Original Research Article

Assessment of effectiveness of delayed cord clamping and umbilical cord milking in early term and preterm infants

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ABSTRACT

Background: Early cord clamping and cutting of the umbilical cord is widely practiced as part of the management of labor; it could deprive the neonate of about a quarter of its blood volume and iron. This thesis is aimed at comparing effects of delayed cord clamping versus umbilical cord milking at birth in preterm and early term infants.

Methods: This single centered randomized study was conducted in Department of Pediatrics and data collection was done on the basis of the preterm and early term infants delivered by vaginal or cesarean delivery in Department of Gynecology, Geetanjali Medical College and Hospital, Udaipur during period of January 2016 to January 2017. Total of 120 infants were included in the study.

Results: Statistically it has been analyzed that in both pre-term and early term infants who underwent DDC and UCM, there was insignificant difference in level of hemoglobin (Hb), haematocrit (HCT), blood sugar, bilirubin level (TSB) and temperature of body. On the other hand, significant difference was observed in weight and cord pH of neonates of both groups. There is also insignificant difference in terms of NICU admission for RDS, sepsis, phototherapy, need of oxygen, saline boluses, PRBC transfusion, polycythemia.

Conclusions: Thus, overall it was observed that there is insignificant difference in delayed cord clamping and umbilical cord milking group. Thus, both are found to be equally effective in improving hematologic parameters.

Keywords: Delayed cord clamping (DCC), Early term, Early cord clamping (ECC), Pre-term, Umbilical cord milking (UCM)

INTRODUCTION

After delivery, a large volume of blood remains in the placenta and umbilical cord that could be the source for an autologous "Placental transfusion".¹ A newborn who receives a placental perfusion at birth either from cord milking or delayed cord clamping, obtains about 30% more blood volume than the newborn whose cord is cut immediately.² Receiving an adequate blood volume from placental transfusion at birth may be protective for the distressed neonate.³ Early cord clamping and cutting of the umbilical cord is widely practiced as part of the

management of labor, but recent studies suggest that it may be harmful to the baby.⁴ Early cord clamping could deprive the neonate of about a quarter of its blood volume and iron.⁵

World Health Organization recommends delaying cord clamping (defined variably as till pulsations cease or up to 120-180 sec) as the standard of care in the delivery room.⁶

The benefits of delayed cord clamping include improved iron status, hemoglobin reduced need for blood

transfusion, prevents perinatal brain injury and improved hemodynamic stability after birth.⁷

Yet, there appears to be concerns about practicing delayed cord clamping especially in neonates needing resuscitation. In such situations, an alternative that could provide the newborn with the desired additional blood is Umbilical Cord Milking (UCM).⁸

Thus, this study aims to compare the effectiveness of DCC and UCM so as to improve hematologic parameters of pre-term and early term infants without affecting the cerebral blood flow indices or producing any noteworthy significant adverse neonatal outcome in initial 48 hours of life.

METHODS

This single centered randomized study was conducted in Department of Pediatrics and data collected was done on the basis Preterm and early term infant delivered by vaginal or cesarean delivery in Department of Gynecology, Geetanjali Medical College and Hospital, Udaipur during period of January 2016 to January 2017.

Inclusion criteria

- Preterm infant (baby delivered before 37 completed week of gestation)
- Early term infant (baby delivered between 37-38 week of gestation).

Exclusion criteria

- Fetal distress
- Non-vigorous baby
- Monochorionic multiples
- Placenta previa
- RH sensitization hydrops
- Congenital anomalies (on antenatal scan).

Total of 120 newborns delivered with gestation age 24 completed weeks to 38 completed weeks that fulfil inclusion and exclusion criteria was considered eligible for enrolment, after taking written informed consent of their parents or guardians.

Out of 120 newborn, 60 undergone DCC and 60 undergone UCM. The analysis was done using the SPSS software version 20. Mean and standard deviation were calculated. Test of significance was done using t-test and Chi-square test. Diagrammatic presentation was done using bar diagrams. $P < 0.05$ was considered as level of significance.

RESULTS

It has been observed from the observations that there was insignificant difference in values of outcomes such as Hemoglobin, HCT, Temperature, TSB and blood Sugar of infants of both groups undergone DCC or UCM ($P > 0.05$). Thus, both processes are leading to same effects and both are effective process.

Table 1: Test of significant difference outcome of infants according to DCC and UCM.

Outcome	DCC (n = 60)		UCM (n = 60)		T value	P value
	Mean	SD	Mean	SD		
Mean weight	1.67	0.35	1.52	0.32	2.45	0.02*
Hemoglobin	17.8	1.4	17.6	1.2	0.71	0.48
HCT	52.7	4.6	52.8	4.3	0.13	0.89
Temperature	36.9	0.25	36.9	0.3	0.61	0.55
TSB	8.48	2.01	8.34	1.53	0.43	0.67
Cord PH	7.41	0.03	7.39	0.03	3.65	0.001*
Blood sugar	84.34	15.04	85.25	15.08	0.33	0.74

Table 2: Test of significant association in health outcome in babies and process of clamping.

Outcome	DCC (%)	Milking (%)	Total (%)	P value
Normal	40 (55.5)	32 (44.44)	72 (100)	0.278
Jaundice	7 (31.82)	15 (68.18)	22 (100)	
RDS	8 (42.10)	11 (57.89)	19 (100)	
Apnea	2(100)	0 (0.00)	2 (100)	
Sepsis	1 (50)	1 (50%)	2 (100)	
Polycythemia	2 (66.67)	1 (33.33)	3 (100)	
Total	60 (50)	60 (50)	120 (100)	

On the other hand, significant difference in birth weight and cord PH was observed in values of outcomes of infants of both groups undergone DCC or UCM ($P < 0.05$) and thus weight and cord Ph of was more in infants undergone DCC as compare to infants undergone process of UCM (Table 1). Out of total of 120 babies, 72 (60.0%) were in normal and healthy condition whereas 22 (18.33%) had Jaundice, 19 (15.83%) had RDS, 3 (2.5%) had Polycythemia and 2 (1.67%) had apnea and sepsis.

Out of 72 healthy babies 40 (55.56%) had undergone DCC and 34 (44.44%) were under milking. Among 22 babies with jaundice 7 (31.82%) had undergone DCC and 15

(68.18%) were under milking, 19 babies with RDS 8 (42.10%) had undergone DCC and 11 (57.89%) were under milking, out of 2 babies with sepsis 1 (50%) undergone DCC and 1 (50%) undergone milking, among 2 babies with polycythemia 2 (66.67%) undergone DCC and 1 (33.33%) undergone milking and 2 (100%) babies with apnea were undergone process of DCC. Out of 65 male children, 29 (44.62%) were undergone DCC and 36 (55.38%) were under milking.

Thus, insignificant difference in association was observed between health outcome of baby and process of clamping (Chi square value = 6.605, p value = 0.278) (Table 2).

Table 3: Distribution of NICU admission as per treatment.

Outcome	DCC (%)	Milking (%)	Total (%)	P value
Phototherapy	4 (36.36)	7 (63.66)	11 (100)	0.81
Need of oxygen	0	0	0	-
Saline Bolus	1 (33.33)	2 (66.67)	3 (100)	1
PRBC Transfusion	2 (66.67)	1 (33.33)	3 (100)	1
Partial exchange for polycythemia	1 (50)	1 (50)	2 (100)	1

There was insignificant difference in outcome due to DCC and Milking according to NICU admission as per treatment such as phototherapy (p = 0.807) and saline bolus, PRBC transfusion and partial exchange for polycythemia. Table 3

Table 4: Neurological outcomes at discharge.

Neurologically Normal	DCC (%)	Milking (%)	Total (%)	P Value
YES	50 (49.50)	51 (50.50)	101 (100)	0.502
NO	11 (57.89)	8 (42.10)	19 (100)	
Total	60 (50)	60 (50)	120 (100)	

Out of 101 infants who were neurologically normal, 50 had undergone DCC and 51 under Milking which was found to be of insignificant difference. Out of 120 infants 19 were found to be neurological abnormality. Among those 19, 11 under gone DCC and 8 under UCM which was also found to be of insignificant difference (Table 4).

DISCUSSION

In present study we observed on the basis of clinical examination that neurological outcome of infants undergoing UCM and DCC have comparable results. Neurological morbidity was significantly less in both the

groups. NICU stay also significantly decreased in both the groups.

Prateek Jaiswal et al had done comparison of umbilical cord milking and delayed cord clamping on cerebral blood flow in term neonates. Two hundred newborns (>36wk) were randomized to UCM and DCC groups.⁹ Resistive Index (RI), Pulsatility Index (PI) and cerebral blood flow velocities of middle cerebral artery (MCA) were measured at 24 to 48h of life. A recent meta-analysis of UCM including seven randomized clinical trials involving 501 infants delivered at < 33 weeks, demonstrated that infants who underwent UCM had a higher hemoglobin level and lower risk of oxygen requirement at 36 weeks and IVH of all grades compared with those who underwent immediate cord clamping. Our results were consistent with this study.

In present study we demonstrated that in both pre-term and early term neonates, the hematological and hemodynamic effects of umbilical cord milking (UCM) were similar to those of delayed cord clamping (DCC) after 60-90 seconds of birth.¹⁰

Both interventions led to comparable results regarding incidence of RDS, supplemental oxygen, need of saline boluses after birth, need of ionotropic support, need of PRBC transfusion, polycythemia, need of partial exchange transfusion for management of polycythemia, jaundice and sepsis. Present results were consistent with the previous studies.¹¹

In the present study, the mean hemoglobin and hematocrit level during the initial 48 hours of life in both the groups were comparable to results observed in previous studies. There have been many trials demonstrating the benefits of DCC on the hematological status in term babies but there have limited trials looking at the benefits of UCM in general and especially in term neonates. As early as in 1960, Lankowsky reported for the first time that DCC has beneficial effects on hemoglobin level of the neonate when he serially assessed them till 96 hours of life.¹²

Grajeda et al also demonstrated that umbilical cord clamping after cessation of cord pulsations resulted in increase in hemoglobin at 2 months of age.¹³ An Indian study also demonstrated that mean hemoglobin and ferritin at 3 months of age was significantly higher in DCC group. The largest trial to evaluate the effect of DCC was done on 476 term babies by Chaparro et al in Mexico.¹⁴ They did serial evaluation of hematological parameters from birth till 6 months of age and reported higher mean corpuscular volume, ferritin, body iron and stored iron. No study has evaluated whether the advantage in hematological parameters persist beyond 6 months of age.

Hosono et al conducted the first randomized controlled trial on 40 very preterm infants of 26-29 weeks of gestation and compared UCM to early cord clamping.¹⁵ They demonstrated higher hemoglobin, decreased number of RBC transfusions and shorter duration of ventilation or

supplemental oxygen in the milked group.¹⁶ A larger randomized controlled trial on 200 term babies by Upadhyay et al also reported that UCM after birth leads to higher hemoglobin and better iron status at 6 weeks of age as compared to babies receiving early cord clamping.¹⁷

Rabe et al reported a higher hemoglobin levels than reported by Upadhyay et al, which was possibly related to the milking technique. Rabe et al milked, when the cord was still attached to the placenta while Upadhyay et al milked after cutting the cord.^{17,18}

So in Rabe et al study the baby got more blood due to subsequent refilling of cord from placenta. In this study we used the same technique of our previous trial that was being practiced in our institution.¹⁹ Rheen et al had also demonstrated higher hemoglobin with DCC in both appropriate for gestational age (AGA) and small for date (SFD) infants at 2-3 months of age.²⁰

This is also close to present study findings. The paucity of data on the effect of DCC or UCM in SFD infant's warrants further research in this population, as SFD constitutes almost 25% of all of babies in developing countries like India.

The study conducted the only trial comparing UCM and DCC in preterm infants. They had randomized relatively small number of 58 preterm infants less than 33 weeks of gestation and reported that both procedures are equally efficacious in improving hemoglobin soon after birth and at 6 weeks of life. Though we also found similar results in term babies, the methodology of the above-mentioned trial and ours differed in terms of time of clamping, frequency of cord milking as well as position of the baby after delivery.²¹

CONCLUSION

Thus, overall from the observations of this study, we can say that there is insignificant difference in delayed cord clamping and umbilical cord milking group. Early cord clamping could deprive the neonate of about a quarter of its blood volume and iron.

Thus, both DCC and UCM are found to be equally effective in improving hematologic parameters of pre-term and early term infants without affecting the cerebral blood flow indices or producing any noteworthy significant adverse neonatal outcome in initial 48 hrs of life.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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