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Morbidity and Mortality from Exchange Blood Transfusion in Neonatal Jaundice

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Summary

Laditan, A. A. O., Effiong, C. E. and Antia, A. U. (1975). *Nigerian Journal of Paediatrics*, 2 (2), 42. **Morbidity and Mortality from Exchange Blood Transfusion in Neonatal jaundice.** 371 exchange blood transfusions were performed on 297 infants with neonatal jaundice over a period of two years in the Department of Paediatrics, University College Hospital, Ibadan.

Our mortality of 0.34 per cent per infant and 0.27 per cent per procedure was low while the complications experienced by us were few and similar to those reported elsewhere. It is suggested that EBT should still be carried out in neonatal jaundice irrespective of its aetiology.

THE hazards associated with exchange blood transfusion (EBT) in neonatal hyperbilirubinaemia (due to causes other than haemolytic disease of the newborn) as compared to the advantages of this procedure, have been a subject of controversy. For instance, Trolle (1961) has suggested that exchange transfusion should not be carried out in cases of neonatal hyperbilirubinaemia of non-haemolytic type because, in about two per cent of such cases, sudden unexpected death occurs. In contrast, Boggs (1965) has recommended that the procedure should be performed in all cases of neonatal hyperbilirubinaemia irrespective of the aetiology. In the department of Paediatrics, University College Hospital (UCH), Ibadan, Nigeria, about 500 cases of neonatal jaundice of various aetiologies are managed per year. Of these 500 cases, nearly 150 require EBT.

The present communication is a review of the morbidity, mortality and other problems associated with EBT procedures carried out in 297 cases of neonatal jaundice over a period of two years. Of the 297 cases, the cause of the jaundice was G6PD defficiency in 41, ABO incompatibility in 15, infection in 71, while the cause was undetermined in 170 cases.

Subjects and Methods

The subjects consisted of infants with neonatal hyperbilirubinaemia who required exchange blood transfusion during the period of July 1971 to June 1973. The average age and weight of the infants at the time of the transfusion, were four days and 3.1 kg. respectively. The indications for carrying out the procedure were:

(*a*) Total unconjugated serum bilirubin level of 20 mg per 100 ml. and above in infants of birthweights 2.5 kg. and above.

(*b*) Total unconjugated serum bilirubin of 15 mg. per 100 ml. or higher in infants of birthweights less than 2.5 kg.

Essential precautions taken before, during and after the procedure consisted of:

(*a*) *Blood*

Fresh blood (not older than four days) compatible with both the baby's and maternal sera, was used in all cases. The donor's blood group was the same as the baby's group. In cases where the jaundice was due to ABO blood group incompatibility, the donor's blood group was the same as the mother's group. In order to prevent post-transfusion anaemia, as much of the citrated plasma as possible, was removed from each blood unit before it was administered.

(*b*) *The Procedure*

At the beginning of the procedure, the venous pressure in the umbilical vein was measured and recorded. 180–200 ml/kg. of semi-packed blood at 37°C was transfused by intermittent technique, using umbilical catheter with a plastic disposable syringe. During the procedure the infant was kept warm by means of padded hot water bottles. One ml. of 10 per cent calcium gluconate was given intravenously via the cannula for every 100 ml. of blood exchanged. Throughout the procedure the heart and respiratory rates, and the colour of the baby were checked and recorded by a nurse every 2–5 minutes. The volume of blood removed from or transfused into the baby was also recorded after every cycle. At the end of the transfusion, prophylactic antibiotics (intramuscular procaine penicillin and streptomycin) were administered daily for five days. Because of a possible malarial parasitaemia in the donor's blood, 50 mg. of chloroquine syrup was also given twice a day for two days at the end of the procedure. In a few cases, digoxin was administered at the beginning, or during the procedure if there was evidence of impending cardiac failure.

Results

During the two-year period of study, 297 babies with neonatal jaundice required a total of 371 exchange blood transfusions. Of the 297 babies, 234 (79 per cent) required one procedure, 53 (18 per cent) required a second exchange transfusion and 9 (3 per cent) a third procedure. One infant was transfused four times.

The mortality of EBT is defined as the number of deaths during the procedure and six hours after it (Boggs and Wesphal, 1960). By this definition, one infant in the present series died during and within six hours of EBT, thus giving a mortality of 0.34 per cent per infant, and a mortality per procedure of 0.27 per cent. The mortality rate in this series compared with those reported from other parts of the world is shown in Table I.

Four other infants died later than six hours after the completion of the procedure, and did not, by definition, fall into the category of mortality from exchange transfusion. Of these four, death was attributed to severe kernicterus in one case, septicaemia in two cases, and gastro-intestinal bleeding in another case. The gastro-intestinal bleeding in the last infant was attributed to perforation of the gut, a well recognized complication of EBT (Orme and Eades, 1968; Hilgartner, Lanzkowowasky and Lipsitz, 1970; Corkery *et al.*, 1968).

Eight (2.2 per cent) of the 371 transfusions were abandoned because of serious complications (Table II). The only infant in the series who died within six hours of EBT had cardiac arrest during his third exchange transfusion. A second baby with cardiac arrest occurring towards the end of the procedure was successfully resuscitated. Three other infants had

TABLE I

Mortality of Exchange Transfusion in the Present Study Compared with other Studies

Study	*Location*	*No. of Babies*	*No. of EBT*	*Related Deaths*	*Per-cent Mortality*	
					per Infant	*per Procedure*
Present	U.C.H.	297	371	1	0.34	0.27
Boggs and Westphal (1960)	U.S.A.	519	875	17	3.30	1.9
Diamond (1966)	U.S.A.	108	120	8	7.40	6.67
Panagopoulos, Valaes and Doxiadis (1969)	Greece	502	606	4	0.79	0.66
Hashemi-Nasab and Ziai (1971)	Iran	143	202	10	6.99	4.95

TABLE II

Major Complications from 371 Exchange Blood Transfusions in 297 Infants:

Complications	*No. of Cases*
Cardiac arrest: died	1
survived	1
Cardiac arrhythmias—Bradycardia	2
Tachycardia	1
Gross abdominal distension with vomiting	1
Vomiting	2
Total	8

various cardiac arrhythmias (bradycardia in two babies, and tachycardia in one). Vomiting associated with gross abdominal distension occurred in one infant, while in two others there was also vomiting without obvious cause. Four other procedures were stopped because of technical problems which consisted of:

(*a*) leakage of blood between the catheter and umbilical vein,

(*b*) difficulty in withdrawing blood in spite of apparently successful introduction of the umbilical catheter and

(*c*) failure to introduce the catheter into the vein in two cases.

The repeat transfusion rate per infant in the present series was 21 per cent compared with the rate of 19, 33 and 45 per cent reported by Panagopoulos, Valaes and Doxiadis (1969), Hashemis-Nasab and Ziai (1971) and Boggs and Westphal (1960) respectively.

Discussion

Since the introduction of exchange blood transfusion in 1945 for the treatment of haemolytic disease due to Rh incompatibility, the procedure has altered the prognosis in neonatal hyperbilirubinaemia caused by various factors.

Death and the tragic consequences of kernicterus have been reduced by this simple therapeutic measure. Recent introduction of another therapeutic measure namely, administration of anti-D gammaglobulin to a Rh negative mother soon after delivery of the first and subsequent Rh positive, ABO-compatible babies, has further reduced the number of EBT in haemolytic disease of the newborn (Freda *et al.*, 1967; Clarke, 1968). However, there is still a great need for EBT in cases of neonatal jaundice caused by factors other than haemolytic disease of the newborn. Our experience has shown the procedure to be simple and safe.

The mortality of 0.34 per cent per infant in the present series was significantly lower than 3·3, 7·4 and 6.99 per cent reported by Boggs and Westphal, (1960); Diamond, (1966) and Hashemi-Nasab and Ziai, (1971) respectively. The low mortality in this series may be attributed to two important factors:

(*a*) The low incidence of Rh. incompatibility in which the jaundice and anaemia are usually rapidly progressive leading in some babies to severe congestive heart failure or hydrops foetalis; and

(*b*) the average age of the infants at the time of transfusion.

In our series the average age was four days, while in those series with high mortality (Boggs and Westphal, 1960; Diamond, 1966), the average age was under 24 hours.

The rate of repeat exchange transfusion of 21 per cent in the present series compares favourably with 19 per cent reported by Panagopoulos, Valaes and Doxiadis (1969). These authors have attributed the low rate of repeat transfusion in their series to (*a*) minimum mechanical damage to the donor's blood during the procedure, and (*b*) the use of a serum bilirubin level of 25 mg. per 100 ml. for the initial and repeat exchanges in all cases other than those caused by haemolytic diseases of the newborn. We are of the opinion that our low rate of repeat transfusions was due to the longer duration of the procedure which was kept between $1\frac{1}{2}$ and 2 hours in all our cases. This long duration allowed a cycle to last 3–5 minutes and by so doing resulted in a thorough exchange. In contrast, Boggs and Westphal (1960); and Panagopoulos, Valaes and Doxiadis (1969) had a duration of 30–40 minutes and 45–60 minutes respectively for their exchange transfusion.

Panagopoulos, Valaes and Doxiadis, (1969) have stated that EBT requires a little experience, and is safe in the hands of junior residents with a little training. We are fully in agreement with this statement. Our mortality from this procedure, carried out on many infants with hyperbilirubinaemia not caused by Rh incompatibility, even in the hands of very junior residents, was less than one per cent. This experience contradicts the suggestion by Trolle (1961), that the procedure should be discouraged when hyperbilirubinaemia is not due to haemolytic disease of Rhesus incompatibility because of the high mortality associated with exchange transfusion in such cases.

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