**Sheet no. : 3 & 4**

**Slides no. : 3 & 4**

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-Kindly note that this lecture contains two separate topics.

**“Blood Transfusion”**

* **Indications for blood transfusion:**
1. **Anemia**
In cases of acute blood loss (bleeding) with drop in hemoglobin level to ***7 or below***.
2. **Ischemic heart disease with hemoglobin level of less than 10**

Stent, catheterization, taking aspirin as a medication, chest pain, heart problems, old-aged males 🡪 indicators of low threshold for blood transfusion.

1. **Hypovolemic shock**

Shocks that are not responsive to fluids.

Severely hypotensive, tachycardic and hypovolemic patient, we manage this by giving him 20ml/kg (bullous dose) fluids. In cases of elderly, we give 2L, if it didn’t work another 2L is administered then we ultimately give colloids to increase intravascular osmotic pressure (blood transfusion).

* **Components of blood** :
1. **Cellular/formed elements**; RBCs, WBCs, platelets
2. **plasma**; 90% water ,10% solutes, Proteins, clotting factors
* **Products of blood:**
1. **Whole blood** (it contains everything that is usually in blood; cells and plasma)

-given to shocked patients for which we need to increase the intravascular volume, especially in hypovolemic shock.

1. **Packed RBCs** (mainly RBCs with little plasma)

-given to patients with CHF or anemia to increase hemoglobin (oxygen carrier) level.

1. **Platelets** (only platelets)

**-**for patients with thrombocytopenia

1. **Fresh frozen plasma** (it doesn’t contain cells, but contains clotting factors & albumin instead)
2. **Granulocytes**
3. **Cryoprecipitate**
4. **Factor VIII**
5. **Albumin**

-for patients with shock or hypoalbuminemia

* **Antigen:**

A substance capable of stimulating the production of an antibody and then reacting with that antibody in a specific way. It’s inherited, found on red cells and contains ABO and D-antigen (Rh).

* **Antibodies:**

Are proteins produced by immune system that destroys or inactivates a particular antigen. It’s produced as a result of antigenic reactions, found in plasma.

Note: you have to memorize the table about ABO groups**.**

* **Ways to give and receive blood are:**
1. **Autologous:** the patient receives his own stored blood when needed.
2. **Homologous**: donated by a volunteer or designated donor**.**
3. **Postoperative**
4. **Intraoperative**
* **Key points:**

\*All blood must be infused within **4 hours**.

\*Blood infusion rate: **15mL/kg/hour**, so one unit of blood should not take less than 2-4 hours to be infused.

\*Catheter size: infuse the blood slowly using cannula **gauge of 14 or 22**

\*We should use filters & blood warmers to avoid HYPOTHERMIA.

* **Products of blood:**
1. **Whole blood:**
* Rarely used, most commonly in emergency room (ER)
* In acute massive blood loss >25% we use whole blood of approximately 500cc so **1 blood unit**, **raises Hemoglobin By** **1g/dL** & **raises hematocrit by** **3%**.
* Must be ABO compatible; in emergency settings where we can’t do ABO compatibility test, we usually give **O**; either positive or negative but in young females in child bearing age we can only give **O-** .
1. **Packed RBCs:**
* Contains **250**-300mL. In symptomatic anemia when we have a Hemoglobin level of 7, we’ll have exertional dyspnea because oxygen doesn’t meet the metabolic demands.
1. **Leukocyte Reduced RBCs:**
* Used for immunocompromised patients.
* Filter 99% of WBCs that cause febrile reactions.
* In some countries like Canada all blood transfusions are Leukocyte Reduced RBCs even in immunocompetent patients.
* Why we give leukocytes reduced RBCs? / Why are transfused WBC bad?
1. WBCs have immunologically mediated effects so they increase the risk of febrile non-hemolytic transfusion reactions. Increases platelets refractoriness & graft-host rejection. Also immunosuppression; reactivation of viral diseases.
2. Infectious disease transmission by viruses and bacteria.
3. Reperfusion injury.

Relates to reperfusion of ischemic myocardium which is known to lead to ultra-structural damage, WBC are thought to play a central role.

Leukoreduction may be an effective way of reducing reperfusion injury after CABG (coronary artery bypass graft).

1. **Platelets:**

There is a protocol for massive blood transfusion; so:

* For each **unit of blood** given we give **one unit of platelets**.
* We administer 1 unit in 5-10 minutes
* ABO compatibility is not required.
* **1 unit** **raises platelet count 5-10,000**.
* We administer **6-8 units per time**.
* When we give 4 units of RBCs we should give fresh frozen plasma and platelets, and when we give more than 6 or 10 units patients will have depleted platelets
1. **Plasma Derivatives; Fresh Frozen Plasma:**
* **Plasma** is the liquid portion of blood.
* **Fresh frozen plasma** isprepared by whole blood separation.

Volume **200-250mL.** Ithas all the clotting factors required.

* Uses: in cases of severe bleeding, **massive blood transfusion** or disseminated intravascular coagulopathy (DIC). Coagulopathy : increased PT, PTT; so for immediate correction of coagulation factors we give fresh frozen plasma.
**\*\*EXAM Q : in massive blood transfusion we should give platelets and fresh frozen plasma** **as well.**
1. **Cryoprecipitate**
* Concentrated form of fibrinogen & Von Willebrand
* **Transfusion Reactions / complications for blood transfusion:**
1. **Immune:**
Acute hemolytic, delayed hemolytic, non-hemolytic febrile & allergy.
2. **Non-immune:**
Circulatory overload (patient with HF given whole blood so we increased the heart load leading to further decongestive heart failure), hyperkalemia, hypothermia, citrate toxicity (for citrate is used for reservation of blood), bacterial contamination, coagulation imbalance & transmission of infectious diseases
* **Immediate Hemolytic Transfusion Reaction**-the most common cause of **hemolytic** transfusion reaction is : **ABO incompatibility** whereas **non-hemolytic** transfusion reaction : **febrile & allergy**

\*\*The most common cause of blood transfusion reactions & complications is CLINICAL ERRORS.

* **Suspected Hemolytic reactions**
If we suspect hemolytic reactions, we should stop transfusion, give fluids & return the blood to the blood bank to double check its compatibility.
* **Febrile reactions**: reaction to antibodies in blood in reaction to leukocytes, management is like the case with suspected hemolytic reactions.
* **Allergic reactions**: antibody formation against plasma proteins. Management is to stop transfusion, hydrate, give antihistamines, if severe you may need to give adrenaline.

**“SURGICAL SITE INFECTIONS”**

Note: Only the information mentioned here are required about this topic.

* **Important terms:**
* **Sterilization:** is the process that remove ALL mmicroorganisms including bacterial endospores form inanimate objects.
* **Disinfection:** is the elimination of most (but not all) disease causing mmicroorganisms from inanimate objects. Used for instruments not a living body. If talking about living body we use **aseptic technique** minimizing microorganisms load.
* **Cleaning:** physically removes ALL visible blood, body fluid, or other foreign material (grossly visible) as dust or soil from skin or intimate objects.
* **Antiseptics**

We use many kinds of antiseptics, some of them are alcohol based & some are not.
Note: you have to know at least the first two antiseptics mentioned in the slides with their advantages & disadvantages**.**

* **Surgical Wound Classification:**
1. **Clean (class I):** atraumatic skin wound that’s not old and not contaminated, and do not enter GI, GU, biliary, or respiratory tract. Like: thyroid surgery, breast surgery and lipoma.
* **1.5%** infection rate
1. **Clean contaminated (class II):** well prepared woundsonce we entered the GI, genital, urinary or respiratory system the wound is considered clean contaminated. **Like the oral cavity wounds** (extraction of wisdom teeth).
* **5%** infection rate expected
1. **Contaminated (class III):** Traumatic wounds, old skin wounds or (not well-prepared) wounds & we entered the GI, genital, urinary or respiratory system.
2. **Dirty (class IV):** when I have (**pus** ,perforations ,stool)
* **40%** expected infection rate
* **Antibiotic cover:**
* For clean contaminated & contaminated wounds (class II & III) we give **prophylactic antibiotics**.
* For dirty wounds (class VI) we give **therapeutic antibiotics**.
* **Infection:**

Microorganisms invading the tissues and releasing toxic materials leading to an inflammatory response. It has some localized (swelling, redness,..) and/or systemic signs (S.I.R.S).

* **S.I.R.S** **(Systemic inflammatory response syndrome)**

Having at least two of the following criteria:

* 1. Temperature: < 36.0, >38.0
	2. Heart Rate: >90
	3. Respiratory Rate: >20
	4. WBC: <4,000, >12,000
* **Sepsis:** To call an inflammation ‘sepsis’ it should have SIRS plus a focus (having a dental infection for example).

**Septic shock:** sepsis plus end organ injury.

* **Surgical Site Infection (SSI)**:
* Infection at or near the site of surgery that occurs within **a month of surgery** if there is **no implant** (hardware, artificial graft, mesh, etc) OR occurs **within 3 months** of the surgery **with an implant** in place.
* We classify SSI depending on its place:
1. **Incisional** : if the infection is confined to the incision, incisional SSI is further divided into :
2. Superficial: if the infection is confined to the skin & subcutaneous tissue only.
3. Deep: involving the fascia & the muscles.
4. If splenectomy, cholecystectomy, appendectomy or colonoctomy was performed & abscess resulted this is called: **Organ Space SSI.**We may have it alone or with incisional SSI.
* **Slide no.42:** Cross Section of Abdominal Wall Depicting CDC SSI Classifications
* **Slide no.46:** wecan’t tell from the picture the type of SSI but we have signs of infection (Redness, swelling) so it’s at least superficial SSI.
* **Risk factors for SSI :**
a) **Exogenous** :

1) Contamination

2) Prolonged operations

3) Sterilization

b) **Endogenous**: depends on the patient himself; immunocompromised or not (having a disease or taking medications that suppresses his immunity), diabetes, malnutrition.

* **Perioperative Risk Factors:**

**Operative site shaving:** we don’t use regular hair shaving blades not to cause micro-cuts that allow bacterial entrance.

* **Principles of Antibiotic Prophylaxis:**

In providing prophylactic antibiotics what I care about is:

1) Highest concentration of antibiotic reaching the site of surgery just before the incision.

2) Antibiotic that is specific to the microorganisms that may affect the surgical site.

3) Sufficient for the duration of surgery (long half-life antibiotic or RE-dosing).

* **high serum level**
1. Timing: one hour before the incision
2. IV route: to reach the maximum availability in a short time
3. Highest dose allowed is administered within limit in order not to be toxic.
* **during procedure:**
1. Long half-life
2. We may re-dose in: long duration procedures or if we had blood loss during surgery because we lose the blood that contains the antibiotic.
* **Duration:**

All the doses of prophylactic antibiotics should be given within 24 hours, other than that it’ll be called **therapeutic antibiotic** .

* **Antimicrobial agents used in dental procedures**:

Most of the infections are caused by gram positive or gram negative bacteria, we don’t really care about the anaerobes.

**Cephalexin, Cephradine, Amoxicillin**

* **Treatment:**
* **Incisional**: open surgical wound, antibiotics for cellulitis or sepsis (incision and drainage).
* **Deep/Organ space**: Source control, antibiotics for sepsis, aspiration for the collection.