

Septic Shock

Yoon Sun Jung

2019.11.07.

Seoul National University Hospital

Case

- F/74
- HTN 이외에 특이 병력 없었음
- 1주일 전부터 시작된 fever 및 RUQ pain, Anorexia 로 내원

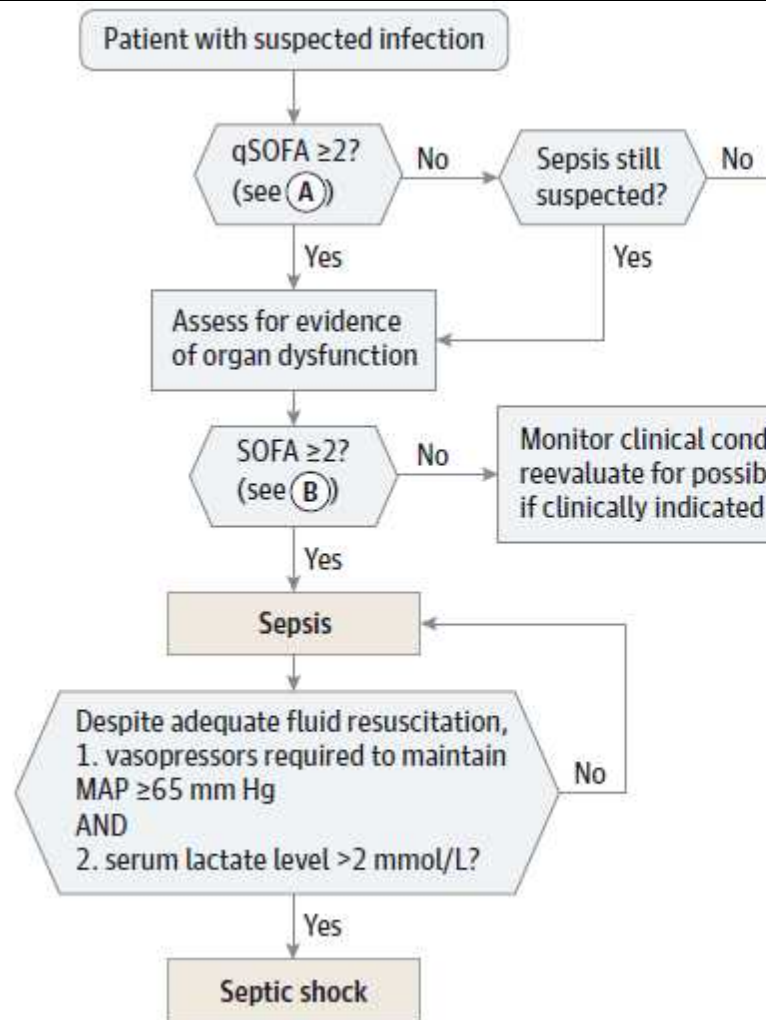
- V/S 70/43-112-28-38.9°C
- Alert

Sepsis and septic shock

- 1. Definition**
- 2. Pathophysiology**
- 3. Treatment**

1. Definition of Sepsis and Septic shock

Sepsis-3



Box 4. qSOFA (Quick SOFA) Criteria

Respiratory rate $\geq 22/\text{min}$

Altered mentation

Systolic blood pressure $\leq 100 \text{ mm Hg}$

- (B) SOFA Variables
- PaO₂/FiO₂ ratio
 - Glasgow Coma Scale score
 - Mean arterial pressure
 - Administration of vasopressors with type and dose rate of infusion
 - Serum creatinine or urine output
 - Bilirubin
 - Platelet count

Changes in total
SOFA score ≥ 2

Sepsis = Infection + **Organ Dysfunction**

→ Infection-induced **Circulatory Shock**

JAMA 2016;315:801-810

SOFA Score

Table 1. The Sequential Organ Failure Assessment (SOFA) Score*

Variables	SOFA Score				
	0	1	2	3	4
Respiratory Pao ₂ /Fio ₂ , mm Hg	>400	≤400	≤300	≤200†	≤100†
Coagulation Platelets ×10 ³ /μL‡	>150	≤150	≤100	≤50	≤20
Liver Bilirubin, mg/dL‡	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular Hypotension	No hypotension	Mean arterial pressure <70 mm Hg	Dop ≤5 or dob (any dose)§	Dop >5, epi ≤0.1, or norepi ≤0.1§	Dop >15, epi >0.1, or norepi >0.1§
Central nervous system Glasgow Coma Score Scale	15	13-14	10-12	6-9	<6
Renal Creatinine, mg/dL or urine output, mL/d	<1.2	1.2-1.9	2.0-3.4	3.5-4.9 or <500	>5.0 or <200

*Norepi indicates norepinephrine; Dob, dobutamine; Dop, dopamine; Epi, epinephrine; and Fio₂, fraction of inspired oxygen.

†Values are with respiratory support.

‡To convert bilirubin from mg/dL to μmol/L, multiply by 17.1.

§Adrenergic agents administered for at least 1 hour (doses given are in μg/kg per minute).

||To convert creatinine from mg/dL to μmol/L, multiply by 88.4.

Vincent JL, et al. Intensive Care Med 1996;22:707-10

2. Pathophysiology of Sepsis

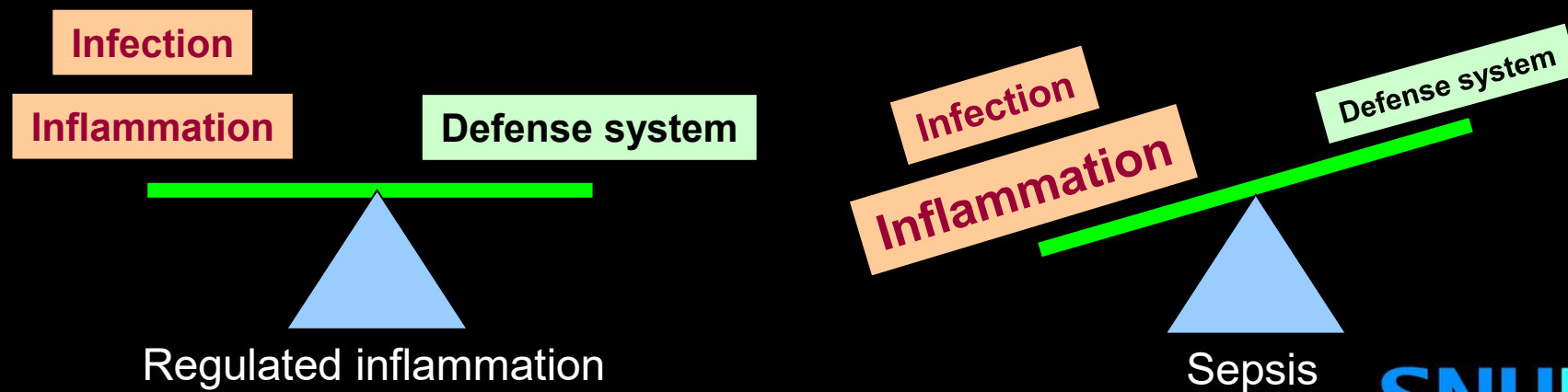
Pathophysiology of Sepsis

- Toxic condition arising from a deregulated systemic inflammatory responses (SIRS)

Nguyen A, et al. Crit Care Med 2003;31(suppl):s1-6

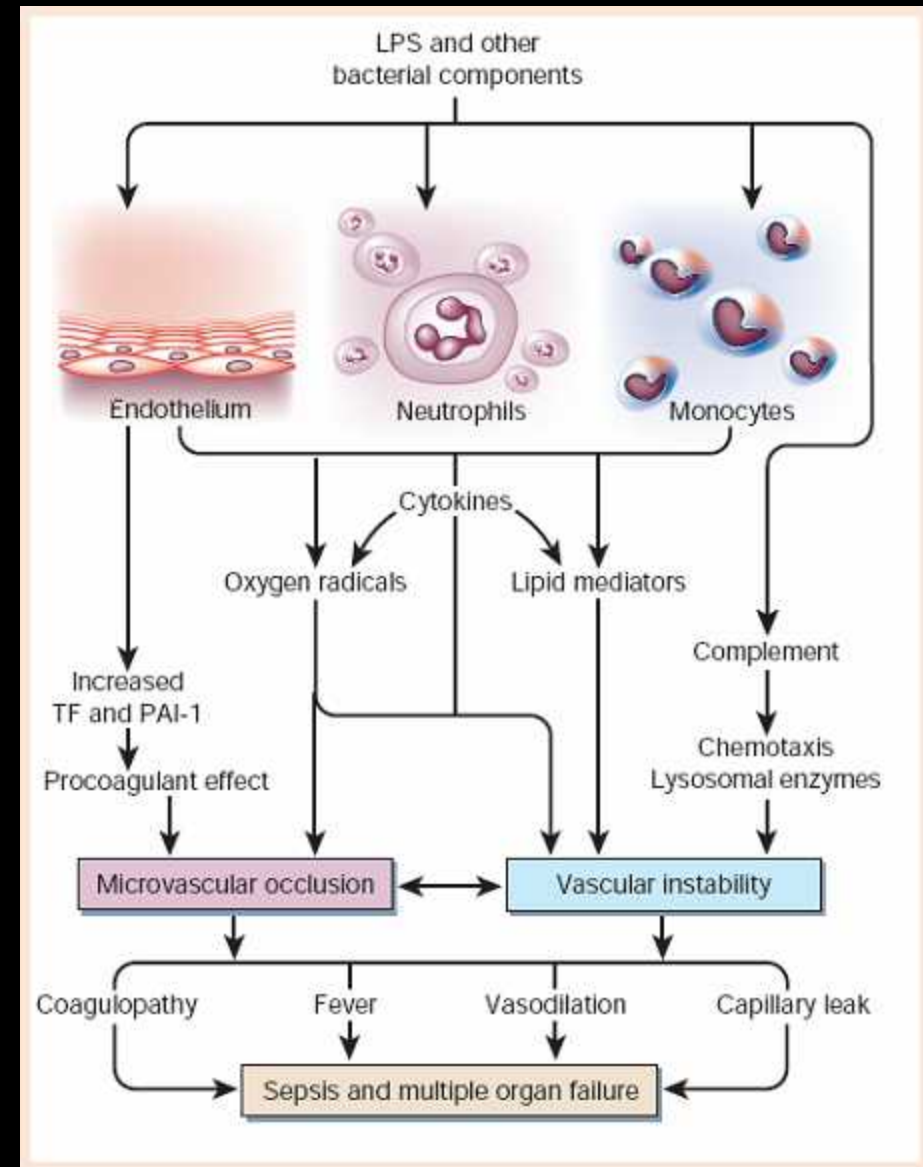
- A condition that results from a harmful or damaging host response to infection

Cohen J. Nature 2002;420:885-91



Pathophysiology of Sepsis

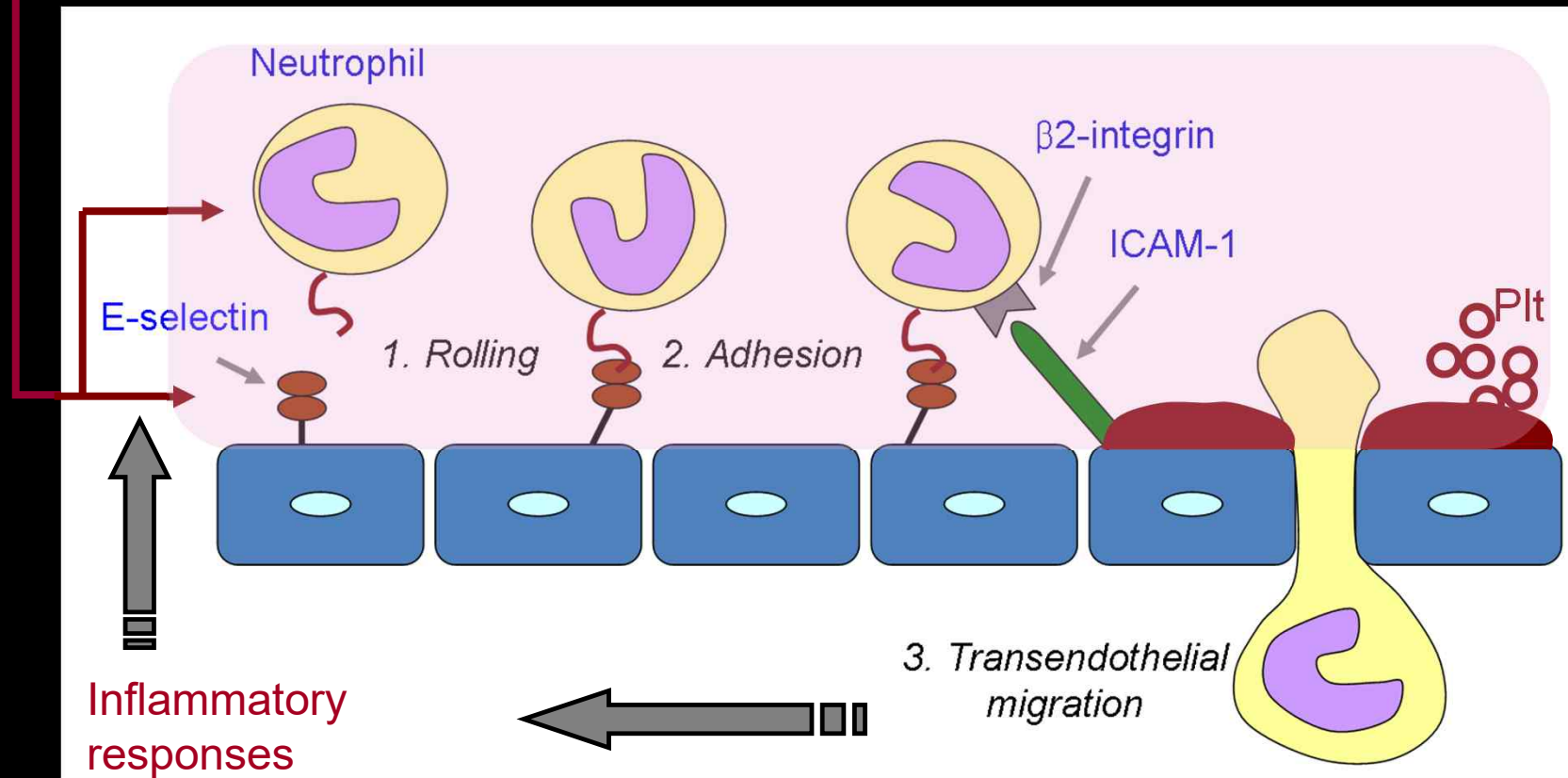
1. Infection & stimulation
2. Inflammatory mediators ↑ & PMN activation
3. Endothelial dysfunction
4. Tissue perfusion defect
5. Multiorgan dysfunction



Cohen J. Nature 2002;19:885-91

PMN Activation & Endothelial Dysfx

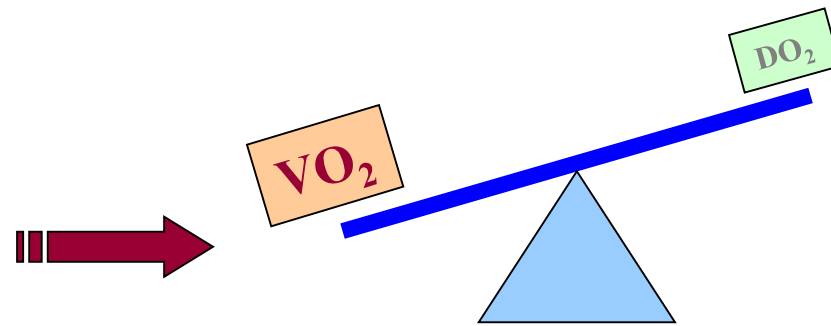
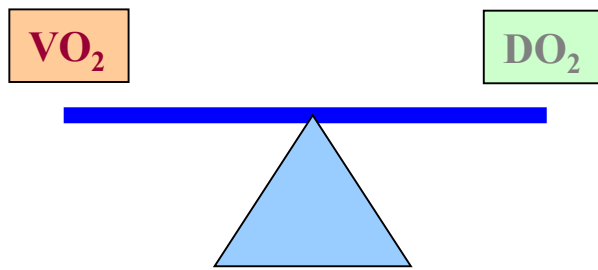
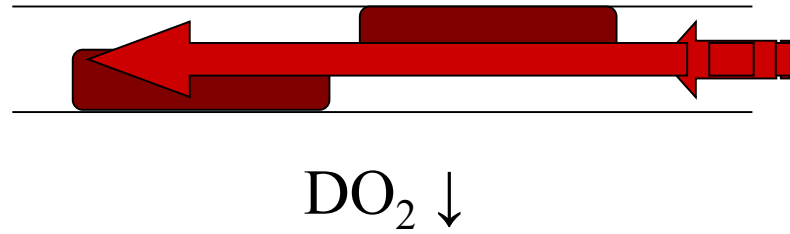
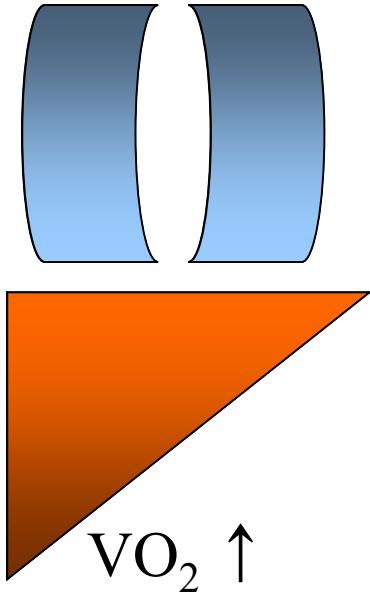
Inflammatory mediator release



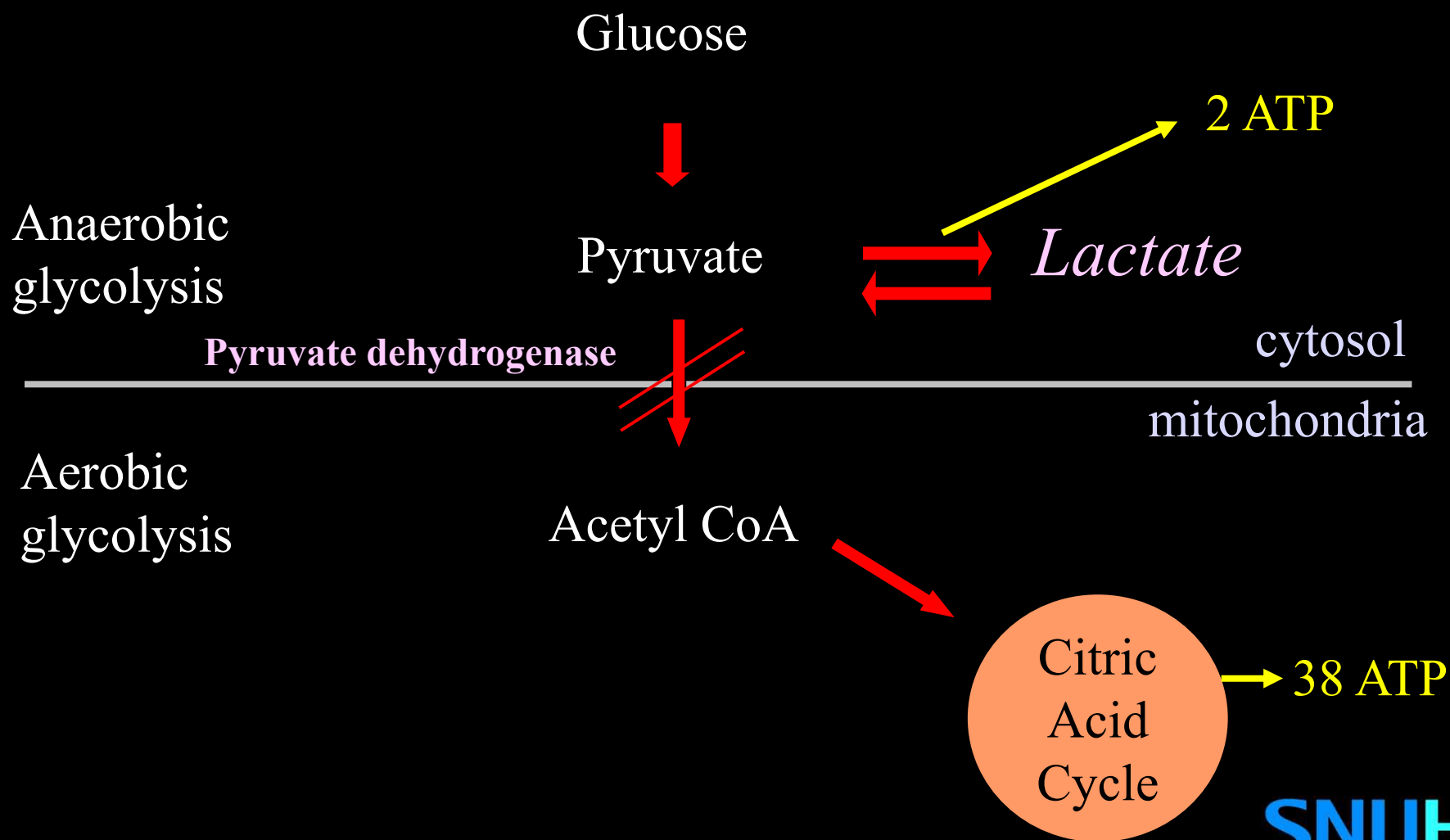
Kayal S, et al. Am J Resp Crit Care Med 1998; 157: 776-84

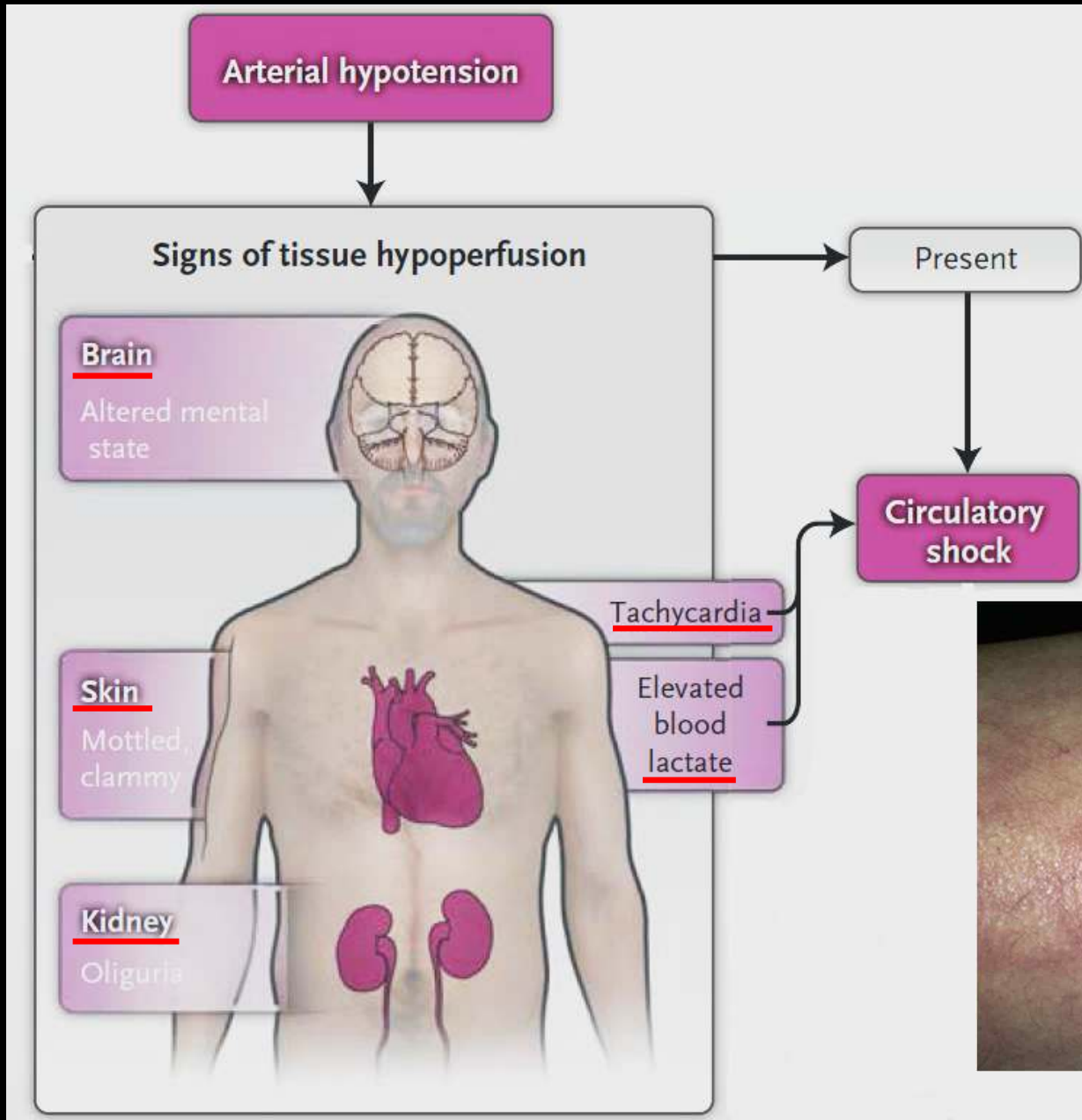
Circulatory Shock:

Unbalance between VO_2 & DO_2



Tissue Hypoxia





Vincent JL, et al. *N Engl J Med* 2013;369:1726-34

Sepsis Phase

	Salvage	Optimization	Stabilization	De-escalation
Phase Focus	Obtain a minimal acceptable blood pressure	Provide adequate oxygen availability	Provide organ support	Wean from vasoactive agents
	Perform lifesaving measures	Optimize cardiac output, Svo ₂ , lactate	Minimize complications	Achieve a negative fluid balance

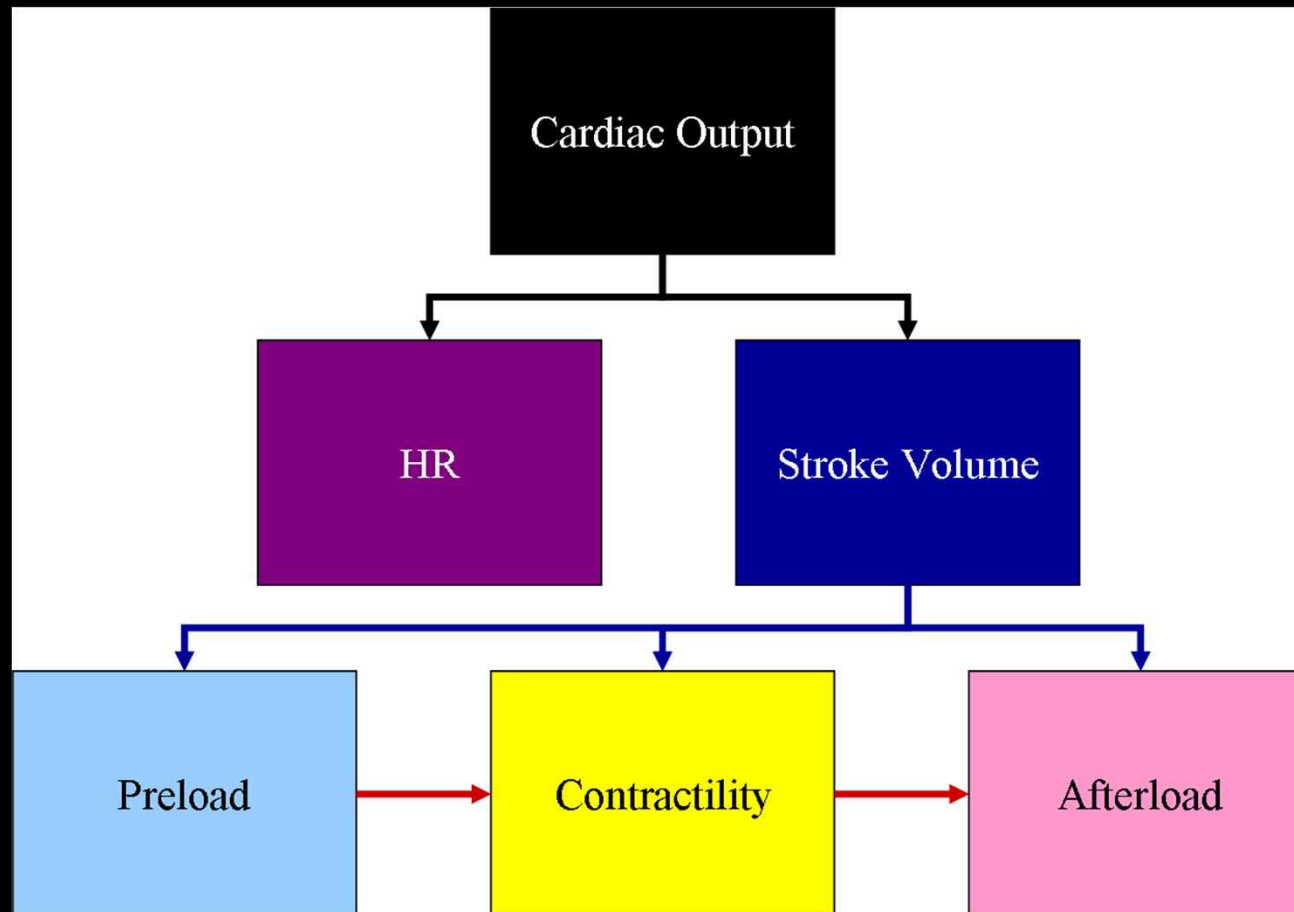
Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

3. Treatment of septic shock

Enhance Tissue Oxygen Delivery

- Oxygen delivery (DO_2) = $Q \times 1.34 \times Hb \times SaO_2 \times 10$
- Q: flow = cardiac output



Concept of SSC Bundle

- Optimize DO_2 during the early period (< 6 hrs)
= Q (preload, afterload, contractility) x 1.34 x Hb x SaO_2
= Early goal-directed therapy (?)
 1. Preload: by hydration
 2. Afterload: by vasopressors
 - ~~3. Hb (> 10 g/dL) by transfusion (?)~~
 - ~~4. Contractility by dobutamine (?)~~

ProMISe Trial:

Mouncey PR, et al. N Engl J Med 2015;372:1301-11

SSC Bundle Update (2018 SSC)

- Sepsis is a medical emergency
- Urgent assessment and treatment
- A detailed initial assessment → ongoing re-evaluation of their response to treatment

HOUR-1 BUNDLE

TABLE 1. Bundle Elements With Strength of Recommendations and Under-Pinning Quality of Evidence (12, 13)

Bundle Element	Grade of Recommendation and Level of Evidence
Measure lactate level. Re-measure if initial lactate is > 2 mmol/L	Weak recommendation, low quality of evidence
Obtain blood cultures prior to administration of antibiotics	Best practice statement
Administer broad-spectrum antibiotics	Strong recommendation, moderate quality of evidence
Rapidly administer 30 mL/kg crystalloid for hypotension or lactate \geq 4 mmol/L	Strong recommendation, low quality of evidence
Apply vasopressors if patient is hypotensive during or after fluid resuscitation to maintain mean arterial pressure \geq 65 mm Hg	Strong recommendation, moderate quality of evidence

Levy MM, et al. Crit Care Med 2018;46:997-1000

Let's Move to the Case!!

Case

- F/74
- HTN 이외에 특이 병력 없었음
- 1주일 전부터 시작된 fever 및 RUQ pain, Anorexia 로 내원
- V/S **70/43-112-28-38.9°C**
- Alert

Q-SOFA = 2

SOFA?

Table 1. The Sequential Organ Failure Assessment (SOFA) Score*

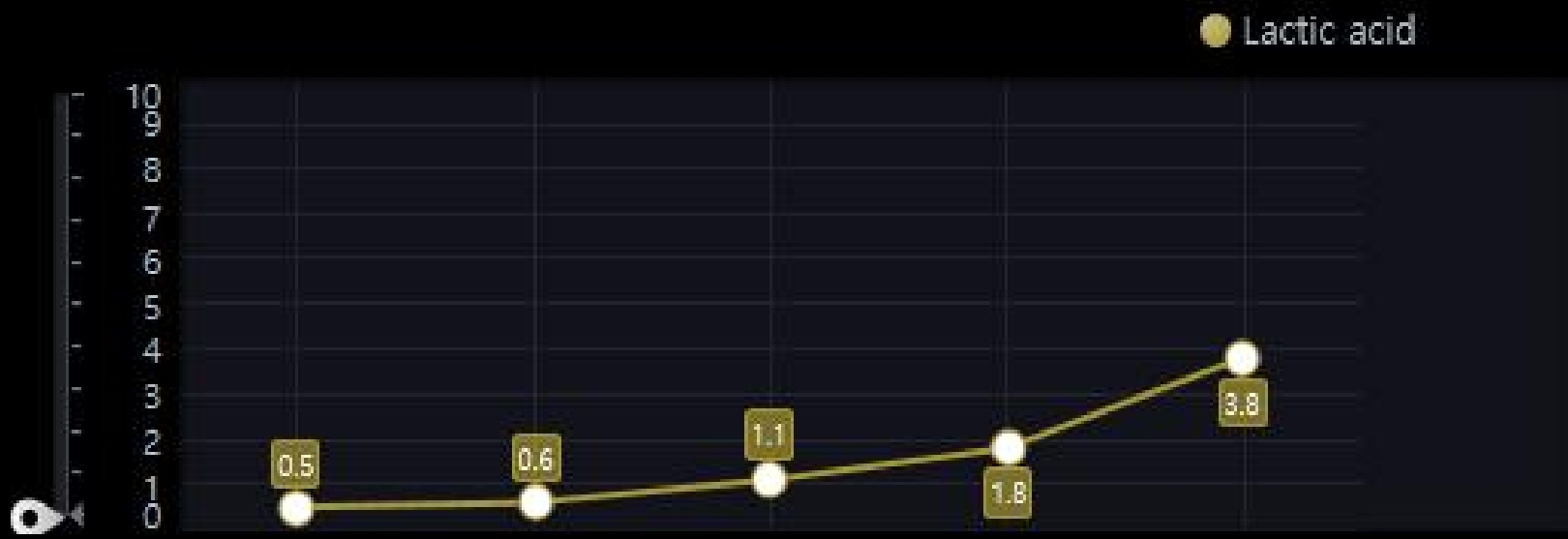
Variables	SOFA Score				
	0	1	2	3	4
Respiratory PaO ₂ /FIO ₂ , mm Hg	>400	≤400	≤300	≤200†	≤100†
Coagulation Platelets × 10 ³ /μL‡	>150	≤150	≤100	≤50	≤20
Liver Bilirubin, mg/dL‡	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular Hypotension	No hypotension	Mean arterial pressure <70 mm Hg	Dop ≤5 or dob (any dose)§	Dop >5, epi ≤0.1, or norepi ≤0.1§	Dop >15, epi >0.1, or norepi >0.1§
Central nervous system Glasgow Coma Score Scale	15	13-14	10-12	6-9	<6
Renal Creatinine, mg/dL or urine output, mL/d	<1.2	1.2-1.9	2.0-3.4	3.5-4.9 or <500	>5.0 or <200

*Norepi indicates norepinephrine; Dob, dobutamine; Dop, dopamine; Epi, epinephrine; and FIO₂, fraction of inspired oxygen.
†Values are with respiratory support.
‡To convert bilirubin from mg/dL to μmol/L, multiply by 17.1.
§Adrenergic agents administered for at least 1 hour (doses given are in μg/kg per minute).
||To convert creatinine from mg/dL to μmol/L, multiply by 88.4.

- ABGA POCT : 7.43-29-116-19.2, Lactate 3.8
- 혈액 검사 결과 : 내원 시간으로부터 **100분 후**
- HOUR-1 bundle ??

- Normal saline 2L at initial
- Norepinephrine CIV
- Blood culture
- Antibiotics : Ceftriaxone + Metronidazole
- Abdomen Contrast CT : Acute cholecystitis with possible gangrenous change
- PTGBD insertion
- EICU admission





Screening – Diagnosis – Treatment

1. q-SOFA positive = Mostly sepsis ?

2. SOFA score before 1-hour bundle?

POCT, SOFA calculation app, Expert opinion

3. 1-Hour bundle

Start 30 mL/kg fluid infusion before SOFA?

4. After 1-Hour bundle

No routinely recommended guideline yet

After 1-Hour Bundle ...

Repeated Focused Exam !!

