Original Article

To Compare the Iron Status of New Borns` 48 Hours After Birth in Delayed Versus Early Umbilical Cord Clamping

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Abstract

Objectives: To compare the iron status of new-born's 48 hrs. after birth in delayed versus early umbilical cord clamping.
Study design: Randomized controlled trials with double blinding
Setting: Department of Obstetrics and Gynaecology, CMH, Quetta.
duration of study with dates: Study was carried out over a period of six months from 10-09-2013 to 09-03-2014.
Methodology: A total of 222 patients (111 in each group) were included in the study. Patients were divided in two groups, delayed cord clamping (Group-A) and early cord clamping (Group-B).
At the time of delivery, maternal venous blood (2ml) was collected in vials that contain EDTA in order to calculate haemoglobin and haematocrit level of the mother. For the new-born, 5ml of blood was taken 48 hours after delivery in both EDTA containing vials and plain vials to estimate Haemoglobin, Haematocrit and ferritin levels respectively.
Results: Mean age was 27.86±2.50 years and 29.09±2.20 years in group-A and B, respectively. Mean gestational age in group-A was 38.79±0.59 and in group-B was 38.59±0.56 weeks. Mean parity was 2.10±0.90 and 1.91±0.77, in group-A and B, respectively. Comparison of haemoglobin (gm/dl) of baby at 48 hours after birth revealed haemoglobin mean 16.45±0.84 in group-A and 14.32±1.08 in group-B. There was a statistically significant difference between two groups ($p<0.001$). In group-A, mean haemocrit of baby at 48 hours after birth was 49.41±2.85 while in group-B mean haemocrit was 43.06±3.90. Statistically significantly difference found between two groups ($p<0.001$). Serum ferritin level of baby after 48 hours of birth showed mean Serum ferritin of group-A 265.79±52.85 and mean Serum ferritin 188.64±35.03 of group-B ($p<0.001$).
Conclusion: It is concluded that iron stores and Hb in infancy can be improved in neonates by delaying cord clamping at birth. Delayed cord clamping at $\geq$ 180 seconds after delivery of baby could help to prevent iron deficiency.
Key words: Early cord clamping, delayed cord clamping, iron status

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Introduction

Iron deficiency and iron deficiency anaemia are major public health problems in young children worldwide especially in developing countries and are associated with poor neurodevelopment.[1] It is estimated that up to 50% of children in developing countries become anaemic at 12 months of age.[2]

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Young children are at particular risk of iron deficiency because of high iron requirements during rapid growth in combination with low iron intake.[1] During the 1st six months of life infants are largely dependent on iron supply present at birth for growth and haemoglobin production.[2]

Iron supplementation improves psychomotor and mental development in infants and children. Thus, the available evidence suggests that it is important to prevent iron deficiency in infants in order to achieve optimal brain development.[2] Maternal iron status, infant birth weight, gestational age as well as timing of umbilical cord all contributes to establishment of adequate total body weight iron at birth.[3]

During the first minute after birth the new born infant may receive a substantial blood transfusion from the placenta. A term new born held 10cms below the level of uterus during the 1st three minutes of life increases its blood volume by an average of 32%.[1] The optimal time to clamp the umbilical cord for all infants regardless of gestational age or fetal weight is when the circulation in the cord has ceased, the cord is flat and no pulse is evident.(approx. three minutes after birth).[2] Delaying the time at which the umbilical cord is clamped after birth by 2-3 minutes will allow a redistribution of blood between the placenta and new-born favoring a "placental transfusion" to the infant:35-40ml/kg body weight which for a 3kg infant represents 75mg of iron as haemoglobin.[3]

Different studies in different parts of the world have been carried out to assess the beneficial effects of delayed cord clamping on iron status of new-borns.[2] By extending umbilical cord clamping to longer than 3 minutes after birth, infants in low-resource settings experience less anemia, which may have positive effects on health and development.[4]

At the present time, both early and delayed cord clamping procedures are standard practices, giving no clear recommendation for either early or delayed clamping.[2] However, some potentially important advantages of delayed cord clamping in healthy term infants, such as higher birth weight, early hemoglobin concentration, and increased iron reserves up to six months after birth are observed.[5]

Delayed umbilical cord clamping has a growing body of research showing many clinical benefits.[6] It is a cost-free intervention, that if successfully implemented especially in poor areas of the world where the prevalence of infant anemia is high, could be an effective and sustainable means to improve child health and nutrition.[8] These interventions need to start early in their mothers pregnancy (by supplementing her) and continue at birth by delayed cord clamping and promoting early initiation of breast feeding.[7] Delayed cord clamping can be successfully and safely implemented using quality improvement methodology and by engaging a multidisciplinary team.[6]

It is suggested that clinicians inform clients during prenatal classes of the benefits of delayed cord clamping and also use current, evidence-based knowledge to dispel client worries regarding the dangers to maternal-neonate health of delayed cord clamping.[9] The rationale of undertaking this randomized control trial is to compare the effects of delayed with early cord clamping on iron status in new-born 48 hours after birth and to show the beneficial effects of delayed cord clamping in improving iron status of new born and preventing anemia in infants as iron deficiency even without anemia has been associated with impaired development.

Methodology

The study was a randomized controlled trial, which was carried out in Department of Gynecology& Obstetrics CMH Quetta over a period of six months from 10/9/2013 to 09/3/2014.

Patients with age groups between 25-35 years having uncomplicated term vaginal deliveries and having hemoglobin levels >10gm/dl were included in the study.

Pregnant women with preeclampsia, severe heart or renal disease, severe APH,>5 deliveries, GA<38wks were not included. Among babies' twins, asphyxiated deliveries, congenital malformation, hyaline membrane or resp. distress syndrome, sepsis and birth wt. <2000gm were not included.

Administrative permission from the concerned authorities and ethical committee was sought.

Informed written consent was taken by explaining to the patient the risks and benefits of the study and also to draw blood from the new born, use of data for research and publication and details of all investigations to be done. All pregnant women fulfilling the inclusion criterion with gestational age ≥ 38 weeks admitted in the department of Obstetrics and Gynaecology CMH Quetta.

Patients were divided into groups by lottery method. The interventions consist of delayed cord clamping (≥180 sec) or early cord clamping (≤10sec).

At the time of delivery, maternal venous blood (2ml) was collected in vials that contain EDTA in order to calculate haemoglobin and hematocrit level of the mother. For the new-born, 5ml of blood was taken 48 hours after delivery in both EDTA containing vials and plain vials to estimate Haemoglobin, Hematocrit and ferritin levels respectively.

Relevant entries for each participant (mother and the newborn) in both groups will be made in already prepared Performa (Annex A) by researcher.

Statistical Analysis: All data would be entered and analyzed using the SPSS version 17. For quantitative variables maternal age, parity, GA, Maternal Hb, birth weight, new born Hb, Hematocrit and serum ferritin levels mean±SD presented. For qualitative variables like timing of cord clamping(early/delayed) frequency and percentage were used for interpretation. For interpretation of results (haemoglobin, haematocrit and serum ferritin of two groups) independent sample t-test would be applied and a P value of less than 0.05 was considered significant.

Results

A total of 222 patients (111 patients in each group) were included in this study during the study period of six months from 10-09-2013 to 09-03-2014.

Patients were divided in two groups, delayed cord clamping (Group-A) and early cord clamping (Group-B).

In group-A, 96 patients (86.5%) and in group-B, 84 patients (75.7%) were between 25-30 years old. 15 patients (13.5%) from group-A and 27 patients (24.3%) from group-B were 31-35 years of age. Mean age was 27.86±2.50 years and 29.09±2.20 years in group-A and B, respectively. Mean gestational age in group-A was 38.79±0.59 and in group-B was 38.59±0.56 weeks.

Parity distribution was as follows: In group-A, primigravida were 22 (19.8%) and in group-B 24 (21.6%). 62 patients (55.9%) from group-A and 71 patients from group B were para 1-2 while 27 patients (24.3%) from group-A and 16 patients from group-B were para 3-4. Mean parity was 2.10±0.90 and 1.91±0.77 in group-A and B, respectively.

Comparison of haemoglobin (gm/dl) of baby at 48 hours after birth revealed haemoglobin mean 16.45±0.84 in group-A and 14.32±1.08 in group-B. There was a statistically significant difference between two groups (p<0.001) (Table I).

Table I: Comparison of haemoglobin (gm/dl) of babyat 48 hours after birth

Group	Mean	Standard` deviation
Group-A Delayed cord clamping	16.45	0.84
Group-B Early cord clamping	14.32	1.08
t value	16.327	
p value	**P < 0.001**	

In group-A, mean haemocrit of baby at 48 hours after birth was 49.41±2.85 while in group-B mean haemocrit was 43.06±3.90. Statistically significantly difference found between two groups (p<0.001) (Table II).

Table II: Comparison of hematocrit of baby at 48 hours after birth

Group	Mean	Standard deviation
Group-A Delayed cord clamping	49.41	2.85
Group-B Early cord clamping	43.06	3.90
t value	13.830	
p value	**P < 0.001**	

Serum ferritin level of baby after 48 hours of birth showed mean Serum ferritin of group-A

265.79±52.85 and mean Serum ferritin 188.64±35.03 of group-B (p<0.001) (Table III).

Table III: Comparison of serum ferritin of baby at 48 hours after birth

Group	Mean	Standard deviation
Group-A Delayed cord clamping	265.79	52.85
Group-B Early cord clamping	188.64	35.03
t value	12.817	
p value	**P < 0.001**	

Discussion

Iron deficiency in the first few months of a child's life is a public health problem. The consequences are both immediate and long-term consequences, such as erythropoiesis and reduced capacity transport oxygen, effects on myelination and synaptogenesis, effects on growth and damage to enzymatic and metabolic functions and to the immune response system, as well as abnormalities in motor and cognitive development.[12] The World Health Organization (WHO) estimates that around 42.0% of pregnant women and 30.2% of women of childbearing age are anemic. This condition is related to the risk of premature birth, poorer Apgar scores, low birth weight, low concentrations of ferritin and development of childhood iron deficiency anemia.[13]

The factors which determine childhood iron deficiency are principally related to post-natal speed of growth and to reserves of this mineral at birth.[22] These are acquired during the final trimester and are crucial for maintaining an adequate nutritional state of iron in the first months of life. Delayed clamping of the cord is recommended as a simple and low-cost strategy for improving iron stores at birth and preventing childhood anemia.[14]

The literature differs concerning classifying what is early and what is delayed clamping. Early is considered to be immediately or within 15 seconds of birth, and delayed that performed after one, two or three minutes, or when the cord ceases to pulsate.[11,14]

It has generally been observed that healthy breastfed infants are unlikely to become iron deficient before 6 months of age.[15] This is possibly because of the high bioavailability of iron from breast milk and not much increase in utilization of body iron during this period.[16] Between 4-12 months of age, body iron is expected to increase by 70%, thus making this a period vulnerable to iron deficiency anemia. The recent NFHS[17] survey has reported very high prevalence of anemia both in mothers and their children in India, with almost a quarter of children of severely anemic mothers being also severely anemic.[17]

Iron stores at birth correlate with iron stores at 6-12 months. Studies have observed that infants of mothers with moderate and severe anemia had significantly lower cord serum ferritin levels and hence lower iron stores at birth.[18,19]

It has also been observed that even in iron replete Indian mothers (serum ferritin >10 µg/L), the cord ferritin was significantly lower compared to western reports.[19] Iron store at birth is an important determinant of anemia in infancy. Delayed clamping of cord at birth has been suggested as a possible strategy to prevent anemia in infants between 4-11 months of age.[20]

Babies with umbilical cord clamping of > 60 seconds had higher mean ferritin levels at birth, similar to what has been shown in other studies evaluating different parameters of the nutritional state for iron at birth. In the study by Shirvani et al, 100 Iranian children were divided into two groups, using a cutoff point of 15 seconds. Forty-eight hours after birth, analysis showed higher levels of hemoglobin in the group with clamping > 15 seconds.[2] In a study conducted in Argentina, evaluating full-term newborns six hours after birth, times of 15 seconds, one and three minutes were tested. The authors observed lower prevalence of low hematocrit levels in the groups with times of one and three minutes, compared with the 15 second group[21] Emhamed et al compared hemoglobin levels in 104 Lebanese children 24 hours after birth, using clamping time of 10 seconds (early) and after cessation of umbilical cord pulsations (delayed) as criteria. The authors found better hemoglobin levels in babies with delayed clamping.[22]

Delayed clamping in full-term babies may encourage increased blood volume of between 25 and 35 mL/kg of body mass, equivalent to 46 to 60 mg of iron from hemoglobin. This would be enough to maintain the necessary levels of iron for the first three months of life, which could make a great difference to the first six months of life of vulnerable babies.[14]

Two randomized controlled trials have evaluated the effect of delayed cord clamping on iron stores in infancy. A trial from Guatemala[10] randomized 69 neonates to one of three groups at delivery: (a) cord clamped immediately at delivery, (b) clamped when cord stopped pulsating with newborns placed at level of placenta, and (c) clamped when cord stopped pulsating with newborn placed below the level of placenta. At two months after delivery the group with delayed clamping had significantly higher hemoglobin levels than the early clamping group. Like above-mentioned studies, these findings are also comparable with our results.

Conclusion

It is concluded that iron stores and Hb in infancy can be improved in neonates by delaying cord clamping at birth. Delayed cord clamping at $\geq$ 180 seconds after delivery of baby could help to prevent iron deficiency.

Therefore, it is suggested that recommending delay in cord clamping specially in infants born to anemic mothers could serve as an additional cost-effective intervention in our anemia prevention/control program.

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