

Case conference

20111226
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Patient Data: case 1

- Age: 74 y/o
- Gender: female
- Date of arriving ER: 2011/XX/XX, 08:13
- Chief complaint: 病患來診為腹瀉, 冒冷汗
- E4M6V5
- T/P/R 35.1/78/20, BP 80/48, SpO₂ 99%
- Triage: 1

What do you want to ask?

What do you want to check?

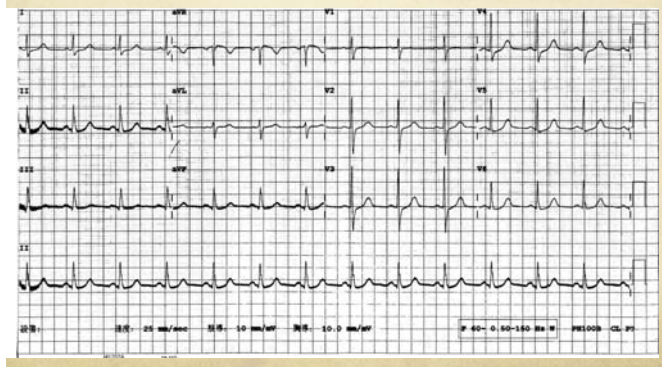
What's your orders?

Bedside echo



- Pericardial effusion
- Echogenic pericardial effusion, suspect hemopericardium
- RV collapse
- No AAA flap

ECG



CXR



Laboratory data

CBC/DC/Plt		PT/PTT/D-dimer		Biochemistry	
Hb	12.3	PT	11.0	BUN	19
Hct	37.9	INR	1.04	Cre	1.2
MCV	87.9	APTT	23.5	GOT	445
WBC	5.1	D-dimer	1489.1	Na	140
Seg	35			K	3.6
Lymp	58			CK	85
Plt	144			CK-MB	26
				Trop-I	0.027

Aorta CT

Result of Aorta CT

- Type A intra-mural hematoma with pericardial effusion

History

- Chief complaint: sudden onset of left chest pain
- Stabbling sensation
- With cold sweating

Past history

- Allergy: NKA
- Hypertension
- No DM
- No CAD

Physical examination

- Consciousness: clear
- Head and neck: supple
- Chest: Clear BS
- Abdomen: soft
- Extremity: free, cold

Impression

- r/o aortic dissection

Question?

- Aortic dissection造成的 shock有可能是哪一種?
- AMI with cardiogenic shock
- 1L fluid resuscitation is enough?
- Fluid resuscitation in AMI with shock?!

Initial orders (08:23)

- N/S 500 ml IV st
- N/S 60 ml/hr
- CXR, EKG
- CBC/DC/Plt
- PT/PTT, d-dimer
- Panel I, enzyme
- Bedside echo
- F/S (382)
- 雙手 BP
 - Left: 63/57
 - Right: 82/60
- Aorta CT with/without contrast
- 備 pRBC 6U, FFP 12U
- O₂ N/C 34 L/min

orders

- 08:50
 - Consult CVS
 - On critical
- 08:57
 - 加備 pRBC 6U, Plt 24U, Cryo 12U
 - Sent pt to OR on call
 - Admit to S003 after OP

Operation finding

- Some fresh blood clot in the pericardial cavity, blood pressure increased after pericardium was opened
- No intima tearing was found at ascending aorta, fresh blood clot in the false lumen
- False lumen was just located at ascending aorta, not extending to aortic arch

Clinical course

- Day 1: emergent operation
- Day 2: extubation
- Day 3: transferred to the general ward
- Day 4: rehabilitation program
- Day 14: discharge



Patient Data: case 2

- Age: 63 y/o
- Gender: male
- Date of arriving ER: 2011/XX/XX, 14:33
- Chief complaint: 病患來診為工作中頭暈跌倒撞到肚子
- E4M6V5
- T/P/R 36.8/87/16, BP 94/55, SpO₂ 92%
- Triage: 1

What do you want to ask?

What do you want to check?

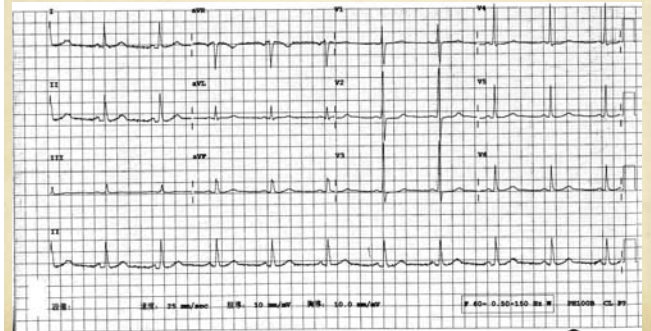
What's your orders?

FAST

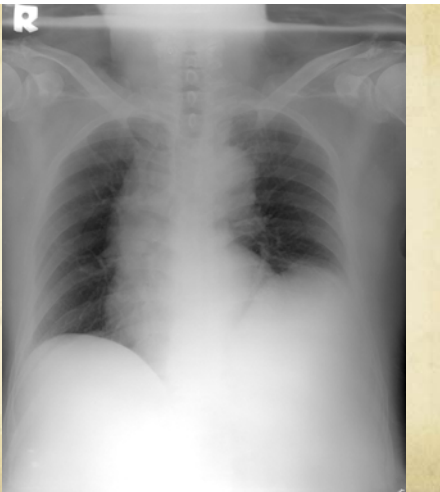
- Lung sliding (+), no lung point
- No pleural fluid
- Heart contractility: well, no pericardial fluid, no IVC collapse
- No ascites in Morrison pouch or splenorenal space
- No obvious laceration in liver, spleen or kidneys
- Left peritoneal hematoma, r/o small bowel injury

Pitfall in FAST

ECG



CXR



Laboratory data

CBC/DC/Plt		PT/PTT		Biochemistry		VBG	
Hb	12.7	PT	11.0	BUN	13	pH	7.420
Hct	36.7	INR	1.04	Cre	1.2	pCO2	38.7
MCV	85.7	APTT	24.6	GOT	37	pO2	35
WBC	9.0			Na	139	BE	1
Seg	54.6			K	3.4	HCO3	25.1
Lymp	37.3			Amylase	64	SO2	69%
Plt	240			Lactate	29.9		

Repeat bedside echo

- Right paracolic area ascites
- Left abdominal hematoma, no increase in size

Chest and abdominal CT

Result of CT

- Spleen laceration with active bleeding

History

- Chief complaint: abdominal blunt injury, then cold sweating, dizziness, near syncope
- 自述被很大鐵塊打到
- No HI

Past history

- Allergy: NKA
- No DM
- No CAD

Physical examination

- Consciousness: clear
- Head and neck: no midline tenderness, pale, cold sweating
- Chest: clear BS
- Abdomen: left side swelling
- Pelvis: nil
- Extremity: nil

Impression

- Abdominal blunt injury
 - r/o internal bleeding

Initial order (14:34)

- | | |
|--|---|
| ○ Warm N/S 1000ml IV challenge, then 120 ml/hr | ○ FAST |
| ○ CBC/DC/Plt | ○ CXR, ECG |
| ○ PT/PTT | ○ Chest and abdominal CT without contrast |
| ○ Panel I | ○ 啟動 trauma blue |
| ○ VBG (G3) | |
| ○ Lactate | |

Orders

- 15:27
 - 補: repeat FAST
 - Transamin 1 g IV st
 - 備 pRBC 8U, FFP 12U, Plt 24U
 - On critical
 - Consult GS
 - N/S warm 500 ml IV challenge

Orders

- 15:40
 - Sign angiography permit
 - Arrange angiography
- 16:03, loss of cons of p't
 - 啟動 trauma red
 - 非常緊急備血 pRBC 8U
 - 輸非常緊急 pRBC 8U
 - DC angiography
 - On endo+ MV
- 續
 - RSI:
 - succinylcholine 40 mg IV st
 - Etomidate ½ Amp IV st
 - CXR (p)
 - On trauma kit
 - Pre-op
 - Send p't to OR on call

Operation finding

- Spleen laceration
- Blood loss: 5500 ml
- Splenectomy was performed

Clinical course

- Day 2: massive blood from the drain tube, the level of Hb decreased
 - Emergent operation: small vessel bleeding, 3000 ml of ascites and blood clot were lost
- Day 3: fever, CXR: bilateral pneumonia with pleural effusion, Tazocin was used
- Day 10: transferred to the general ward
- Day 11: no fever, the condition was stable
- Day 21: still admitted

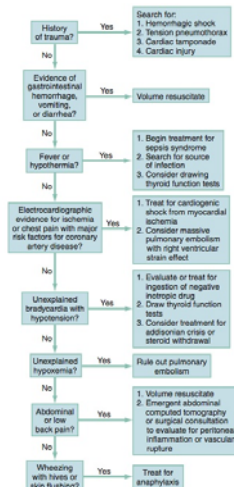
Discussion

Shock

Classification of shock

Causes That Require Primarily the Infusion of Volume	Causes That Require Volume Support and Vasopressor Support
Hemorrhagic shock <ul style="list-style-type: none">TraumaticGastrointestinalBody cavity Hypovolemia <ul style="list-style-type: none">Gastrointestinal lossesDehydration from insensible lossesThird-space sequestration from inflammation	Hyperdynamic/septic shock <ul style="list-style-type: none">Anaphylactic shockCentral neurogenic shockDrug overdose
Causes That Require Inotropic Support or Reversal of the Cause of Pump Dysfunction	Problems That Require Immediate Relief from Obstruction to Cardiac Output
Myocardial ischemia <ul style="list-style-type: none">Coronary artery thrombosisArterial hypotension with hypoxemia Cardiomyopathy <ul style="list-style-type: none">Acute myocarditisChronic diseases of heart muscle (ischemic, diabetic, infiltrative, endocrinologic, congenital) Cardiac rhythm disturbances <ul style="list-style-type: none">Atrial fibrillation with rapid ventricular responseVentricular tachycardiaSupraventricular tachycardia Hypodynamic/septic shock <ul style="list-style-type: none">Overdose of negative inotropic drugBeta-blockerCalcium channel antagonist overdose Structural cardiac damage <ul style="list-style-type: none">Traumatic (e.g., fall, mitral valve)Ventriculoseptal rupturePapillary muscle rupture	Pulmonary embolism <ul style="list-style-type: none">Cardiac tamponadePneumothoraxValvular dysfunction<ul style="list-style-type: none">Acute thrombosis of prosthetic valveCritical aortic stenosisCongenital heart defects in newborn (e.g., closure of patent ductus arteriosus with critical aortic coarctation)Critical idiopathic subaortic stenosis (hypertrophic obstructive cardiomyopathy)
	Cellular Poisons That Require Specific Antidotes
	Carbon monoxide <ul style="list-style-type: none">MethemoglobinemiaHydrogen sulfideCyanide

What kind of shock?



Specific causes

- Hemorrhagic shock
- Septic shock
- Cardiogenic shock

Hemorrhagic shock

- Blood loss
 - PR↑, cardiac contraction↑, vasoconstriction↑
 - DBP↑, PP↓
 - Ventricular filling↓, SBP↓
 - Blood flow to noncritical organs↓, so lactic acid↑
- Acidemia
 - Blood pH may not alter
 - Base deficit: decrease BEFORE the change of blood pH and BP
 - Normal: > -2 mEq/L
 - In hemorrhage: < -2

Hemorrhagic shock

- Brainstem chemoreceptors → RR↑, PaCO₂↓
- Blood loss > 1/3 of total blood volume, then:
 - Hypotension: BP < 90-100 mmHg
 - Activate the hypothalamic-pituitary-adrenomedullary axis
 - Release of stress hormones
 - Glycogenolysis, lipolysis, mild hypokalemia
 - Arterial lactate >4 mmol/L (36 mg/dl), PaCO₂ <35 mmHg, blood sugar 150-170 mg/dl, K 3.5-3.7 mEq/L

Septic shock

- Relative hypovolemia
 - Venous capacitance↑, capillary leak
- Cardiovascular depression
- Induction of systemic inflammation
 - TNF-α, IL-1β, NO
 - Cause:
 - Heart injury
 - Lung injury: ARDS, V/Q mismatch, pneumonia

Cardiogenic shock

- >40% of myocardium necrosis
 - Ischemia, inflammation, toxins, immune...
- Heart echo: severe LV dysfunction

Clinical features of shock

Ill appearance or altered mental status
Heart rate >100 beats/min
Respiratory rate >20 breaths/min or Paco₂ <32 mm Hg
Arterial base deficit <-4 mEq/L or lactate >4 mmol/L
Urine output <0.5 mL/kg/hr
Arterial hypotension >20 minutes duration

4 criteria should be met

- SBP < 100 mmHg: mortality ↑
- HR/SBP ratio > 0.8
- U/O: normal (>1 mL/kg/hr), reduced (0.5-1 mL/kg/hr), severely reduced (<0.5 mL/kg/hr), obs at least 30 min
- Arterial lactate >4 mmol/L (36 mg/dl), base deficit < -4 mEq/L

Definitions and criteria for the common shock

Septic Shock
Systemic Inflammatory Response Syndrome (SIRS)
Two or more of the following:
1. Temperature >38°C or <36°C
2. Heart rate >90 beats/min
3. Respiratory rate >20 breaths/min or Paco₂ <32 mm Hg
4. White blood cell count >12,000/mm³, <4000/mm³, or >10% band neutrophilia

Severe Sepsis
SIRS with suspected or confirmed infection and associated with organ dysfunction or hypotension; organ dysfunction may include presence of lactic acidosis, oliguria, or altered mental status

Septic Shock
SIRS with suspected or confirmed infection with hypotension despite adequate fluid resuscitation; septic shock should still be diagnosed if vasopressor therapy has normalized blood pressure

Hemorrhagic Shock
Simple Hemorrhage
Suspected bleeding with pulse <100 beats/min, normal respiratory rate, normal blood pressure, and normal base deficit

Hemorrhage with Hypoperfusion
Suspected bleeding with base deficit <-4 mEq/L or persistent pulse >100 beats/min

Hemorrhagic Shock
Suspected bleeding with at least four criteria listed in Box 4-2

Cardiogenic Shock
Cardiac Failure
Clinical evidence of impaired forward flow of the heart, including presence of dyspnea, tachycardia, pulmonary edema, peripheral edema, or cyanosis

Cardiogenic Shock
Cardiac failure plus four criteria listed in Box 4-2

Management guideline

Hemorrhagic Shock
Ensure adequate ventilation/oxygenation
Provide immediate control of hemorrhage, when possible (e.g., traction for long bone fractures, direct pressure)
Initiate judicious infusion of isotonic crystalloid solution
10-20 mL/kg
With evidence of poor organ perfusion and 30-minute anticipated delay to hemorrhage control, begin packed red blood cell (PRBC) infusion (5-10 mL/kg)
With suspected central nervous system trauma or Glasgow Coma Scale score <9, immediate PRBC transfusion may be preferable as initial resuscitation fluid
Treat coincident dysrhythmias (e.g., atrial fibrillation with synchronized cardioversion)

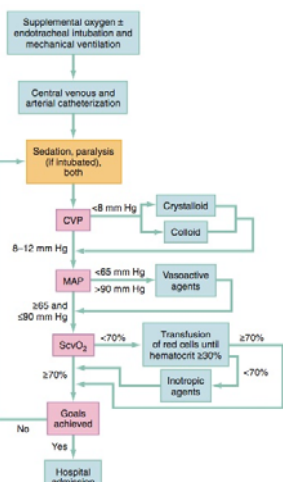
Cardiogenic Shock
Ameliorate increased work of breathing; provide oxygen and positive end-expiratory pressure (PEEP) for pulmonary edema
Begin vasopressor or inotropic support; norepinephrine (0.5 µg/min) and dobutamine (5 µg/kg/min) are common empirical agents
Seek to reverse the insult (e.g., initiate thrombolysis, arrange percutaneous transluminal angioplasty)
Consider intra-aortic balloon pump counterpulsation for refractory shock

Septic Shock
Ensure adequate oxygenation; remove work of breathing
Administer 20 mL/kg of crystalloid or 5 mL/kg of colloid, and titrate infusion to adequate central venous pressure and urine output
Begin antimicrobial therapy; attempt surgical drainage or debridement
Begin PRBC infusion for hemoglobin < 8 g/dL
If volume restoration fails to improve organ perfusion, begin vasopressor support; initial choice includes dopamine, infused at 5-15 µg/kg/min, or norepinephrine, infused at 0.5 µg/min

Management of shock

- Lactate clearance index
 - ↓10% in 2 hours
 - Resuscitation should continued until lactate <2 mM/L (18 mg/dl)
- Mixed venous oxygensaturation (SvO₂)
 - The balance between O₂ delivery and consumption
 - Goal: 65% (i.e. CI 2.5-3.5 L/min/m²)
 - Need pulmonary artery catheter; could use ScvO₂ (central venous oxygen saturation)

Early goal-directed therapy



For cardiogenic shock

- For intubation: use etomidate and ketamine
- To improve myocardial contractility:
 - SBP <70 mmHg with shock: Norepinephrine
 - SBP >70 mmHg with shock: Dopamine
 - SBP >70 mmHg without shock: Dobutamine

Conclusion

KEY CONCEPTS

- Circulatory shock can occur with normal arterial blood pressure, and not all patients with arterial hypotension have circulatory shock.
- A base deficit more negative than -4 mEq/L or a serum lactate > 4.0 mmol/L indicates the presence of widespread circulatory insufficiency in suspected shock.
- Urine output is a reliable index of vital organ perfusion in patients with suspected shock.
- Ill patients with tachycardia, a worsening base deficit, and low urine output should be diagnosed with circulatory shock.
- Use of defined physiologic endpoints to measure systemic perfusion during resuscitation (quantitative resuscitation) is a valuable approach to optimal resuscitation in ED patients with shock.

- History taking is VERY important!

thanks

