**Question 1**

Deficiency of which of the following factors DOES NOT cause an increased Prothrombin time?

A X

B VIII

C V

D VII

Explanation B

Prothrombin time (PT) assess the extrinsic and common coagulation pathways. The clotting of plasma after addition of an exogenous source of tissue thromboplastin (e.g. brain extract) and Ca+ ions is measured in seconds. A prolonged PT cab result from a deficiency or dysfunction of factor V, VII, X, prothrombin and fibrinogen.

Factor VIII is part of the intrinsic pathway and will affect the partial thromboplastin time (PTT)

**Question 2**

Regarding non-inflammatory oedema, which of the following statements is correct?

A Has a protein content > 2g/dl

B Is caused by raised plasma colloid pressure

C Has a cholesterol content of < 45mg/dl

D Has a specific gravity > 1.012

Explanation C

A non-inflammatory oedema or transudate has a low protein content, a specific gravity of < 1.012, a serum cholesterol of < 45mg/dl and a protein content of <2g/dl. It is caused by increased hydrostatic pressure and a decreased plasma colloid pressure.

**Question 3**

Non-thrombocytopaenic purpura is associated with which of the following?

A Human immunodeficiency virus (HIV)

B Meningococcaemia

C Systemic lupus erythematosus (SLE)

D Aplastic anaemia

Explanation B

Non-thrombocytopaenic purpura is a type of purpura (red or purple skin discoloration) not associated with thrombocytopaenia. Causes include menigococcaemia, Henoch-Schonlein purpura (HSP), hereditary telangiectasia and congenital cytomegalovirus. The bleeding disorder is due to vessel wall abnormality. The platelet count and coagulation tests (PT,PTT) are usually normal, pointing by exclusion to the underlying problem

Thrombocytopaenia is caused by a decreased production of platelets (HIV, aplastic anaemia), decreased platelet survival (SLE, HIV), sequestration of platelets (hypersplenism) and dilutional, for instance by massive transfusion.

Reduction in platelet number, a count <100000 platelets/uL is generally considered to constitute thrombocytopaenia. Levels <20000uL may be associated with spontaneous bleeding. 20000-50000 is associated with post traumatic bleeding. PT and PTT are normal.

**Question 4**

Regarding increased vascular permeability due to endothelial contraction, which of the following statements is false?

A It is most common in capillaries

B It is due to formation of endothelial gaps

C It is the most common mechanism of increased vascular permeability

D It occurs quickly and is short lived

Explanation A

The endothelium is responsible for normal fluid exchange and microvascular permeability. During inflammation the endothelium becomes leaky. Formation of endothelial gaps in venules is the most common mechanism. It is short-lived (15-30min) and usually reversible. Other mechanisms include cytoskeletal reorganization (endothelial retraction), increased transcytosis, direct endothelial injury, delayed or prolonged leakage, leukocyte mediated endothelial injury, and leakage from new blood vessels

**Question 5**

Which of the following is not a cause of oedema?

A Increased venous pressure

B Increased lymph flow

C Decrease oncotic pressure

D Increased interstitial colloid pressure

Explanation B

Pathophysiologic categories of oedema;

 - Increased hydrostatic pressure

 - Reduced plasma oncotic pressure

 - Lymphatic obstruction

 - Sodium retention

 - Inflammation

**Question 6**

Regarding amniotic fluid embolism, which of the following statements is correct?

A Increased risk in prolonged labour

B Mortality of 30%-50%

C Occurs in 1:40 000 births

D There is an increased risk in primagravida patients

Explanation C

Amniotic fluid embolisms occur more often in multigravids at a rate of 1:40000. Increased risk factors include;

Precipitous or tumultuous labour (listed as risk factors in UpToDate, traumatic labour, caesarean section, operative vaginal delivery, abruption, placenta previa, cervical or uterine laceration, medical induction of labour, eclampsia, foetal distress, grand multiparity and advanced maternal age

The underlying cause is the infusion of amniotic fluid or foetal tissue into the maternal circulation via a tear in the placental membranes or rupture of uterine veins

Mortality is in the range of 80% (5th highest cause of maternal mortality)

Note: The older editions of Robbins state an incidence rate of 1:50000. The eighth edition reports a rate of 1:40000

**Question 7**

Regarding thrombotic and antithrombotic properties which of the following statements is correct?

A Clot retraction is independent of platelets

B Tissue thromboplastins activate the intrinsic cascade

C Thrombomodulin can bind and activate thrombin into an anticoagulant

D Increased plasminogen activator extends thrombus

Explanation C

Tissue thromboplastins do not activate the intrinsic pathway but rather the extrinsic pathway. Clot retraction is dependant on release of multiple coagulation factors from platelets trapped in a fibrin mesh. Increased plasminogen decreases thrombus. Thrombomodulin binds and converts it from a procoagulant into an anticoagulant via its ability to activate protein C, which inhibits clotting by inactivating factors Va and VIIIa.

**Question 8**

Passive hyperaemia is caused by, which of the following mechanisms?

A Inflammatory mediator release

B Exercising muscle

C Portal hypertension

D Arteriolar dilatation

Explanation C

Passive hyperaemia (congestion) is caused by portal hypertension, congestive cardiac failure, isolated venous obstruction and hepatic obstruction. Exercise, inflammatory mediator release, arteriolar dilatation are all active causes of hyperaemia

Passive hyperaemia is CONGESTION or STASIS

**Question 9**

Which of the following options best defines the pathophysiology underlying shock?

A Low cardiac output

B Lactic acid production

C Cellular hypoxia resulting from impaired tissue perfusion

D Decrease blood volume

Explanation C

Shock is defined as cellular hypoxia resulting from impaired tissue perfusion. It is caused by a reduction in cardiac output and/or effective blood volume

**Question 10**

Which of the following is the central pathophysiological feature of shock?

A Decreased blood volume

B Hypotension

C Cardiac failure

D Cellular hypoxia at a tissue level

Explanation D

Shock is defined as cellular hypoxia resulting from impaired tissue perfusion. It is caused by a reduction in cardiac output and/or effective blood volume

**Question 11**

Septic shock may cause all of the following, except?

A Disseminated intravascular coagulopathy (DIC)

B Vasoconstriction

C Adult respiratory distress syndrome (ARDS)

D Acute renal failure (ARF)

Explanation B

Features of septic shock include systemic vasodilitation (giving rise to hypotension), diminished myocardial contractibility, widespread endothelial injury (causing disseminated intravascular coagulopathy, DIC) and activation causing systemic leukocyte adhesion along with pulmonary alveolar capillary damage (e.g. adult respiratory distress syndrome, ARDS)

**Question 12**

The process of blood coagulation involves which of the following?

A The action of antithrombin 3

B Alpha 2 macroglobulin

C The removal of peptides from each fibrinogen molecule

D The action of plasmin on fibrin

Explanation C

Alpha 2 macroglobulin (A2MG), antithrombin III and the action of plasmin are all anticoagulants

Extra: Alpha 2 macroglobulin acts as an antiprotease and is able to inactivate an enormous variety of proteinases. It functions as an inhibitor of fibrinolysis by inhibiting plasmin and kallikrein. It functions as an inhibitor of coagulation by inhibiting thrombin. Alpha 2-macroglobulin may act as a carrier protein because it also binds to numerous growth factors and cytokines, such as platelet-derived growth factor, basic fibroblast growth factor, TGF-β, insulin, and IL-1β.

Note: the inhibiton of thrombin will prevent coagulation. Althouugh A2MG has a plasmin inhibition, I dont think it will be procoagulant

**Question 13**

Regarding the complement system which of the following statements is correct?

A C3 inhibits the final common pathway

B The alternative pathway is stimulated by Ag-Ab interaction

C C6-9 forms the membrane attack complex (MAC)

D C5a initiates arachadonic acid metabolite release from neutrophils and monocytes

Explanation D

MAC is the cytolytic endproduct of the complement cascade; it forms a transmembrane channel, which causes osmotic lysis of the target cell.The classic pathway is stimulated by the Ag-Ab interaction. C3 complement activates the final complement pathway. C5-C9 forms the membrane-attack complex (MAC). MAC is the cytolytic endproduct of the complement cascade; it forms a transmembrane channel, which causes osmotic lysis of the target cell. The critical step in complement activation is the proteolysis of complement C3. Which ever pathway is activated they all lead to the formation of C3 convertase which splits C3 into C3a and C3b. C3a involved in the recruitment and activation of leukocytes. C3b then goes onto activate and form the MAC (through C5-C5a, C5b. C5b binding to C5-C9). **C5a activates the lipoxygenase pathway of AA metabolism in neutrophils and macrophages**, causing release of more inflammatory mediators. Leukocyte activation, adhesion, and chemotaxis. C5a activates leukocytes, increasing their adhesion to endothelium, and is a potent chemotactic agent for neutrophils, monocytes, eosinophils, and basophils. **C3a and C5a have anaphylatoxin activity**, directly triggering degranulation of mast cells as well as increasing vascular permeability and smooth muscle contraction.

**Question 14**

With regard to emboli, which of the following statements is correct?

A Pulmonary emboli are rarely multiple

B Arterial emboli most often lodge in the viscera

C All emboli consist of either gas or solid intravascular mass

D Amniotic fluid emboli are associated with the highest mortality

Explanation D

The major sites of arteriolar embolisation are the lower extremities (75%) and the brain (10%), with the intestines, kidneys, spleen, and upper extremities involved to a lessor degree. Pulmonary emboli are frequently multiple and cause 200 000 deaths per year in the USA. A patient who has had one pulmonary embolus is at a high risk of having more. Emboli consist of a solid (fat, tumor, bone fragment), liquid, gas or foreign body material e.g. shrapnel or a bullet. The incidence is only 1:40000 deliveries but the mortality is >80%. Amniotic fluid embolism is the fifth most common cause of maternal death world wide. It accounts for 10% of maternal deaths in the USA a year and results in>85% of permanent neurological deficits in survivors

**Question 15**

Regarding the veins of the lower limb, which of the following statements is correct?

A Phlegmasia alba dolens is associated with iliofemoral vein thrombosis, occurring in pregnant females

B Thrombosis in the superficial veins is a common source of emboli

C Varicosity development has no genetic component

D Dermatitis is a common consequence of Buerger's disease

Explanation A

Superficial vein thrombosis is not a common source of emboli. Deep veins account for >90% of cases of thrombophleblitis and phlebothrombosis. 10% of venous thrombosis occurs in the superficial veins.

Pain, ulcers and gangrene are a common consequence of Buerger’s disease (thromboangitis obliterans). It is a recurring progressive inflammation and thrombosis of small and medium arteries and veins of the hands and feet. Strongly associated with the use of tobacco products

Varicosity development is genetically based.

**Question 16**

Fat embolism syndrome is associated with which of the following options?

A Symptoms typically develop after 4 days

B A mortality of greater than 20%

C Although 90% of skeletal injuries cause fat emboli, less than 10% of patients develop symptoms

D The core clinical feature is the presence of neurological abnormalities

Explanation C

Fat embolism occurs in 90% of individuals with skeletal injuries, but less than 10% of such patients develop fat embolism syndrome.

Fat embolism syndrome is the term used when patients become symptomatic. It is characterised by pulmonary insufficiency, neurological symptoms, anaemia and thrombocytopaenia. 5-15% of cases are fatal. The fat causes physical (obstructive) and biochemical (free fatty acid, FFA, inflammation) injury

Typically these symptoms develop 1-3 days after injury and occur suddenly

Thrombocytopaenia is attributed to platelet adhesion to fat globules and subsequent aggregation or splenic sequestration; anaemia results from a similar red cell aggregation or haemolysis.

A diffuse petechial rash (20-50% of cases) is related to rapid onset of thrombocytopaenia and can be a used diagnostic feature.

**Question 17**

Non-inflammatory oedema is characterised by which of the following?

A A specific gravity > 1.012

B A high protein content > 2g/dl

C An elevated level of atrial natriuretic peptide (ANP)

D Caused by a decrease in intravascular hydrostatic pressure

Explanation C

A non inflammatory oedema or transudate has a low protein content, a specific gravity of < 1.012, a serum cholesterol of < 45mg/dl and a protein contant of <2g/dl. It is caused by increased hydrostatic pressure and a decreased plasma colloid pressure. Atrial natriuretic peptide's (ANP) main function is to increase sodium excretion from the kidney due a raised right atrial pressure. Other actions include an increase in capillary permeability, leading to extravasation of fluid and oedema.

**Question 18**

Which of the following factors is part of the intrinsic pathway of coagulation?

A XI

B VIIa

C X

D II

Explanation A

Calcium is found in the common pathway of the coagulation cascade, together with factors I, II, V, X.

The tissue factor pathway (also know as the extrinsic pathway) contains factor VII and is activated by coagulation factor III (tissue factor, thromboplastin). The intrinsic pathway contains factors VIII, IX, XI, XII and is activated by exposing factor XII to thrombogenic surfaces

**Question 19**

Which of the following are features of a post mortem clot?

A Adherence to vascular walls Your Answer

B Presence of Lines of Zahn

C Presence of fibrin deposits in the thrombus

D Supernatant resembling chicken fat

Explanation D

Lines of Zahn imply the development of a thrombosis at the site of blood flow. These lines represent pale platelet and fibrin deposits alternating with darker red cell rich layers. Such lines signify that a thrombus has formed in flowing blood. Postmortem clots are gelatinous (due to the lack of fibrin) with a dark red dependent portion where red cells have settled by gravity and a yellow "chicken fat" upper portion. They are usually not attached to the underlying wall.

**Question 20**

Which of the following is a feature of non-inflammatory oedema?

A Right atrial pressure is high

B Decreased intravascular hydrostatic pressure

C Specific gravity >1.012

D A protein content > 2g/dl

Explanation A

A non inflammatory oedema or transudate has a low protein content, a specific gravity of < 1.012, a serum cholesterol of < 45mg/dl and a protein contant of <2g/dl. It is caused by increased hydrostatic pressure and a decreased plasma colloid pressure. Atrial natriuretic peptide's (ANP) main function is to increase sodium excretion from the kidney due a raised right atrial pressure. Other actions include an increase in capillary permeability, leading to extravasation of fluid and oedema.

**Question 21**

Which of the following amounts of air is liable to produce significant pulmonary air embolism?

A 20ml

B 10ml

C 1ml

D 100ml

Explanation D

Generally, small amounts of air in the arterial system are broken up in the capillary bed and absorbed from the circulation without producing symptoms, however the injection of 2 or 3mL of air into the cerebral circulation can be fatal. Furthermore, as little as 0.5mL of air in the left anterior descending coronary artery has been shown to cause ventricular fibrillation

Traditionally, it has been estimated that more than 5mL/kg of air displaced into the intravenous space is required for significant injury (shock or cardiac arrest) to occur. However, complications have been reported with as little as 20mL of air (the length of an unprimed IV infusion tubing) injected intravenously. Basically, the closer the vein of access is to the right heart, the smaller the lethal volume is.

**Question 22**

The most common haemodynamic mechanism in the production of pulmonary oedema is?

A Decrease oncotic pressure

B Lymphatic obstruction

C Increase hydrostatic pressure, as occurs in left ventricular failure (LVF)

D Increase oncotic pressure

Explanation C

Pulmonary oedema occurs because of left sided heart failure. Decreased cardiac output causes a reduction in renal perfusion, which leads to the activation of the renin-angiotensin-aldosterone system. This in turn induces the retention of salt and water and the expansion of the interstitial and intravascular volumes, resulting in a greater hydrostatic pressure and pulmonary oedema

**Question 23**

Regarding factor VIII, which of the following statements is correct?

A Factor VIII is useful in the treatment of haemophilia B

B Factor VIII combines with factor X to activate thrombin

C Factor VIII deficiency causes a prolonged prothrombin time (PT)

D A deficiency of 50% of the normal levels of factor VIII gives rise to mild disease

Explanation D

Factor VIII joins with factor IX to activate factor X. It is used to treat haemophilia A as only the intrinsic pathway is affected. Those with less than 1% of normal levels have a severe form of the disease, 2-5% moderate and 6-50% mild. In haemophilia A, laboratory tests reveal a prolonged partial thromboplastin time (PTT), normal bleeding time, normal prothrombin time (PT) and normal platelet count.

Haemohilia B is a factor IX deficiency.

Haemophilia A is the most common hereditary (X-linked recessive trait) disease associated with life threatening bleeding

Note: PT measures factors (1,2,5,10), 7 AND aPTT measures factors (1,2,5,10), 8, 9, 12