SHOCK

Dr H SILVA
Dept of Pathology

Objectives

- Define and classify shock.
- Explain stages of shock.
- Explain the pathophysiology of each type of shock.
- 4. Describe the compensatory mechanisms in shock.
- 5. List the morphological changes in organs.

Shock

State of systemic tissue hypoperfusion, due to reduced cardiac output and/or reduced effective circulating blood volume; resulting hypotension followed by impaired tissue perfusion and cellular hypoxia.

Types of shock

Hypovolaemic shock

(volume)

Cardiogenic shock

(pump)

Distributive shock

Septic shock

Anaphylactic shock

Neurogenic shock

(vessel)

Shock....

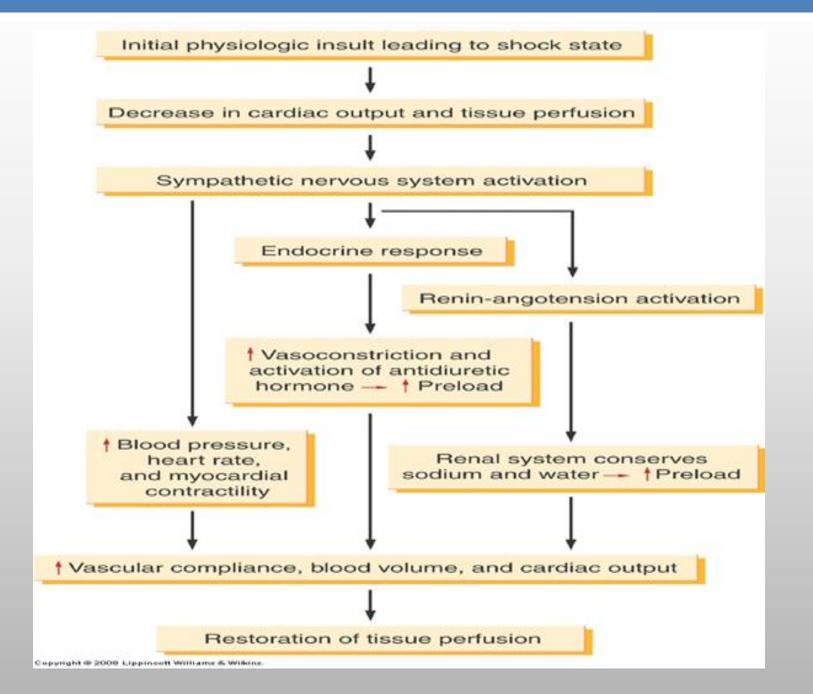
- Is a progressive disorder.
- Rare exceptions can be rapidly lethal (aortic aneurysm)
- Unless underlying problem is not corrected leads to death.
- The progression can be divided into 3 stages.

1. Non progressive stage

 Reflex compensatory neurohormonal mechanisms are activated to maintain the perfusion of vital organs.

 Body reacts specifically to preserve blood supply to the brain and heart. The adrenal gland secretes catecholamines which increase peripheral resistance (raising the blood pressure).

- The kidneys secrete renin which retains sodium and thus water by the renin angiotensin system
- Posterior Pituitary will secerete ADH to act on Distal nephron to preserve Na+ and water.



- baroreceptor reflexes
- release of catecholamines
- release Of ADH
- activation of Renin-angiotensin axis
- generalized sympathetic stimulation

- PR increase
- Peripheral vasoconstriction
- Renal blood flow reduce- fluid conservation
- Cutaneous vasoconstriction- pale and cold skin (Septic shock??)

Vital organ perfusion is maintained

2. Progressive stage

If the underlying cause is not corrected

persistent Q_2 deficit

intracellular aerobic respiration replaced by anaerobic glycolysis

excessive production of lactic acid (lactic acidosis)

low tissue PH

Blunts the vasomotor response

Progressive phase cont....

Arterioles dilate

Blood pool in the microcirculation

Poor cardiac output

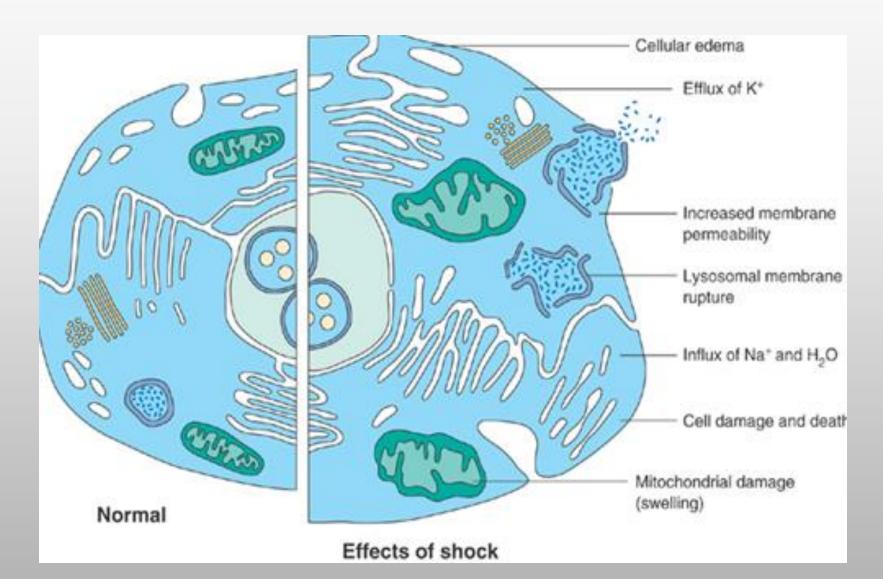
Anoxic injury to endothelial cells

vital organs are damaged and fail

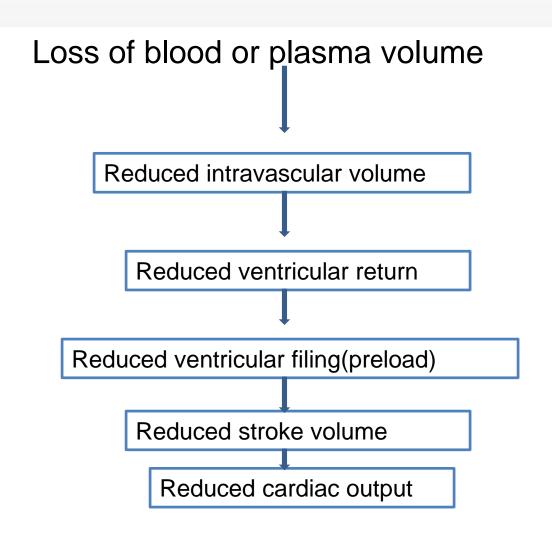
3.Irreversible stage

- If the underlying cause is not corrected....
- Causes Irreversible cell injury

Irreversible cell injury



Hypovolaemic shock



Causes for hypovolaemic shock

Haemorrhagic

- Trauma
- Gastrointestinal bleed

Fluid loss

- Dehydration
- Vomiting
- Diarrhea
- Polyuria

Cardiogenic shock

Myocardial pump failure Reduced stroke volume Low cardiac output

Causes- cardiogenic shock

- Myocardial infarction
- Myocarditis
- Cardiomyopathy
- Myocardial contusion
- Cardiac tamponade
- Septal defects
- Valvular heart diseases
- Arrhythmias
- Pharmacological- Eg. Calcium channel blockers

Septic shock

Septic shock is caused by systemic microbial infections.

 The toxins can be released, for example from bacteria in a focus of sepsis such as an abcess, or from bacterial growth in the flowing blood (septicaemia e.g. meningococcal)

Read: what is SIRS, sepsis, septicaemia, severe sepsis, septic shock

Sources of septic shock

- Infected burns
- Septicaemia
- Localised infections
- Instrumentation e.g. Urogenital
- Immunosuppression

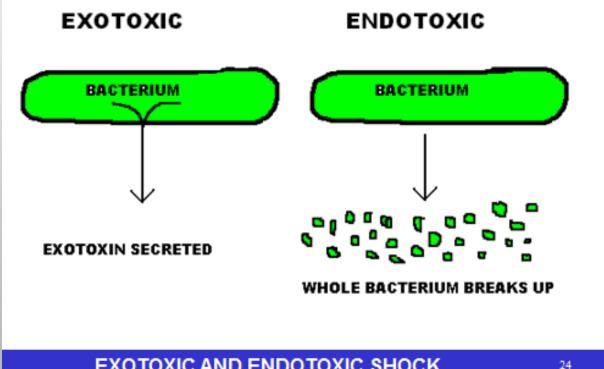
"Synonym of endotoxic shock is not appropriate"

Septic shock

Production of exotoxins by bacteria which remain intact

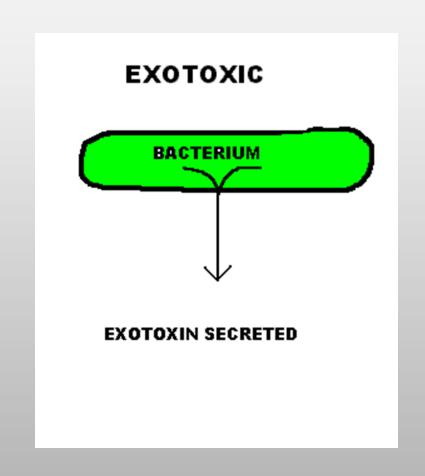
 In endotoxic shock the whole bacteria break up and cell wall lipopolysaccarides activate the complement and coagulation

cascades



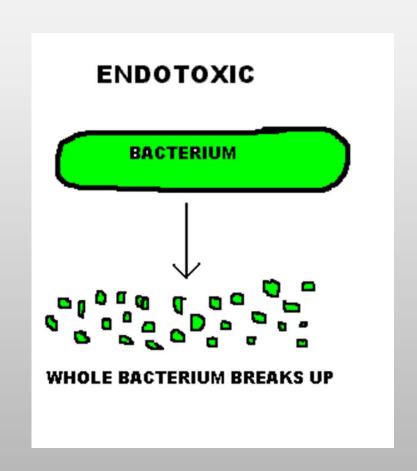
SEPTIC SHOCK EXOTOXIC:

- GRAM POSITIVE EXOTOXINS
- Much rarer than endotoxic shock
- Example of cause: Staph aureus skin infection
- TOXIC SHOCK SYNDROME
 - Staph aureus



Septic Shock Endotoxic: Aetiology

- GRAM NEGATIVE ENDOTOXINS
- CELL WALL LIPOPOLYSACCARIDES
 - E coli
 - Proteus
 - Klebsiella
 - Bacteroides
 - Pseudomonas (burns)
 - Meningococci



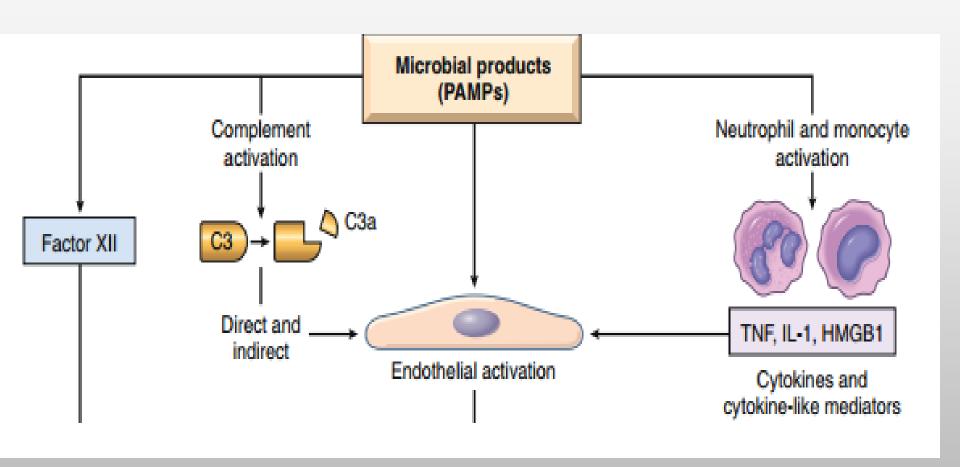
Lipopolysaccharide in the wall of Gram (-) organisms

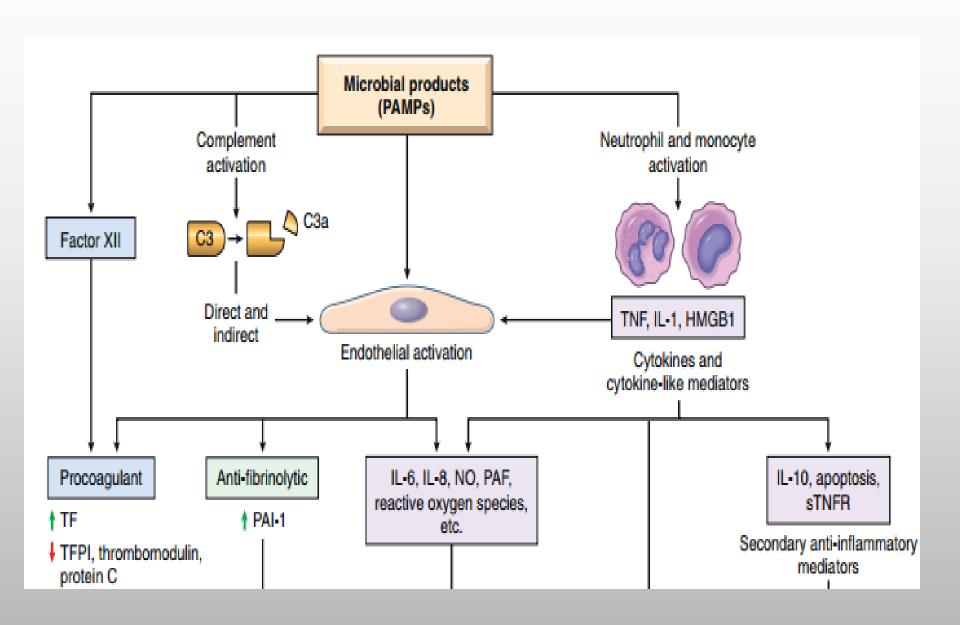
Free LPS bind with LPS binding protein(LBP)

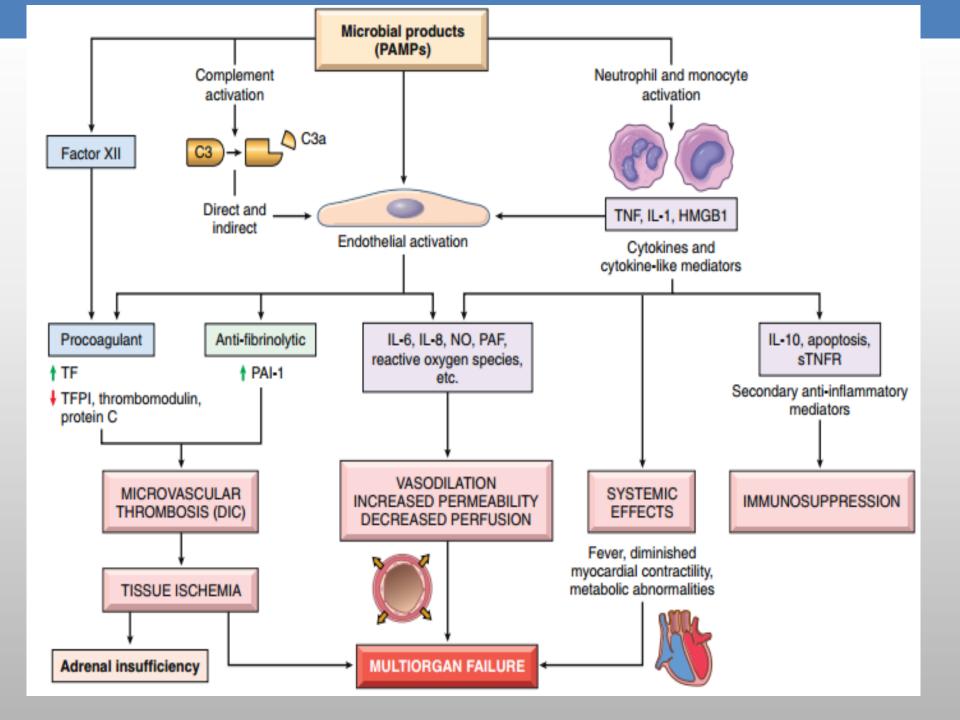
LPS+LBP complex activate macrophages

secrete inflammatory mediators

Pathophysiology of septic shock







Morphology

- Shock is characterized by failure of multiple organs.
- The tissue and cellular changes induced by shock are those of hypoxic injury.
- Changes can occur in any tissue.
- But are particularly evident in brain, lung, kidney, intestines, adrenals.

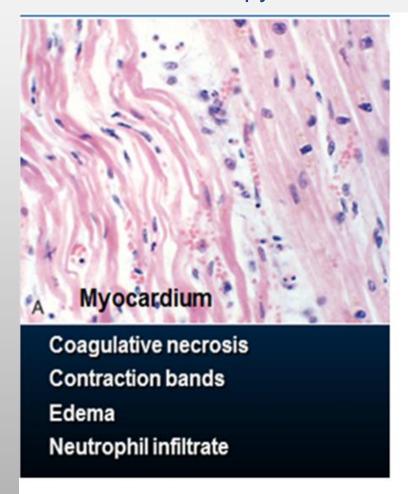
Morphology- Heart

Macroscopy

Sub endocardial changes

- If relevant may see evidence of the initiating cause
- eg: haemopericardium, cardiomyopathy

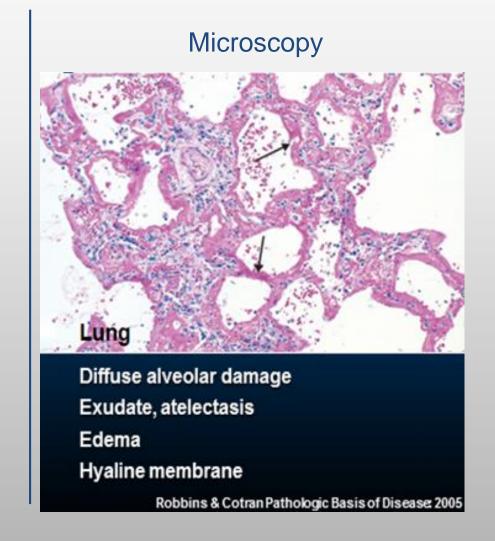
microscopy



Lung

Macroscopy

· Wet, heavy, firm, red lung



Intestines

Macroscopy

 Multiple spots of mucosal bleeding and necrosis(gangrenous areas)

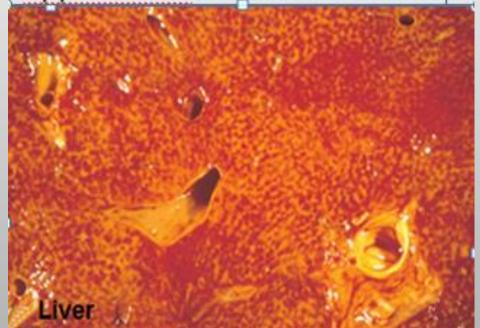
Microscopy



Liver

Macroscopy

Heavy and wet
Nut meg appearance
Fatty change



Microscopy

 Central haemorrhagic necrosis.

Kidney

Macroscopy

Erythema / hemorrhage



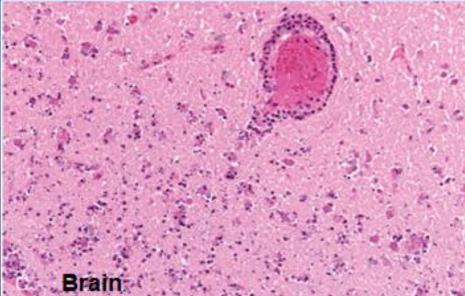
Brain

Macroscopy

Microscopy Ischemic encephalopathy



Bland infarct Punctate hemorrhages



Eosinophilia and shrinkage of neurons
Neutrophil infiltration

 With the exception of neuronal and myocyte loss virtually all these changes will revert to normal if the patient survives.

 But most patients with irreversible changes owing to shock succumb before the tissues can recover.

Prognosis

Depend on

- 1. Origin of shock
- 2. Duration
- 3. Host factors- age, comorbidities

summary

- Shock is a progressive disorder.
- There are three main categories of shock; which are volume, pump and vessel related.
- Stages of shock are non progressive, progressive and irreversible.
- There are compensatory mechanisms which include neurohormonal, renal and adrenal responses during the non progressive stage.
- In progressive stage the vasomotor response is blunted by the increased pH.

- If the underlying cause is not corrected irreversible cell injury will occur.
- Septic shock is not synonymous to endotoxic shock
- Microbial products which lead to septic shock, activate coagulation pathway, complement pathway, endothelium and inflammatory cells.
- The morphological changes related to the ischemia will be seen in almost all the organs.