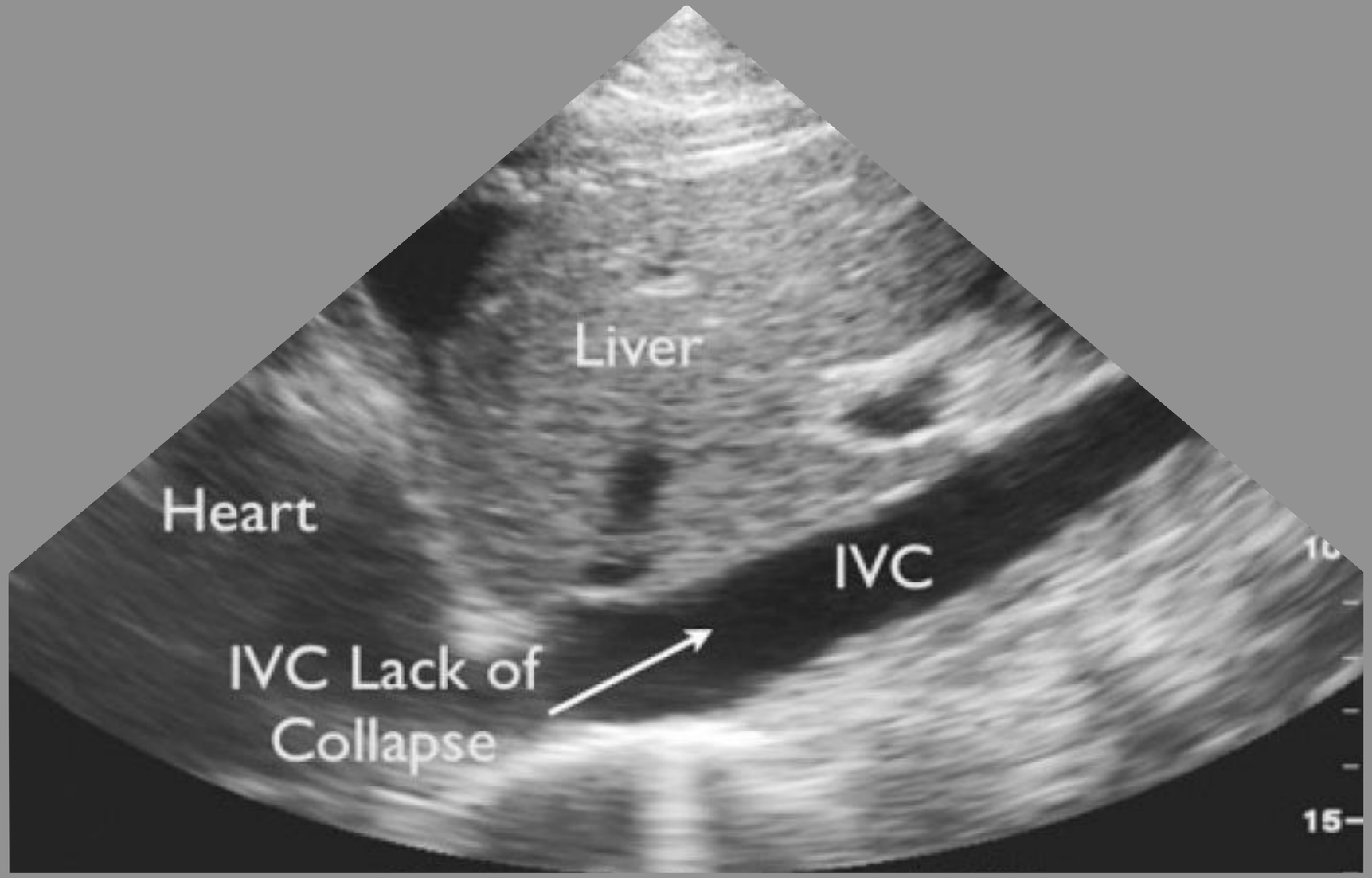
Critical Point #8

qSOFA and SOFA are not screening tools

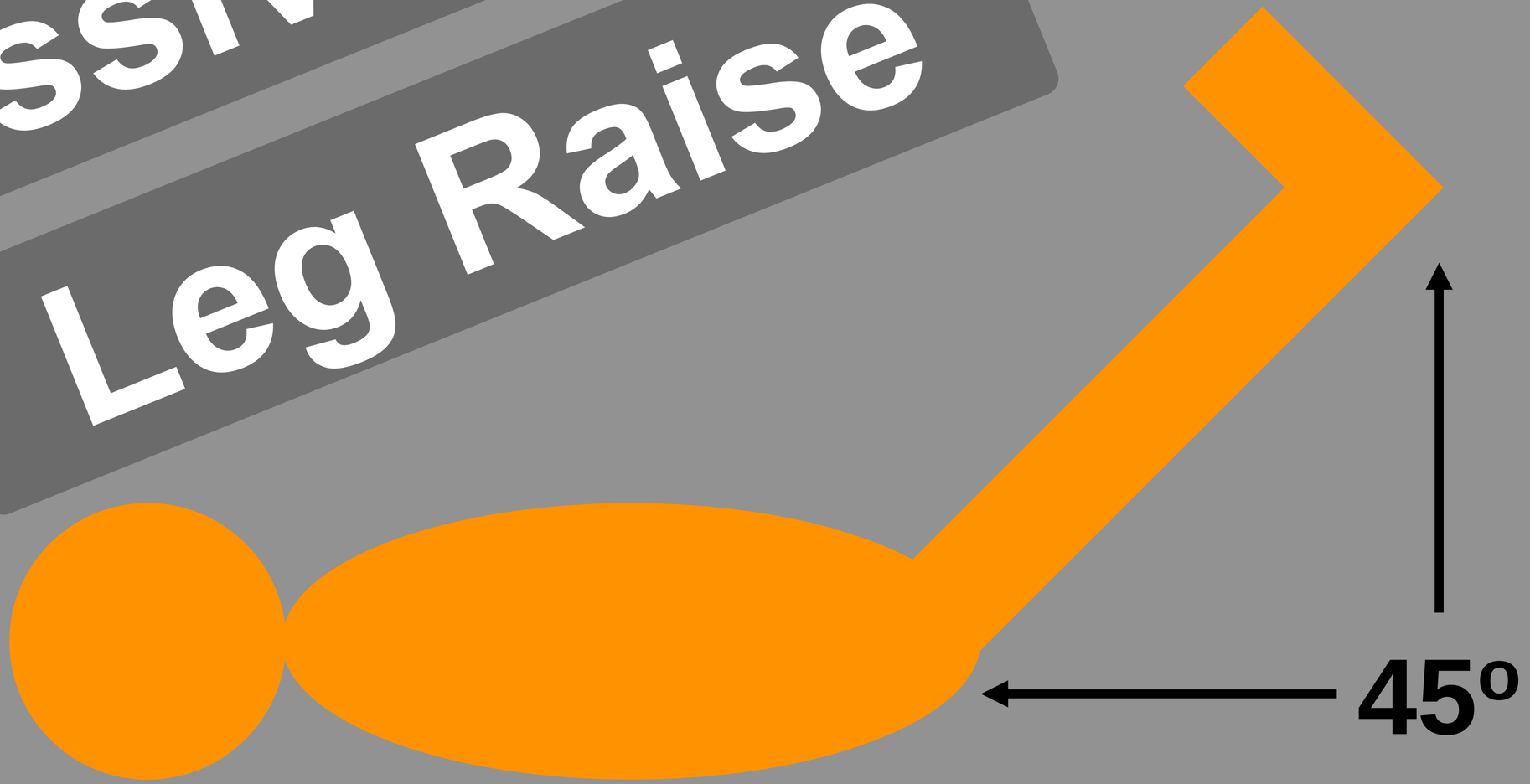
Passive Leg Raise




Liver
Heart
IVC
IVC Collapse


Liver
Heart
IVC
IVC Lack of
Collapse
15

Passive Leg Raise




Antibiotics

Antibiotics

CMS Core Measure

Broad Spectrum

HAP VAP HCAP

Antibiotics

IDSA 2016 Updates

HAP

VAP

The DRIP Score

The DRIP Score

Major Criteria (2 points)

- Abx in 60 days
- SNF
- Tube Feedings
- Prior Resistance

Minor Criteria (1 point)

- Hospital in 60 days
- Chronic Pulm Dz
- Poor Function
- Gastric Suppression
- Wound Care

The DRIP Score

Score ≥ 4 had 82% sensitivity

The DRIP Score

Reduced broad-spectrum antibiotics by 46%

Antibiotics

Add Vancomycin

- ICU Admits
- IVDU
- Post Influenza

Pneumonia

Non-Severe

-Beta lactam plus macrolide

-Ceftriaxone 1-2g + Azithromycin 500mg

Pneumonia

Severe (risk for MRSA/Pseudomonas)

-Vancomycin 15mg/kg q12hrs

-Cefepime 2g q 8hrs

Vasopressors

Vasopressors

1) Norepinephrine is 1st line

Vasopressors

2) Early use of vasopressors

Vasopressors

3) Peripheral line is acceptable

Vasopressors

1) Norepinephrine is 1st line

2) Early use of vasopressors

3) Peripheral line is acceptable

Surviving Sepsis Algorithm

1-Hour Bundle:

1) Measure Lactate Level
2) Obtain Blood Cultures
3) Broad-spectrum antibiotics
4) Fluid bolus 30mL/kg
5) Apply vasoactive drugs


Vitamin C

Marik Protocol

IV Vitamin C 1.5g q6hrs x 4d

Hydrocortisone 50mg q6hrs x 7d

Thiamine 200mg q12hrs x 4d

Marik Protocol

1º - Hospital Survival

2º - Duration of Vasopressors
ICU Length of Stay
Change in SOFA over 72 hrs

Marik Protocol

94 patients each group

Mortality 8.5% vs. 40.4%

Vasopressors 18.3 hrs vs 54.9 hrs

▲ SOFA 4.8 pts versus 0.9 pts

Medical Legal #1

42-year old firefighter

Left Shoulder Pain

Medical Legal #1

Pulse – 111

BP – 102/67

Medical Legal #1

Wife states he’d been acting strangely

Patient refuses to move the arm

Medical Legal #1

Discharged home

Returned in worsening condition

Medical Legal #1

Admitted with:

Necrotizing soft tissue infection
Septic Shock
ARDS

Medical Legal

52 year old female

Cough and Fever for 3 days

Medical Legal

Temp – 102.5 F
Pulse – 106
BP – 115/46

Medical Legal

Repeat Vital Signs
Temp – 101.6 F
Pulse – 96
BP – 96/40

Medical Legal

Return Visit

Admitted for:
Acute Respiratory Failure
Pneumonia
Sepsis

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