***Lecture 7 Blood transfusion***

***History of the Rh System***:

Levine and Stetson described a hemolytic transfusion reaction in an obstetric patient following delivery of stillborn infant. The women required transfusion. Her husband, who had the same ABO type, was selected as her donor, after transfusion the recipient, demonstrated the classic symptoms of acute hemo]ytic transfusion reaction.

Subsequently an antibody was isolated from the mother’s serum that reacts both at 37° C and 20 °C with the father’s red cells. It was postulated that the fetus and the father possessed a common factor that the mother lacked. While the mothers carry the fetus, the mother was exposed to this factor and subsequently built up an antibody that reacted against the transfused red cells from the father and resulted in hemolytic transfusion reaction.

***Rhesus system:***

According to Fisher-Race theory, the antigens of the Rh system produced by three closely linked sets of alleles (Genes) (D&d), (C&c,E&e) and these alleles defined by the same capital and small letters of the antigens. To date, no-d-antigen has been found, so-d-gene is considered as amorph gene.

•Landsteiner and Wiener reported on an antibody by guinea pigs and rabbits when they were transfused with rhesus monkey red cells.

•This antibody which agglutinated 85% of human red cells was named Rh. Rh was retained for the human produced antibody.

D antigen

Close D gene Production RBC

C antigen C gene Linkage

Surface Path way E gene

E antigen

Chromosome

The Rh phenotype of a given red cell is defined by the presence or absence of D, C, c, E, and e antigen. The D antigen has a frequency of 85% Rh +ve phenotype denotes the presence of D antigen while Rh –ve phenotype denotes the absence of D antigen. It is essential to bear in mined that (d) is not an antigen, but simply represents the absence of Rh D antigen. C,c, E, and e represent actual antigens recognized by specific antibodies. The antigens of Rh system are cell bound and not present in the serum. The results of typing do not define genotype, it only define the phenotype. Probable genotypes are useful for parentage studies as well as for population studies. Probable genotype also may be useful in predicting the likelihood of hemolytic disease of the new born (HDN) for the offspring of women with a Rhesus antibody. See table

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Reaction with antisera*** | | | | | Phenotype | Common genotype and % | Code | Other possibility genotype |
| Anti D | AntiC | Anti E | Anti c | Anti e |
| **+** | **+** | **-** | **+** | **+** | DCce | DCe/dce  (35%) | R1r | dCe/Dce |
| **+** | **+** | **-** | **-** | **+** | DCe | DCe/DCe  (19%) | R1R1 | DCe/dCe |
| **+** | **+** | **+** | **+** | **+** | DCcEe | DCe/DcE  (13%) | R1R2 | DCe/dCe  dCe/DcE  DCE/Dce |
| **-** | **-** | **-** | **+** | **+** | ce | Dce/dce  (15%) | Rr | ----------- |

As the Rhesus gene complex consists of 3 alleles that determine the production of the combination of 3 antigens, there are 8 Rhesus gene complexes that for reasons of simplicity are coded as following:

|  |  |  |
| --- | --- | --- |
| genes | code | % in population |
| CDe | R1 | 42% |
| Cde | R | 38% |
| Cde | R2 | 14% |
| cDe | R° | 2% |
| CDE | Rz | 1% |
| CdE | rʼʼ | 1% |
| Cde | rʼ | 1% |
| CdE | rv | Very rare |