Hematology

PHYSIOLOGY

☑ Sheet ☐ Slide ☐ Handout

Number: 9

Subject: .....

Done By: Ali Rateb Younes

Corrected by: .....

Doctor:

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Price:

blood groups

We have many systems that use for blood grouping 1- classic "ABO" system

2- Rh group

3- minor group " MM,MN,NN,PP,NP"

First, ABO Group :

*- It classified according to some antigens "Ag" that are expressed on the surface of the RBC'S during fetal life and remain until death.

*- phenotype	*- genotype
1- A	AA,AO
2-B	BB,BO
3-AB	co-dominance
4-O	is inherit recessive allele from parent
	OO

Second, Rh group :

*- 85% of Europe have Rh+, 15% have Rh-

*- in Arab 95% have Rh+.

*- Rh found in addition to other blood group (major and minor).

*- Rh + ------> have NO antibody "Ab'S BUT only Ag'S.

*- Rh - --------> neither Ab'S nor Ag'S.

The importance of blood grouping :

If man Rh+ get's married to a woman Rh- , so, there may have Rh+ child ----> during pregnancy if some Rh+ pass to maternal blood ----> the mother develop Ab'S ----> the Ab's back to the fetus blood ---> react with RBC's antigen (Ag of Rh+ blood of the child) ----> agglutination "hemolysis" occur .

this is ***the first condition*** when the mother develop Ab's.

the second condition: when the mother before marriage have Rh- ---> expose to blood transfusion from Rh+ ---> the mother either develop Ab's or become sensitive to develop Ab's .

*- in these case the sensitivity is higher than Ab's formation.

*-develop Ab's is more dangerous than only become sensitive to formation it .

the 3rd condition: is placental infection ---> the placenta become leakable to blood ---> blood pass to the mother ---> develop Ab's ---> back to fetus ----> agglutination occur

NOTE: the child at high risk in this case .

the 4th condition: is during delivary some blood secrete to mother blood and then either form Ab's or become sensitive

NOTE : in this case the child is pull " no risk"

NOTE: The danger depend on the severity of the hemolysis .

The agglutination:

some time it could be mild , moderate , saver

*-***Mild agglutination*** in fetal blood "**Erythroblastic Fetalis**", and this can be corrected after birth by blood transfusion of "-veRh" blood, without doing any change on the main blood group (ABO). (The blood transfused to the child is not from the mother who has the Abs already)

- Moderate agglutination "**Icterus graves neonatorum**"; the infant is born on term, with Jaundice (or gets it within 24hrs) and severe neurological lesions where the pigments are deposited (basal ganglia of the brain).

- Severe "**Hydrops Fetalis**"; severe hemolysis, the infant may die in uterus, or develop jaundice, edema, and sever anemia and die within few hours after birth.

Within 72 houres after the delivery, -veRh mothers of +veRh fetuses should be given certain gamma-globulins against the foreign +veRh Ags on leaked fetal RBCs, these will fight the foreign Ags, then be eliminated from the body due to their limited half life, thus no normal agglutination or maternal normal Abs are formed.

compatible blood transfusions :

B-RBCs blood receives blood from B + O groups only.

A-RBCs blood receives blood from A + O groups only.

O-RBCs blood can be given to any group, "General Donor".

AB-RBCs blood receives blood from any group. "General Recipient".

*- actually we don't have General Donor or General Recipient because we can't transfer blood form AB group to O group (AB have both Ag's and O have both Ab's)

NOTE *: Limited* volumes of blood should be transfused normally even *for general donors and recipients*, 3 bags maximally (1.5 L).

*- In cases of wars and emergencies, more blood (up to 4 bags) may be transfused.

*- The limited volume transfused is monitored due to the fact that Abs in the transfused plasma should be diluted when added to patient's blood, so they won't cause harm or agglutinations, thus 1-2 bags of blood with their Abs may be tolerated by the recipient blood, more (3-4bags, with more Abs) will put the patient in a new risk.

- "A" + "B" Ags don’t produce similar agglutinatin reactions between an infant and his mother (as in Rhesus);

A women with "O" group has the Abs-A and Abs-B in her plasma. Any "A" or "B" transfused blood to her, will induce agglutination reactions. BUT, if she's pregnant, these Abs won't affect the baby, why?

- → "A" + "B" Ags are not much expressed on fetal RBCs. Also these Abs in mother's circulation are of "IgM" type → cannot cross the placenta easily!

- Indications for blood transfusion;

1. Compensating lost blood or decreased blood volume in Hemorrhages.
2. Providing Blood cells.
3. Increasing blood coagulation in cases of Hemophilia.
4. Replacing blood (in infants) in cases of erythroblastosis foetalis.
5. Supplying Antibodies + Proteins.
6. Provide WBCs in cases of leucopenia.
7. Supply proteins in hypoproteinemia.

- - Certain machines and laboratory techniques can separate different cells and components in blood; thus you can transfuse only plasma, or only RBCs, etc.

- Complications of blood transfusion;

A. EARLY:
Hemolytic reactions (immediate vs. Delayed) / Infections / Allergic reactions (in response to new WBCs, Platelets, Proteins, etc.) / Circulatory Overload / Air embolism/ citrate toxicity / Hyperkalemia / Clotting abnormalities (After massive transfusion).

B. LATE:

- Transmission of serious diseases (Hepatitis, Malaria, Syphlis, AIDS) / Transfused Iron Overload / Immune Sensitization.

- What's cross-matching? And why do we do it?
  Cross matching is done by mixing a small sample of recipient blood with a small sample of the donor blood and it takes two steps,
  If we have a donor and a recipient:
  step 1 → plasma from the donor and RBCs from the recipient
  step 2 → plasma from the recipient and RBCs from the donor

  If there's no reaction (no clumping of blood), then it's safe to transfuse it.

- If there's a reaction (i.e. clumping of blood), then we say that the blood of the donor is incompatible with that of the recipient. So, we don't donate blood in this case.
- The blood stored in blood bank is anticoagulated. The best anticoagulant to be used is ACD (Acid Citrate Dextrose).
- The blood is stored at 4° Celsius.
- Above 4, blood is rotten.
- Below 4, RBCs membranes are destroyed.
  ➔ We put the blood on the ice not inside it, to prevent destruction of RBCs.
- Sometimes the patient needs blood transfusion, and we don't have the same blood type, so we give him **Orh**-. In extreme emergency cases, if the same blood type and even **Orh**- are not available, we transfuse **ORh**+ (because these are the universal donors).
- During blood storage in blood bank, sodium-potassium pump is weakened. The balance between sodium and potassium is disrupted. So, cells gradually lost K+ and gain Na+. This makes cells oval and more prone to hemolysis.

  → Hemolysis of RBCs occurs during storage.
- (Na+/K+ pump is paralyzed, and K+ leaves the cell while sodium enters it). **More than 2 weeks of storage**, potassium leaks progressively from the erythrocyte and the extracellular concentration increases.
- During storage, red blood cells intended for transfusion undergo progressive changes affecting survival and function, therefore, we should avoid transfused blood that is stored for more than 2 weeks, and the best duration is less than 2 weeks.
- For example: If we transfuse blood that has been stored for 2 weeks, and measure the percentage of surviving cells, they will be around 80% of the donated cells and every day 1% of them undergo hemolysis.
- If we want to donate WBCs or platelets, we give fresh blood.
- Aggregation of RBCs is called agglutination.
- Agglutination occurs as a result of antibodies binding antigens.

T or F:

2- Donor blood is usually collected to heparin which acts as an anticoagulant.
F

Answer: ACD not heparin

3- Antibodies are absent in group O babies
T

4- Von-Willebrand Disease is X-linked.
F

5- The bleeding time is usually normal in Von-Willebrand Disease.
F

6- Factor VII is low in Von-Willebrand Disease
T

7- Factor VII:AG is usually normal in Von-Willebrand disease.
F

8- Platelet function is abnormal in Von-Willebrand disease

T