Chapter 2

Review of Related Literatures

Tapia et al from Chile did the study comparing normal saline and albumin to fresh frozen plasma by using erythropheretic technique[15]. The polycythemic infants were also randomized into different study groups and the volume of blood exchange was calculated according to Rawlings nomograms. They did not find any signiticant difference in term of hematocrit (Hct), viscosity (V) and sodium value (Na) (Table).

Group	Saline (n-10)	Plasma (n-9)	Albumin (n-10)
Birthweight (g)	279 1 ± 758	3419 ± 762	2457 ± 625
Gestation (W)	38.4 ± 2	38.7 ± 1.8	36.5 ± 2.5
Hctpre-E (%)	72.4 ± 2.5	72.5 ± 2.4	70.9 ± 2.1
Hctpost	56.7 ± 4.3	56.1 ± 5.3	57.8 ± 3.8
Hct 12-24 h post	56.1 ± 4	54.2 ± 2.7	57.7 ± 4.3
V pre-E (mPa s)	8.5 ± 1.7	9.1 ± 1.2	5.6 ± 1.3
V post	5.5 ± 1	6 ± 0.7	6 ± 1.2
Na pre - E	137.4 ± 3.3	138.4 ± 2.3	138.1 ± 1
Na 12-24h post	138.7 ± 2.7	139 ± 1.3	136.6 ± 2.7

$P< 0.05$ by ANOVA used for significance.

They concluded that the 3 solutions were as effective in decreasing significantly the hematocrit and viscosity. In the 3 groups the decrease of hematocrit equally persisted in time and sodium remained without significant changes. Normal saline solution has the advantage of less risk and cost.

As we can see, this document was only the abstract. The study was small including small power and it was hard to obtain any significant value out of such a small number of population. It also did not clearly show the time at diagnosis, time when treatment started and the duration of waiting time for treatment. These times are important because if they are different in between groups, they would interfere with the outcome. Normally the time to wait for plasma was the longest time and the blood banking process took a long time, at least 3 hours. The value of hematocrit would come down by itself before treatment started. The study did not state that pre-exchange hematocrit was an immediate pre-exchange or hematocrit at diagnosis. Therefore, the result was still controversial.

For hemaccel study[16], the power of the study was also small, less than 20 sample size, the method was not clear and the result was also controversial.

Although normal saline are cheap, safe from infection and always available, the side effects are unable to maintain adequately in the vascular compartment, hypernatremia and hyperchloremia and dilutional effect of all blood chemistries and coagulation factors[8]. By balancing the risk and benefits of normal saline and plasma, normal saline is still of lesser risk than all the risk of plasma.

Normal saline solution contains 154 mEq/L of sodium. This amount is not far more than the amount of sodium in fresh frozen plasma of 135-145 mEq/L.

The newborn infants'kidneys cannot tolerate saline loading of greater than 2.2 mEq/kg body weight over a short period of time in the immediate post natal period due to the limited ability to excrete the excess amount of sodium by immature tubules[17]. Serial records of blood chemistry of newborn each hour after birth have shown high values in the first 4 hours of life, which gradually decreased except for total protein which was lower in the first hour of life then increased[18].

During the process of partial exchange transfusion using normal saline, the maximum amount of blood taken out from the severest polycythemic infants with hematocrit of 80% is not greater than 30% of blood volume. An addition of sodium given by normal saline in equal volume of blood taken out is less than 0.5 mEq/kg body weight is far from the level of unbearable saline loading and the level of sodium and chloride will still be within normal limit for term infants.

Exchange of sodium calculation is shown here

Volume of blood taken out

$$= \frac{\text{observed Hct-desired Hct x blood volume x body weight}}{\text{Observed Hct}}$$

Where :

Observed Hct = hematocrit at immediate pre exchange

Desired Hct = mean hematocrit of the normal fullterm infants =55%

Blood volume = volume in ml. of blood according to Rawlings et al nomogram[19]

Body weight = birthweight in kilogram

Four Kilogram newborn who has peripheral venous Hct 80%

Volume of blood taken out $= \frac{(80 - 55) \text{ X } 4 \text{ X } 76}{80} = 95$ ml.

Normal saline 1000 ml contain sodium 154 mEq/L

Normal saline 95 ml. contain sodium $= \frac{154 \times 95}{1000} = 14.6$ mEq

Blood taken out 95 ml. contain sodium $= \frac{0.2 \times 95 \times 145}{1000} = 2.8$ mEq

Total sodium that the infants will get from NSS = 14.6 - 2.8 = 11.8mEq

FFP 1000 ml. contain sodium 145 mEq

FFP 95 ml. contain sodium $= \frac{145 \times 95}{1000} = 13.8$ mEq

Total sodium that the infants will get from FFP = 13.8 - 2.8 = 11 mEq

Additional sodium from NSS (more than FFP) = 11.8 - 11 = 0.8 mEq

Infants will get additional sodium from NSS = $\frac{0.8}{4}$ = 0.2 mEq/Kg

For economic study, there was no report at all in the medical literature. This report is going to be the first one ever to be done.