EXCHANGE TRANSFUSION

THESIS

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By

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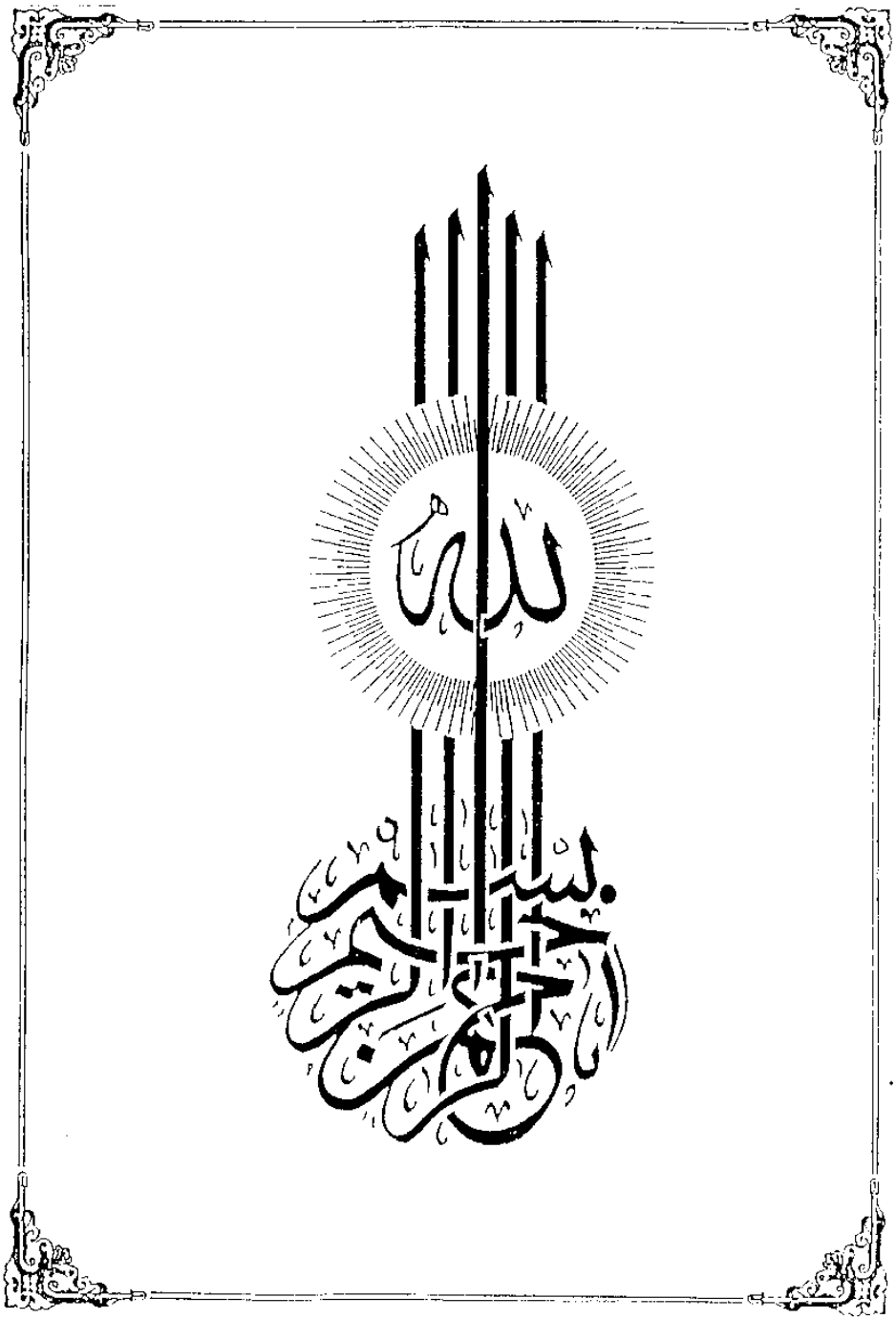
TO MY PARENTS



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Miguèle Lucien Bocti.

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INTRODUCTION AND AIM OF THE WORK

INTRODUCTION

Exchange Transfusion is considered a life-saving procedure in cases of hemolytic diseases of the newborn due to Rh or ABO incompatibilities.

Exchange Transfusion is so universally accepted as the treatment of choice that some physicians use this treatment without question in all cases of erythroblastosis to prevent kernicterus and its sequelae, no matter how mild they may be.

Other goals of Exchange Transfusion therapy are :

1] To prevent intrauterine or extrauterine death from severe anemia and its complications in a patient who has potential or actual cardiac failure.

2] To avoid neurotoxicity from hyperbilirubinemia.

3] To treat many other cases as acute chloramphenicol toxicity, boric acid poisoning, severe toxemia, neonatal myasthenia and neonatal hyperviscosity.

Results have proved to be favorable with a death rate varying between 1.0 to 8.0 per cent.

Some complications have been noticed but most of them can be avoided when Exchange Transfusion is done under optimum circumstances.

AIM OF THE WORK

The aim of this work is to emphasize the different uses of the Exchange Transfusion in pediatric diseases, to indicate the types and the blood needed.

It also gives a description of the different procedures for Exchange Transfusion, its effects and complications.

INDICATIONS FOR EXCHANGE TRANSFUSION

EXCHANGE TRANSFUSION

Exchange Transfusion is becoming more & more popular in the treatment of many cases in pediatric diseases and has proved to be life saver giving better results than the treatment with conventional methods.

Hereunder are findings of Exchange Transfusion treatment in the following diseases :

1] Erythroblastosis fetalis

2] Boric acid poisoning

3] Severe toxemia

4] Severe anemia

5] Severe iron deficiency anemia prior to emergency surgery

6] Sickle cell anemia

7] Acute fulminating hepatitis and hepatic coma

8] Hyperleukocytosis, anemia and metabolic abnormalities in patients with leukemia

9] Acute chloramphenicol toxicity

10] Neonatal myasthenia

11] Neonatal hyperviscosity

12] Severe neonatal septicemia

INDICATIONS OF EXCHANGE TRANSFUSION

I EXCHANGE TRANSFUSION IN ERYTHROBLASTOSIS FETALIS (HEMOLYTIC ANEMIA OF THE NEWBORN)

It has been estimated that approximately 5 to 15% of all live-born infants with erythroblastosis will develop kernicterus if untreated.

About 70% of babies with kernicterus will succumb within 7 days of birth of the 30% that survive the acute stage of cerebral symptoms, neurologic sequelae are likely to develop at a later date. They constitute about 10% of all cases of cerebral palsy (Hsia et al, 1952)

Kernicterus has been established as a post-natal complication and is almost preventable.

Assiduous attention to maintain serum bilirubin concentrations at levels below 20 mg/100 ml by one or more Exchange Transfusions has led to a remarkable reduction in the incidence of kernicterus (Smith, 1972)

OBJECTIVES OF TREATMENT

The treatment of the infant with erythroblastosis fetalis has three major aims:

1) The prevention or control of cardiac failure
2) The prevention or control of bilirubinemia in an effort to prevent the occurence of kernicterus
3) The control of anemia

The mainstay of treatment is the Exchange Transfusion, but its successful achievement depends upon many correlated items of procedure. (Smith, 1972)

What an Exchange Transfusion will do ?

Certain conclusions about the effectiveness of Exchange Transfusion may be drawn.

A) Desirable effects efficiently accomplished:

1) Removal of sensitized infant's red cells and replacement with nonsensitizable adult red cells. The usual exchange using donor blood in one and a half to two times the baby's blood volume will accomplish the removal of 85 to 90 per cent of the sensitized red cells.

2) Regulation of the infant's blood volume. The baby with severe erythroblastosis is apt to have increased blood volume, increased venous pressure and heart failure. The exchange can be used to control the blood volume and thus relieve the heart failure.

3) Increase in the oxygen carrying capacity of the infant's blood. The baby who is anemic will benefit of replacement of his blood by donor's blood of a higher hematocrit. This will occur if the infant's hemoglobin concentration is lower than that of the donor's blood (around 10 gm per 100 ml. on the average. (Wheeler.& Ambuel 1957)

B) Desirable effects not efficiently accomplished:

1) Removal of bilirubin. So much of the infant's bilirubin lies extravascularly that whole blood exchange is an inefficient method of bilirubin removal. - (Brown, et al, 1957). Although bilirubin is removed simultaneously with the red cells of the infant, by exchange of plasma, it frequently rebounds to approximately two-thirds of pretransfusion levels because of pigment sequestered

in the extravascular reservoirs. It has been demonstrated that bilirubin accumulates in the plasma during Exchange Transfusion, even while it is being removed, and must therefore enter the circulation from the tissues. Evidence from Exchange Transfusion is that about two-thirds of all bilirubin is extravascular. (Brown, et al, 1957).

2) Removal of antibody. Whole blood replacement is an inefficient means of removal of maternal antibody from the baby because it is also distributed widely in extravascular spaces. (Wheeler, & Ambuel, 1957).
In infants with Rh erythroblastosis the immediate objective is to replace the vulnerable Rh-positive cells, which are the sources of bilirubin, with the calculated amount of Rh-negative cells. The concurrent aim is the removal of pigment from the intravascular and extravascular fluid compartments. This procedure is usually accomplished expeditiously within one to one and a half hours. In the deeply jaundiced patient in whom correction of the anemia may not be so important as the removal of bilirubin, an interval of about 30 minutes to 1 hour may be permitted to elapse between each volume of the exchange. This delay will depend upon the condition of the infant and the general overall care in the treatment room. (Smith, 1972)

The blood volume also can be adjusted by Exchange Transfusion, especially in infants with cardiorespiratory embarrassment. Infants with cord blood hemoglobin levels of 8 gm per 100 ml. or less are often distressed at birth and can be shown to have elevated venous pressure and often cardiac failure. (Mollison & Cutbush, 1949). One factor which may contribute to excessive blood volume and circulatory overload is the sudden passage of placental blood into the newborn infant at birth , hence the precaution of clamping the cord at the earliest moment. In this type of case every effort is made to reduce blood volume and venous pressure by establishing a deficit before beginning the Exchange Transfusion. The venous pressure is measured at intervals during the exchange, and appropriate deficits are created as necessary. The reduction in blood volume and correction of the anemia by an Exchange

Transfusion at birth may be life saving in the severely anemic infant. (Smith, 1972). Although it has been shown without question that Exchange Transfusion for hyperbilirubinemia associated with erythroblastosis fetalis results in lowering the incidence of kernicterus, there is no universal agreement as to the exact indication for it. (McKay, 1964).

According to Smith, 1972, the indications for Exchange Transfusion in hemolytic diseases of the newborn may be summarized as follows:

INDICATIONS FOR IMMEDIATE EXCHANGE AT BIRTH

Assuming that the direct Coombs test is positive, the indications for an immediate exchange are as follows:

1) Clinical signs of severe disease:

a) Pallor

b) Hepatosplenomegaly

c) Poor respiration

d) Jaundice

e) Edema with or without definitive signs of cardiac failure.

2) Laboratory evidence of severe hemolytic disease.

a) Cord hemoglobin of 14 gm/100ml or below (less than 14.5 gm venous blood or 15 gm capillary blood).

b) Reticulocytosis over 6%.

c) Normoblastosis greater than 10 % white blood cells.

It should be remembered, however, that a low cord hemoglobin level may coexist with a low cord bilirubin level (below 3 mg/100ml), hence the greater importance of the former criterion for exchange at birth.