核心課程編號：E14

休克

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第四版

學習目標

PGY

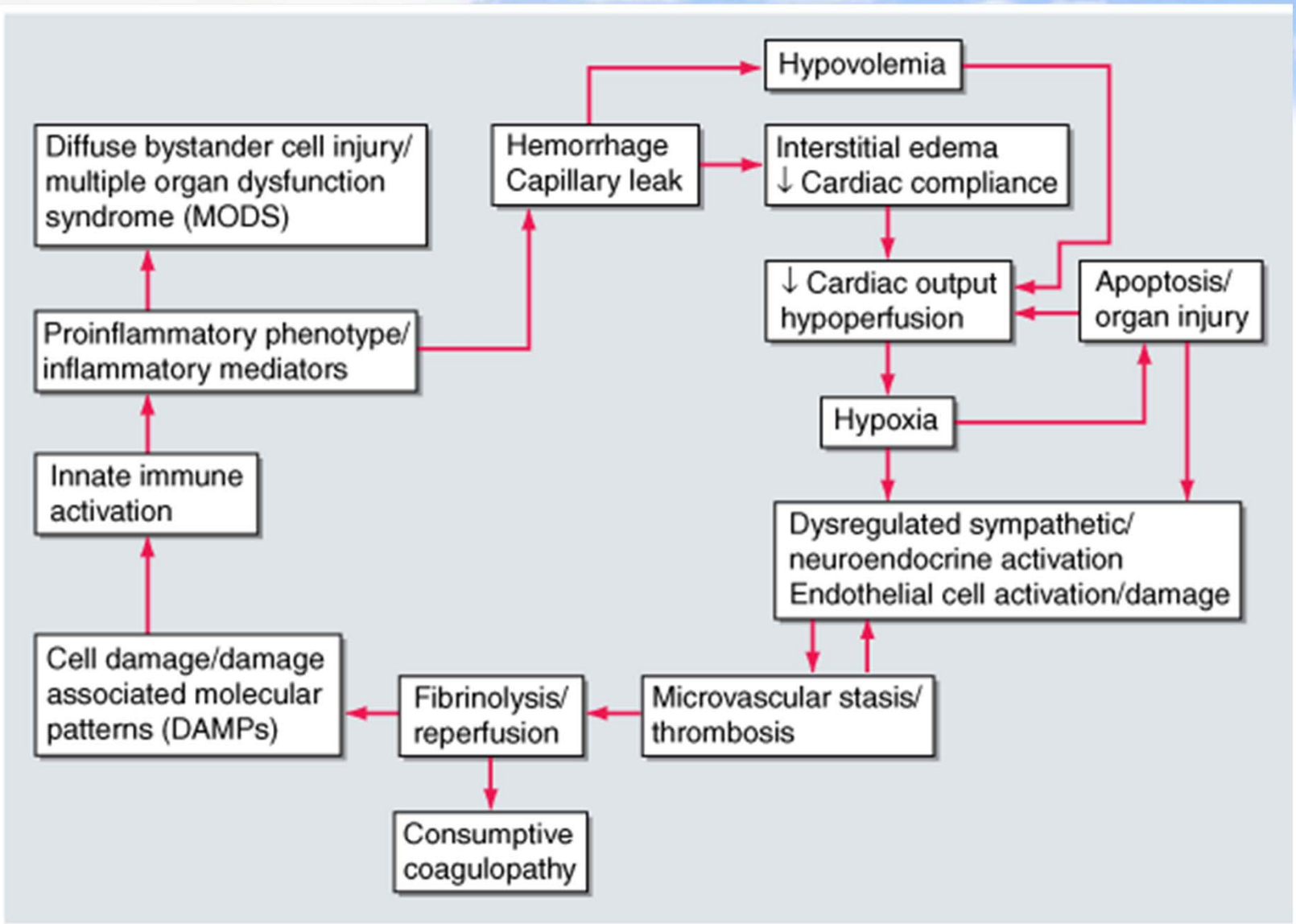
知識

1. 能夠明瞭休克的定義及臨床症狀。
2. 能夠對休克的病人進行鑑別診斷並安排適當的檢查。
3. 能根據休克病人的危急程度給予適當的初步處置。
4. 能根據休克病人的病因安排進一步的治療、照會及動向安排。
5. 能夠對休克的病人及其家屬進行適當的病情解釋及醫病溝通。

休克的定義

Definition of Shock

- The clinical syndrome that results from inadequate tissue perfusion.
- The diagnostic essentials of shock include:
  - Hypotension
  - Tachycardia
  - Oliguria
  - Altered mental status
  - Peripheral hypoperfusion
  - Hypoxia.



Shock-induced vicious circle.

鑑別診斷並安排適當的檢查

1. Hypovolemic Shock
2. Cardiogenic Shock
3. Obstructive Shock
4. Distributive Shock

Hypovolemic Shock

- Decreased intravascular volume resulting from loss of blood, plasma, or fluids and electrolytes
- Above 15% blood volume loss results in:
  - Hypotension
  - Increased peripheral resistance
  - Collapse of capillary and venous beds
  - Progressive tissue hypoxia

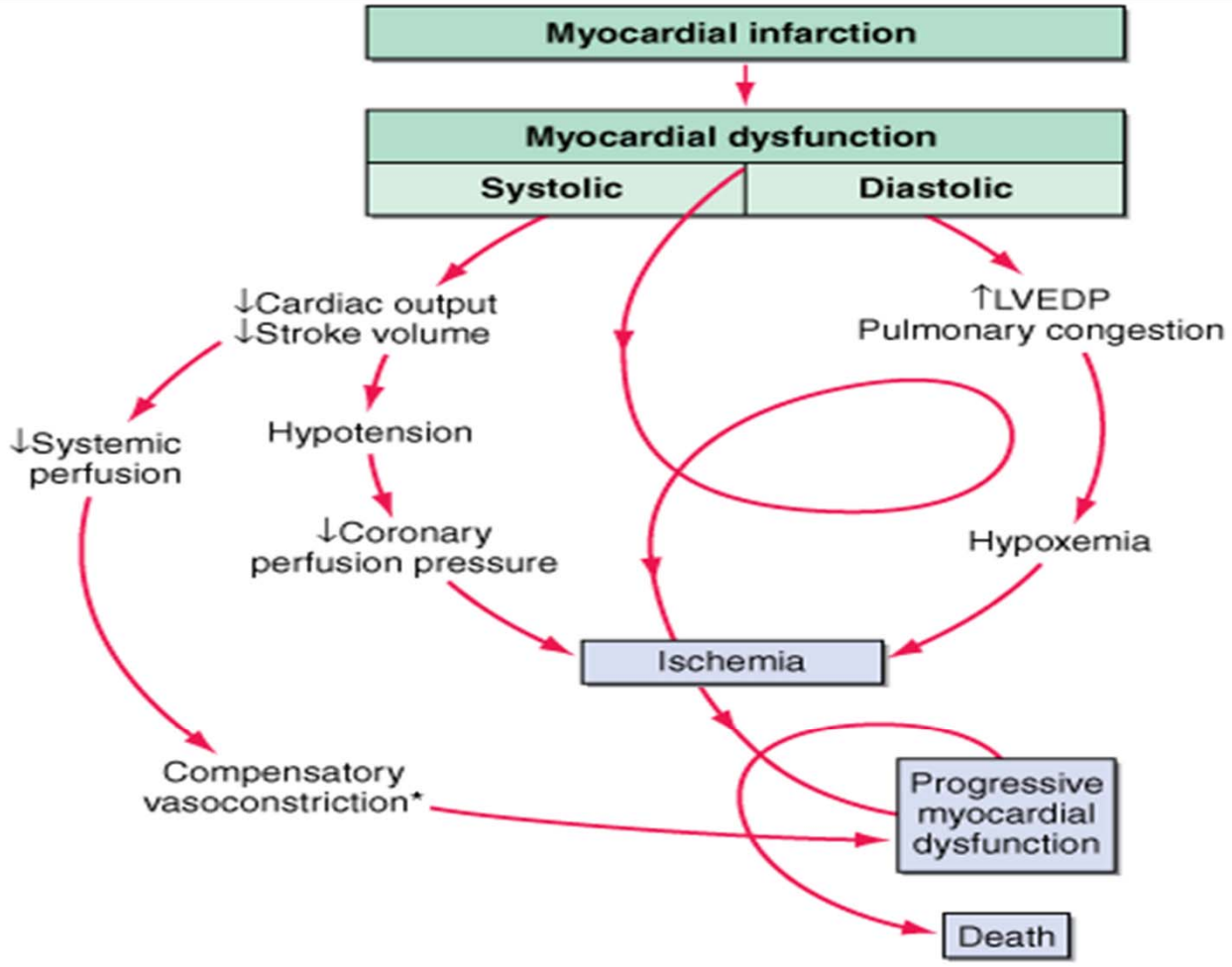
Hypovolemic Shock

Mild (<20% Blood Volume)	Moderate (20–40% Blood Volume)	Severe (>40% Blood Volume)
Cool extremities	Same, plus:	Same, plus:
Increased capillary refill time	Tachycardia	Hemodynamic instability
Diaphoresis	Tachypnea	Marked tachycardia
Collapsed veins	Oliguria	Hypotension
Anxiety	Postural changes	Mental status deterioration (coma)

Cardiogenic Shock

- Pump failure related to:
  - Myocardial infarction
  - Myocardial contusion
  - Cardiomyopathy
  - Valvular regurgitation or stenosis
  - Arrhythmias

Cardiogenic shock



Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine*, 17th Edition: http://www.accessmedicine.com

Etiologies of Cardiogenic Shock or Pulmonary Edema

- Acute myocardial infarction/ischemia
  - LV failure
  - VSR
  - Papillary muscle/chordal rupture—severe MR
  - Ventricular free wall rupture with subacute tamponade
  - Other conditions complicating large MIs
    - Hemorrhage
    - Infection
    - Excess negative inotropic or vasodilator medications
    - Prior valvular heart disease
    - Hyperglycemia/ketoacidosis
- Post-cardiac arrest
- Post-cardiotomy
- Refractory sustained tachyarrhythmias
- Acute fulminant myocarditis
- End-stage cardiomyopathy
- Left ventricular apical ballooning

Obstructive Shock

- Cardiac tamponade
- Tension pneumothorax
- Massive pulmonary embolism

Distributive Shock

- Reduction in systemic vascular resistance from sepsis, anaphylaxis, systemic inflammatory response syndrome (SIRS) produced by severe pancreatitis or burns, or acute adrenal insufficiency

Septic Shock

- Most often caused by gram-negative bacteremia (*Escherichia coli*, *Klebsiella, Proteus*, and *Pseudomonas*)
- Less often caused by gram-positive cocci (*Staphylococcus*, *Streptococcus*) or gram-negative anaerobes (*Bacteroides*)

Neurogenic Shock

- Resulting from traumatic spinal cord injury or effects of an epidural or spinal anesthetic
- Reflex vagal parasympathetic stimulation evoked by pain, gastric dilation, or fright

臨床症狀

Symptoms & Sings of Shock

- Hypotension
- Cool or mottled extremities
- Weak or absent peripheral pulses
- Delayed capillary refill
- Tachycardia
- Oliguria
- Bowel ischemia
- Hepatic dysfunction
- Altered mental status
- Increasing agitation
- Sepsis

Characteristics of the Various Forms of Shock

Type of Shock	CVP and PCWP	Cardiac Output	Systemic Vascular Resistance	Venous O_2 Saturation
Hypovolemic	↓	↓	↑	↓
Cardiogenic	↑	↓	↑	↓
Septic				
Hyperdynamic	↓↑	↑	↓	↑
Hypodynamic	↓↑	↓	↑	↑↓
Traumatic	↓	↓↑	↑↓	↓
Neurogenic	↓	↓	↓	↓
Hypoadrenal	↓↑	↓	=↓	↓

Laboratory Tests for Diagnosis of Shock (1)

- Check CBC, PT, PTT, serum electrolytes, free Ca, Mg, phosphate
- Serial cardiac enzymes to exclude myocardial infarction
- Serial hematocrits to exclude hemorrhage
- Serum lactic acid

Crit Care Med. 2009 May;37(5):1670-7

Laboratory Tests for Diagnosis of Shock (2)

- Serum glucose to exclude hyperglycemia, reflecting insulin resistance
- Fecal occult blood test to exclude gastrointestinal hemorrhage

Laboratory Tests for Diagnosis of Shock (3)

- Arterial blood gas determinations
- Type and cross-match, as indicated
- Urinalysis, urine culture, and blood cultures
- Image studies: CxR, EKG, Echocardiogram, KUB, or CT (if needed)

The Diagnostic Procedures of Shock (1)

- Arterial line for continuous blood pressure measurement
- Foley catheter to measure urinary output
- Central venous pressure (CVP) (right atrial pressure) or pulmonary capillary wedge pressure (PCWP)
  - < 5 mm Hg: suggests hypovolemia
  - > 18 mm Hg suggests volume overload, cardiac failure, tamponade, or pulmonary hypertension

The Diagnostic Procedures of Shock (2)

- Pulmonary artery catheter for hemodynamic pressure measurements
- Systemic vascular resistance (SVR)
  - Low (< 800 dyne x s/cm–5): suggests early sepsis and neurogenic shock
  - High (> 1500 dyne x s/cm–5) suggests hypovolemic and cardiogenic shock

The Diagnostic Procedures of Shock (3)

- Pulmonary artery catheter for hemodynamic pressure measurements
- A high cardiac index (> 4 L/min/m2) in a hypotensive patient suggests early septic shock

The Diagnostic Procedures of Shock (4)

- The RUSH exam: Rapid Ultrasound in SHock in the evaluation of the critically Ill.

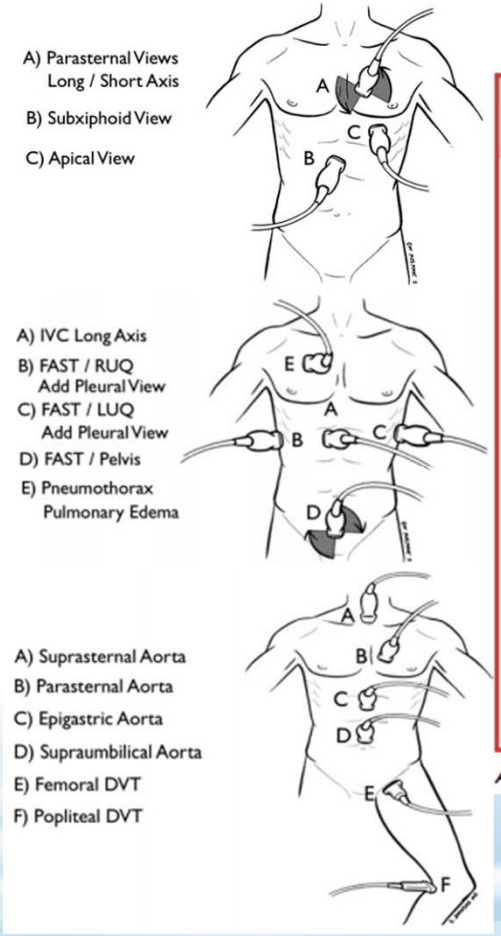


Table 1
Rapid Ultrasound in SHock (RUSH) protocol: ultrasonographic findings seen with classic shock states

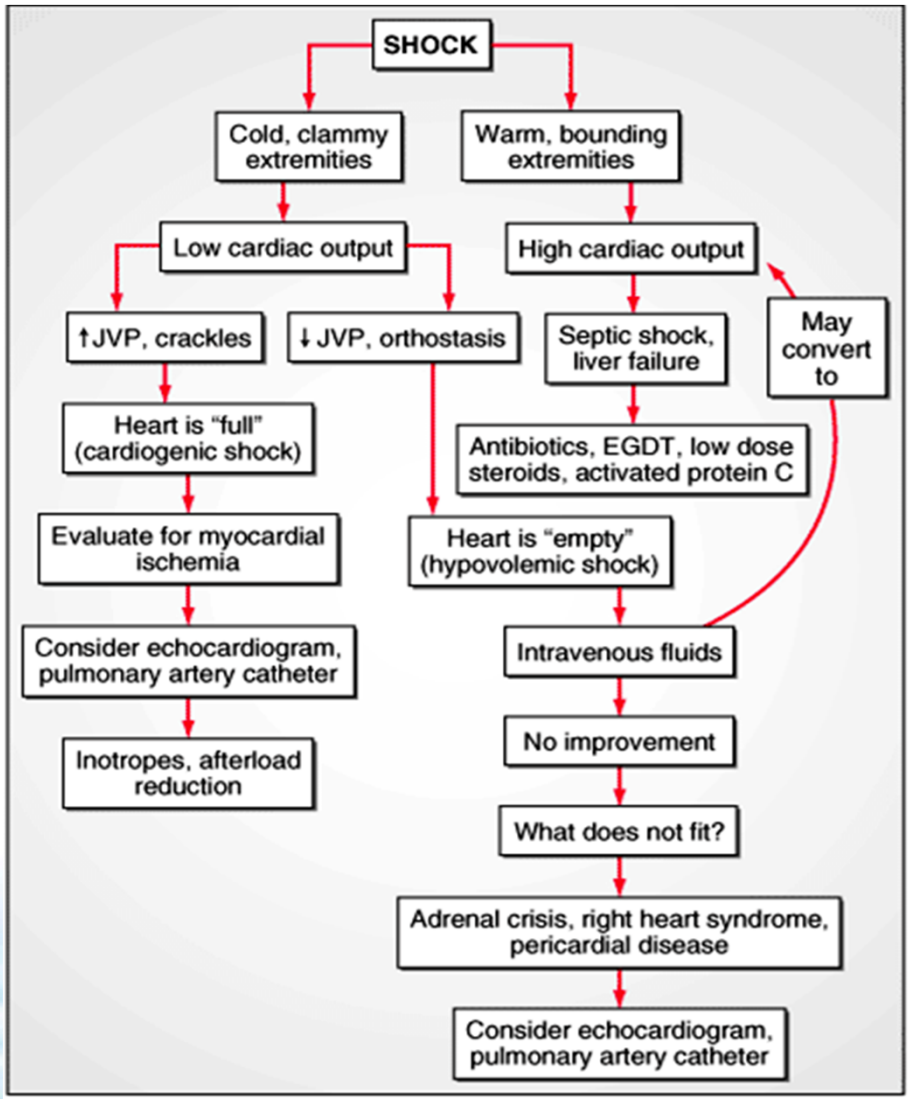
RUSH Evaluation	Hypovolemic Shock	Cardiogenic Shock	Obstructive Shock	Distributive Shock
Pump	Hypercontractile heart Small chamber size	Hypocontractile heart Dilated heart	Hypercontractile heart Pericardial effusion Cardiac tamponade RV Strain Cardiac thrombus	Hypercontractile heart (early sepsis) Hypocontractile heart (late sepsis)
Tank	Flat IVC Flat jugular veins Peritoneal fluid (fluid loss) Pleural fluid (fluid loss)	Distended IVC Distended jugular veins Lung rockets (pulmonary edema) Pleural fluid (effusions) Peritoneal fluid (ascites)	Distended IVC Distended jugular veins Absent lung sliding (pneumothorax)	Normal or small IVC (early sepsis) Peritoneal fluid (peritonitis) Pleural fluid (empyema)
Pipes	Abdominal aneurysm Aortic dissection	Normal	DVT	Normal

Abbreviations: DVT, deep venous thrombosis; IVC, inferior vena cava; RV, right ventricle.

Emerg Med Clin North Am. 2010 Feb;28(1):29-56

根據休克病人的危急程度給予
適當的初步處置

Figure 249-2
Approach to the patient in shock



JVP, jugular venous pulse;

EGDT, early goal-directed therapy

Management of Shock (1)

- Medications
  - Pressor medications
    - Dopamine, > 5 g/kg/min
    - Dobutamine, 2–20 g/kg/min
  - Diuretics, thrombolytics, morphine, nitroglycerin, antiarrhythmics, and antiplatelet agents as indicated in acute myocardial infarction

Management of Shock (2)

- Medications
  - Peripheral vasoconstrictors such as epinephrine, 2–10 g/min, or norepinephrine, 0.5–30.0 g/min, in distributive or neurogenic shock

Management of Shock (3)

- Medications (continued)
  - Vasopressin (antidiuretic hormone)
  - Broad-spectrum antibiotics in septic shock
  - Corticosteroids in acute adrenal insufficiency
  - Calcium gluconate to maintain an ionized calcium level > 1.0
  - Sodium bicarbonate for arterial pH < 7.20

Management of Shock (4)

- Surgery
  - Dependent on the cause of shock
  - Cardiogenic shock: transcutaneous or transvenous pacing or intra-aortic balloon pump, and emergent revascularization by stent angioplasty or coronary artery bypass grafting, as indicated
  - Drainage or excision of source of sepsis

Management of Shock (5)

Therapeutic procedures

- Treatment must be directed both at the manifestations of shock and at its cause
- Basic life support: airway maintenance, oxygen, cardiopulmonary resuscitation, IV access and fluid resuscitation with crystalloid or blood products

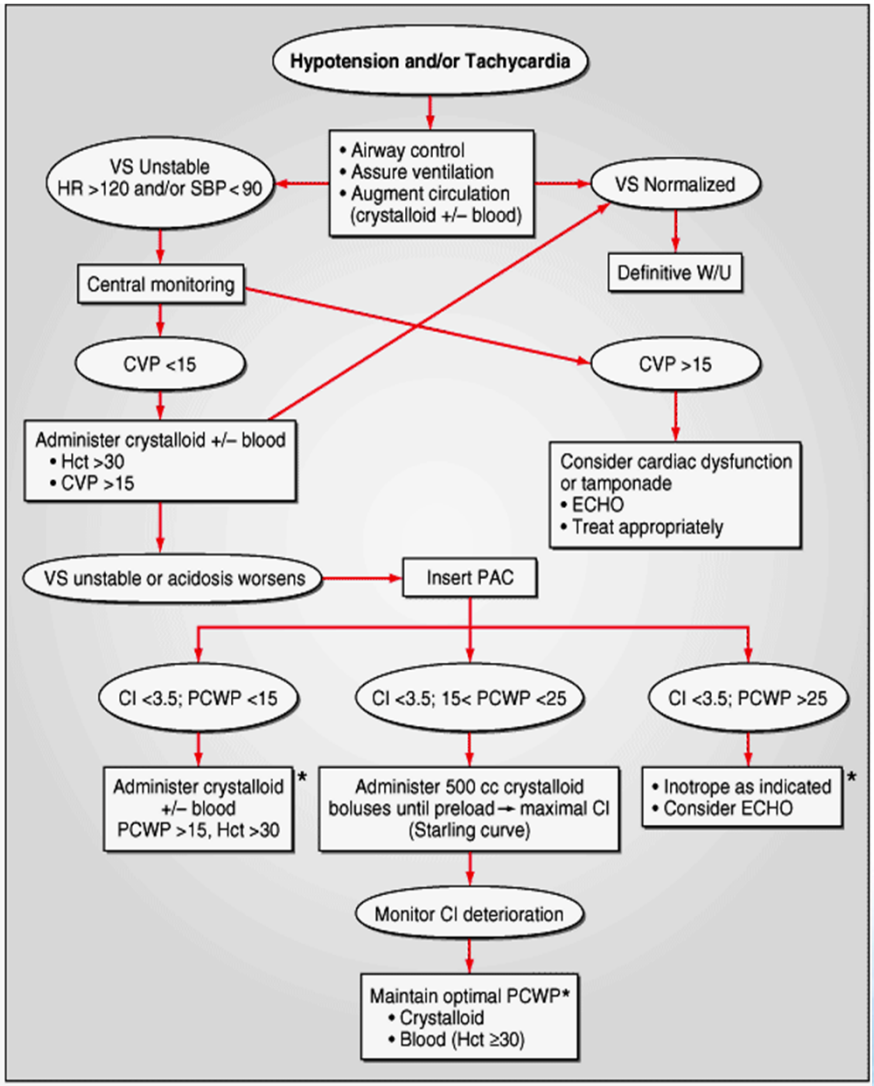
Management of Shock (5)

❖Therapeutic procedures

- Treatment is directed at maintaining a CVP of 8–12 mm Hg, a mean arterial pressure of 65–90 mm Hg, a cardiac index of 2–4 L/min/m2, and central venous oxygen saturation of > 70%

安排進一步的治療、照會及動向安排

Algorithm for the resuscitation of the patient in shock



W/U, work up; PAC, pulmonary artery catheter; CI, cardiac index in (L/min)/m2; PCWP, pulmonary capillary wedge pressure in mmHg.

***Monitor SVO2, SVRI, and RVEDVI as additional markers of correction for perfusion and hypovolemia. Consider age-adjusted CI. SVO2, saturation of hemoglobin with O2 in venous blood; SVRI, systemic vascular resistance index; RVEDVI, right-ventricular end-diastolic volume index.**

進行適當的病情解釋及醫病溝通

Setting Goals of Care

- Discuss goals of care and prognosis with patients and families
- Incorporate goals of care into treatment and end-of-life care planning, utilizing palliative care principles where appropriate
- No later than **within 72 hours** of ICU admission