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Effect of Timing of Umbilical Cord Clamping of Term Infants on Maternal and Neonatal Outcome in Benghazi Medical Center 2022-2023

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Background: The best time to clamp the umbilical cord has been disputed for decades, and definitions differ "Early" cord clamping (ECC) occurs before one minute after birth (about 15-30 seconds), whereas "delayed" cord clamping (DCC) occurs after one minute or when cord pulsations have stopped Doctors and midwives have traditionally defined ECC as malpractice, associated with danger and harm to both mother and newborn, and There is strong evidence that early cord clamping causes neonatal hypovolemia, anemia, and poor iron reserves.
Objectives: To determine the levels of newborn hemoglobin and serum ferritin at birth and three months after delivery in infants who had their umbilical cord clamped for 60 seconds. And to determine the levels of newborn hemoglobin and serum ferritin at birth and three months after birth in infants who had their umbilical cord clamped within 30 seconds.

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Subjective and Methods: A randomized controlled trial was conducted in Benghazi Medical Center from June 2021 to March 2022 for 300 pregnant women who were admitted for elective cesarean section: 150 (the control group) received early cord clamping, and 150 (the study group) received delayed cord clamping.
Conclusion: Delay Cord Clamping provides considerable health benefits to term infants; it has been shown to lessen the risk of anemia in babies as young as three months old. Delay Cord Clamping (DCC) in term infants was feasible and safe, and there should be no hesitation in implementing this procedure routinely. Delay cord clamp is beneficial for the Apgar score of babies.

Keywords: Umbilical cord; neonatal; cord clamping; maternal blood transfusion.

1. INTRODUCTION

“At birth, the placenta circulation is cut off, and the peripheral resistance suddenly rises. The pressure in the aorta rises until it exceeds the pressure in the pulmonary artery, and the infant becomes increasingly asphyxiated. Finally, the infant gasps, which contributes to lung expansion, but other factors are likely to be involved” [1].

“The sucking force of the first breath, together with the constriction of the umbilical vein, squeeze s up to 100 ml of blood from the placenta. A rapid increase in pressure has been observed following an early cord clamp” [2].

“Iron deficiency and iron deficiency anemia are serious public health issues in young children all over the world” [3].

The best time to clamp the umbilical cord has been disputed for decades, and definitions differ "Early" cord clamping (ECC) occurs before one minute after birth (about 15-30 seconds), whereas "delayed" cord clamping (DCC) occurs after one minute or when cord pulsations have stopped “Doctors and midwives have traditionally defined ECC as malpractice, associated with danger and harm to both mother and newborn, and There is strong evidence that early cord clamping causes neonatal hypovolemia, anemia, and poor iron reserves” [4].

“DCC has been shown to benefit term and preterm infants by increasing hemoglobin levels blood volume, hematocrit, ferritin, and iron status, improving infants' and children's neurodevelopment, reducing anemia, increasing blood pressure, requiring fewer transfusions, and lowering rates of intraventricular hemorrhage (IVH), chronic lung disease, necrotizing enterocolitis, and late-onset sepsis. DCC may cause polycythemia, jaundice, and a higher demand for phototherapy, as well as maternal postpartum hemorrhage or the need for maternal blood transfusion” [5].

“The newborn's position during delayed cord clamping has traditionally been at or below the level of the placenta, based on the premise that gravity enhances placental transfusion” [6].

The World Health Organization (WHO) has formally approved the practice of 'delayed' cord

clamping. “Early cord clamping has also been eliminated from active management guidelines by the International Federation of Gynecology and Obstetrics and the International Confederation of Midwives” [7].

“Infant anemia is widespread in Sub-Saharan Africa, with more than 75% of infant’s anemic before the age of six months. Infant anemia is linked to an increased risk of death as well as poor mental and motor development. Its prevention is crucial, and delaying umbilical cord clamping could be an effective technique for reducing anemia and improving child survival“ [8].

“Although delayed cord clamping (DCC) is considered the standard of care for all vigorous infants, cesarean delivery babies are less likely to be given this option, especially for more than 30 to 60 seconds” [9].

2. LITERATURE REVIEW

“Over five percent of infants born worldwide will need help breathing after birth. Delayed cord clamping (DCC) has become the standard of care for vigorous infants. DCC in non-vigorous infants is uncommon because of logistical difficulties in providing effective resuscitation during DCC” [10].

"Several randomized controlled trials have reported favorable benefits of DCC on infant hemoglobin at birth or at various follow-up times, demonstrating a subsequent reduction in anemia without intolerable side effects" [11,12].

"A randomized controlled trial conducted in 2007 by Jaleel, R. et al. in the Department of Obstetrics and Gynecology, Dow Medical College, and Lyari General Hospital demonstrated that delayed umbilical cord clamping at birth appears to be safe and can be expected to reduce the prevalence of anemic newborn babies in our community" [11].

"A clinical trial conducted in Zambia in 2007 to demonstrate delayed cord clamping and hemoglobin levels in infancy found that DCC could enhance the hematological status of term newborns living in a malaria-endemic environment at 4 months of age. and the procedure may give a way to lower the incidence of early neonatal anemia" [12].

A clinical trial study conducted by Ceriani Cernadas, J. M., et al. to show "the effect of cord clamping timing on neonatal venous hematocrit values and clinical outcome at term discovered that DCC of term newborn infants at 1 or 3 min improved venous hematocrit levels measured at 6 h after birth within a physiologic range and decreased the prevalence of neonatal anemia without any harm to newborns or mothers" [13].

At 2017 Chen, X., and Li, X. conducted "a randomized experiment in China in which 720 term newborns were randomly assigned to ECC (15 s) or DCC (30, 60, 90, 120, 150, or 180 s, or when the umbilical cord pulsation stopped). to demonstrate the effect and safety of cord clamping timing on neonatal hematocrit levels and clinical outcomes in term infants. The findings revealed that DCC for at least 60 seconds could significantly improve neonatal hematocrit levels at 24 hours of life and that the mean infant hematocrit increased with increasing DCC time" [14].

At 2007, meta-analysis by Hutton, E et al demonstrated that "Late cord clamping was delayed for at least 2 minutes, whereas most trials did early clamp immediately after birth. Benefits of late cord clamping include improved hematologic state as evaluated by hematocrit, iron status as determined by ferritin concentration and stored iron, and a clinically significant reduction in the risk of anemia from ages 2 to 6 months" [15]

At 2013 a clinical trial conducted by McDonald, S. et al to demonstrate "effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. The result was showed Serum ferritin levels in newborns from the delayed cord clamping group increased. Infants 'ferritin levels remained higher in the delayed cord clamping group than in the early cord clamping group" [16].

"DCC improved hemodynamic outcomes and reduced hospital mortality in many systematic reviews and meta-analyses, supporting current guidelines that promote DCC in preterm newborns" [17].

"In contrast to the ILCOR guidelines, a study conducted in Japan in 2015 by Nakagawa, M., to show the correlation between umbilical cord hemoglobin and the rate of jaundice requiring phototherapy in healthy newborns revealed that umbilical cord hemoglobin may increase neonatal jaundice in newborns" [18].

Several studies have reported the effect of DCC on iron reserves in term and preterm newborns at various follow-up times.

A randomized controlled trial conducted by Gupta, R., et al. at 2002 to evaluate "the effects of cord clamping on iron stores of infants born to anemic mothers at 3 months of age showed that iron stores and Hb in infancy can be improved in neonates born to anemic mothers by delaying cord clamping at birth" [19].

Das, B., et al. conducted "a randomized controlled trial on placental transfusion in 2018 to demonstrate the effect of placental transfusion on iron stores in moderately preterm neonates of 30-33 weeks gestation. The end result was that placental transfusion resulted in significantly greater serum ferritin at discharge in 30 to 33-week premature newborns compared to early cord clamping. However, this improvement did not last until 3 months after PMA" [20].

In a prospective observational study conducted by Andersson et al., iron stores at 4 months in infants born after elective cesarean section with DCC for 30 s were comparable to those in vaginally born infants subjected to DCC for 180 s and were improved compared with vaginally born infants subjected to ECC for 10 s. [21].

On the other hand, Ultee et al. conducted a clinical trial study to show the effect of delayed cord clamping in preterm infants delivered at 34–36 weeks' gestation and observed that DCC did not affect the ferritin level at 10 weeks' age in infants born between 34 and 36 weeks' gestation [22].

Intraventricular hemorrhage (IVH) occurs when a cerebral hemorrhage expands into the brain ventricular system via a variety of mechanisms [23].

Few studies have been conducted on the effect of DCC on IVH in preterm newborns, which are a Mercer JS et al. conducted a randomized clinical trial. To compare the effects of delayed cord clamping (DCC) with immediate cord clamping (ICC) on intraventricular hemorrhage (IVH), it was determined that DCC had no influence on the incidence of IVH in preterm newborns. High-risk demographic for IVH [24].

A historic cohort study conducted by Chiruvolu, A., et al. to determine whether implementation of the DCC process would reduce the incidence of IVH in very preterm infants without adverse consequences The result, associated with a significant reduction in IVH DCC in very preterm infants, appears to be safe, feasible, and effective with no adverse consequences [25].

A randomized controlled trial was conducted in Benghazi Medical Center and Elmgharif Hospital at Ejdabia at2017by Musa O. Busarira, et al To evaluate the benefit of delayed cord clamping on the infant's health status. 2) To assess hemoglobin, iron and ferritin at birth and at 4 months of age in infants who underwent early cord clamping (at 30 seconds) as compared with infants who underwent delayed cord clamping (at 60 seconds) it demonstrated that there was strong association between delayed umbilical cord clamping and improvement of iron indices and developmental mile stones in infants at 4th month of age [26].

Aim and objectives:

- To determine the levels of newborn hemoglobin and serum ferritin at birth and three months after delivery in infants who had their umbilical cord clamped for 60 seconds.
- To determine the levels of newborn hemoglobin and serum ferritin at birth and three months after birth in infants who had their umbilical cord clamped within 30 seconds.

Patient and methodology:

Study area: Benghazi Medical Center

Study period: Jun. 2021 to Mar.2022

Study design: A randomized controlled trial

Sample size:300 pregnant women,150(control group) early cord clamping & 150 (study group) delayed cord clamping.

Study Population: patients for elective cesarean section who attend Benghazi Medical Center At period of the study

Inclusion Criteria: full term pregnant women, Rh+ve, with single fetus, who was delivered by elective cesarean section, and who agreed to participate in the study and signed a written consent

Exclusion Criteria: patient delivered by normal vaginal delivery or by emergency C\S, patient with twine pregnancy and Rh -ve mother

Randomization: There were two theaters for elective CS in the OT ward, which were divided into two groups. theater 1 for cases (DCC) and theater 2 for control (ECC), the selection of the patients who enter which theater was done by the technician of anesthesia and not by the investigator.

Intervention: A doctor performed the cord clamping in the operating room. Cord clamping was performed within 30 seconds for the control group and 60 seconds for the research group the umbilical cord was clamped as early as delayed.

After clamping the umbilical cord, venous blood was drawn from both groups double clamped umbilical cords for a full blood count (collected in EDTA tubes) and serum ferritin (collected in plain tubes), and blood samples were sent to the clinical laboratory for analysis.

The pediatrician performed the first medical examination of the newborn in the labor room. The

last assessment was performed for each baby at 3 months of age, where the complete medical history, medical examination, and necessary investigations were completed with the use of a follow- up sheet.

Data Management: The data analyzed by using the Statistical Package for the Social Sciences (SPSS) program ver.25

Measurements and Statistics: Mean, minimum, maximum, and standard deviation was used. Inferential statistics such as; independent sample T Test, at $p<0.05$ will be used to denote statistical significance.

3. RESULTS

The study population was 300 pregnant ladies admitted for elective lower segment cesarean section, 150 of whom underwent delayed cord clamp and 150 underwent early cord clamp.

The table 1 shows the minimum age of all ladies in the study was 20, maximum age was 43, while the mean age was 32.66, and the SD was 5.949.

Table 2 shows mean age in ladies at (ECC) 26, and in (DCC) was 30, the mean parity in (ECC)3 , while in (DCC) 2 , and the GA was similar 38 weeks.

Table 1. Distribution of age in pregnant ladies in the study

N	Minimum	Maximum	Mean	SD
300	20	43	32.66	5.949

Table 2. Distribution of age, parity, and GA in ladies with early versus delayed cord clamp.

	Early cord clamp		delay cord clamp	
Characters	Mean	SD	Mean	SD
Age	26	5.83	30	6.04
Parity	3	1.62	2	1.67
GA	38.07	0.68	38.23	0.271

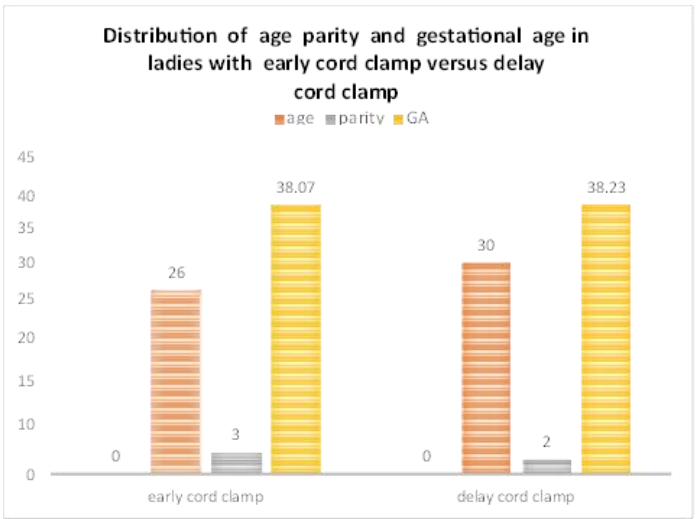

Fig. 1. Distribution of age, parity, and GA in ladies with early versus delayed cord clamp

Table 3. Distribution of the ladies by the time of cord clamping and the level of their hemoglobin

Group	Mean	SD	P value
Maternal Hb (early cord clamp group)	11.5	1.005	0.364
Maternal Hb (delay cord clamp group)	11.7	1.02	

Table 3. shows there is no significance between Hb level in ladies in ECC and in DCC was almost similar 11.5

Table 6 shows there is strong significance difference in Hb and HCT level after 3 monthes in babies with ECC versus babies with DCC p value < 0.005

Table 7 shows highly significance differences in serum iron and serum ferritin in both groups (ECC and DCC) P value <0.005

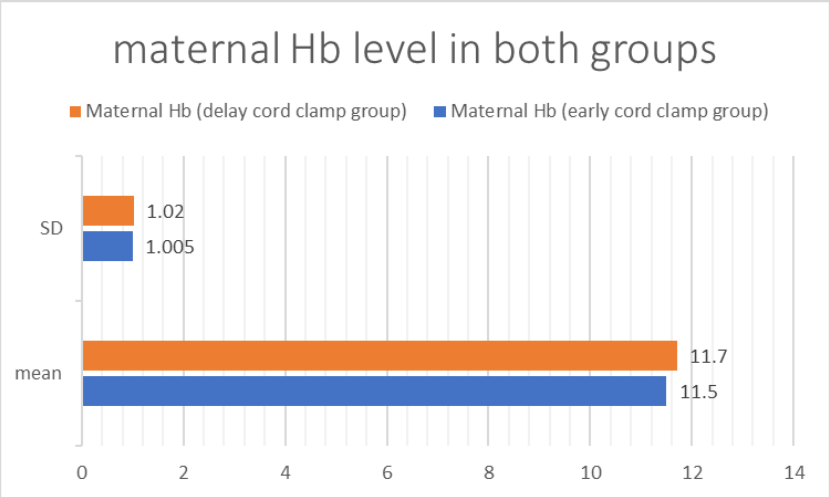

Fig. 2. Distribution of the ladies by the time of cord clamping and the level of their hemoglobin.

Table 4. Distribution of the babies by the time of cord clamping and the Apgar score at 1 minute and at 5 minutes post- delivery

Group	Mean	SD	P value
Apgar score at 1 min.(ECC)	8.5	.50990	0.017
Apgar score at 5 min. (ECC)	9	.48423	
Apgar score at 1 min.(DCC)	9	.00000	
Apgar score at 5 min. (DCC)	10	.00000	

There is significance different in Apgar score in babies with ECC and babies with DCC P value <0.05 (independent t test)

Table 5. Distribution of the infants by the time of cord clamping and the level of their hemoglobin and hematocrits at birth

Group	Mean	SD	P value
Hb level (ECC)	12.7	1.58252	.000
HCT (ECC	55.4231	1.17211	
HB(DCC)	18.0167	1.44725	.000
HCT(DCC)	64.6000	2.63400	

There is strong significance difference in Hb and HCT level at birth in babies with ECC versus babies with DCC p value < 0.005

Table 6. Distribution of the babies by the time of cord clamping and the level of their hemoglobin and hematocrits after 3 months of delivery.

Group	Mean	SD	P value
Hb level (ECC	12.9	1.35	.000
HCT (ECC	34	1.85	
Hb level (DCC	17.8	1.52	.000
HCT (DCC	36	1.85	

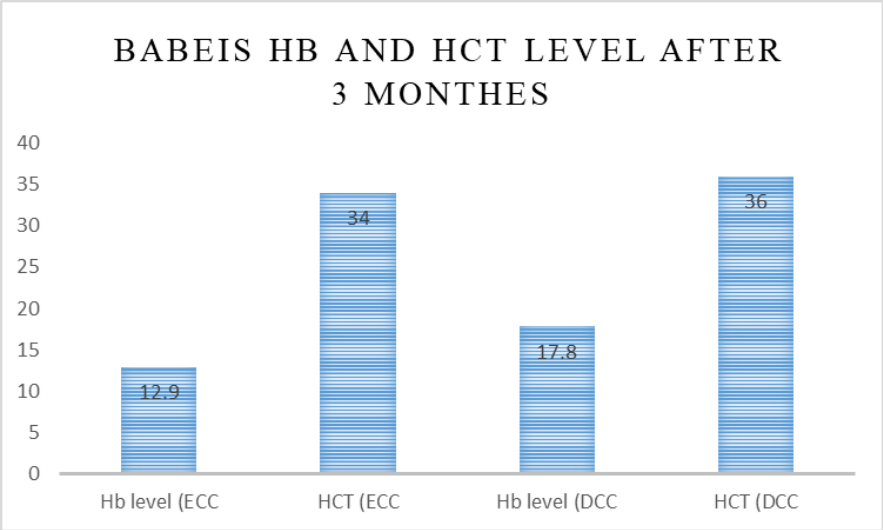

Fig. 3. Distribution of the babies by the time of cord clamping and the level of their hemoglobin and hematocrits after 3 months of delivery.

Table 7. Distribution of the babies by the time of cord clamping and their Serum ferritin, serum iron at the three months of age

Group	Mean (ECC)	Mean (DCC)	P value
S ferritin	69.3	115.5	.000
S iron	86.5	117.3	

4. DISCUSSION

National and international organizations recommend delaying cord clamping for at least 30–60 seconds after delivery. Delay in cord clamping has been proven to enhance blood volume, hematocrit, hemoglobin, ferritin, and iron reserves in term babies. It reduces anemia while also improving long-term neurodevelopmental results. Delaying cord clamping is unlikely to increase maternal postpartum hemorrhage [1].

Several studies have shown the effect of maternal age, gestational age, parity, and maternal hemoglobin. The effect of these characteristics was eliminated in the current trial, as women in both the delayed and early cord clamped groups were similar in terms of age, gestational age, parity, and hemoglobin level [19,20]

Anemia is defined as a hematocrit (Hct) or hemoglobin (Hgb) concentration that is less than two standard deviations (SD) below the age-specific mean [8].

In our study there is strong significant differences in Hb and HCT level at birth in babies with early cord clamp versus with delayed cord clamp, so reduce risk of anemia in babies with delayed cord clamp (hemoglobin levels was higher in delayed umbilical cord clamping group as compared to early clamping group) (p-value<0.000) this in agreement with study conducted in India [25].

In our study there is significant differences in Hb and HCT level at 3 months in babies with early cord clamp versus with delayed cord clamp, so reduce risk of anemia in babies with delayed cord clamp this in agreement with studies conducted in Lyari, Zambia, China [8,9.11].

In our study there is highly significant differences in s iron and s ferritin level at 3 months in babies with early cord clamp versus wit delayed cord clamp, with P value <0.005 this in agreement with studies in Mexico [27].

The Apgar score is a recognized and practical way for documenting the newborn infant's state shortly after birth, as well as the reaction to resuscitation if necessary. In our study the Apgar score at the first minute of delivery varied from 8 to 9, with the mean Apgar score of 8.5 in early cord clamp, and9 in delayed cord clamp which is

better than the Apgar score at the first minute in research done in Bolivia (their mean was 7.4) [28].

5. CONCLUSION

- Delay Cord Clamping provided considerable health benefits to term infants
- Delay Cord Clamping (DCC) has been shown to lessen the risk of anemia in babies as young as three months old.
- Delay Cord Clamping (DCC) in term infants was feasible and safe, and there should be no hesitation in implementing this procedure routinely.
- Delay cord clamp is beneficial in Apgar score

6. RECOMMENDATION

1. More research is needed to identify the ideal cord clamping time.
2. More studies should be conducted in preterm group to verify the DCC on it.

7. LIMITATIONS

Cost of investigations such as ferritin and iron during delivery and in the third month performed in private laboratories because no investigations are performed in our hospitals except CBC at birth for mothers and their newborns.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Basta M, Lipsett BJ. anatomy, abdomen and pelvis: Umbilical cord. [Updated 2022 Jul 25]. In: Stat Pearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan.
Available:https://www.ncbi.nlm.nih.gov/books/NBK557389
2. Wiberg N, Kallen K, Olofsson P. Delay umbilical cord clamping at birth has effect on arterial and venous blood gases and lactate concentration. British Journal of Obstetrics and Gynecology. 2008; 115(6):697-703
3. Van Rheenen PF, Brabin BJ. A practical approach to timing cord clamping in resource poor settings. BMJ. 2006;333: 954-8.
4. van Rheenen PF, Brabin BJ. A practical approach to timing cord clamping in resource poor settings. BMJ (Clinical research ed.). 2006;333(7575):954–958.
Available:https://doi.org/10.1136/bmj.39002.389236.BE
5. Sæther E, Gülpen FR, Jensen C, Myklebust TÅ, Eriksen BH. Neonatal transitional support with intact umbilical cord in assisted vaginal deliveries: a quality- improvement cohort study. BMC pregnancy and childbirth. 2020;20(1):496.
Available:https://doi.org/10.1186/s12884-020-03188-0
6. Fogarty M, Osborn DA, Askie L, Seidler AL, Hunter K, Lui K, Simes J, Tarnow-Mordi
W. Delayed vs early umbilical cord clamping for preterm infants: A systematic review and meta-analysis. Am J Obstet Gynecol. 2018;218(1):1–18.
7. Yao AC, Hirvensalo M, Lind J. Placental transfusion-rate and uterine contraction. Lancet. 1968;291(7539):380-3.
Available:https://doi.org/10.1016/S0140-6736(68)91352-4 [Accessed 3rd July 2008].
8. McDonald SJ, Middleton P. Effect of timing of umbilical cord clamping of term infants on maternal neonatal outcomes. Cochrane Database of Systematic Reviews; 2008.
9. Welsh S, Elwell J, Manister NN, Gildersleeve RK. Implementing delayed umbilical cord clamping in Cesarean birth using a novel method: A pilot study of feasibility and safety. Journal of Midwifery & Women's Health. 2020;65(1):109–118.
Available:https://doi.org/10.1111/jmwh.13075
10. Blank DA, Badurdeen S, Omar F, Kamlin C, Jacobs SE, Thio M, Dawson JA, Kane SC, Dennis AT, Polglase GR, Hooper SB,

Davis PG. Baby- directed umbilical cord clamping: A feasibility study. Resuscitation. 2018;131:1–7. Available:https://doi.org/10.1016/j.resuscitation.2018.07.020

11. Jaleel R, Deeba F, Khan A. Timing of umbilical cord clamping and neonatal haematological status. JPMA. The Journal of the Pakistan Medical Association. 2009;59(7):468–470.
12. van Rheenen P, de Moor L, Eschbach S, de Grooth H, Brabin B. Delayed cord clamping and haemoglobin levels in infancy: a randomised controlled trial in term babies. Tropical Medicine & International Health: TM & IH. 2007;12(5):603–616. Available:https://doi.org/10.1111/j.1365-3156.2007.01835.x
13. Ceriani Cernadas JM, Carroli G, Pellegrini L, Otaño L, Ferreira M, Ricci C, Casas O, Giordano, D, Lardizábal J. The effect of timing of cord clamping on neonatal venous hematocrit values and clinical outcome at term: A randomized, controlled trial. Pediatrics. 2006; 117(4):e779–e786. Available:https://doi.org/10.1542/peds.2005-1156
14. Chen X, Li X, Chang Y, Li W, Cui H. Effect and safety of timing of cord clamping on neonatal hematocrit values and clinical outcomes in term infants: A randomized controlled trial. Journal of perinatology: Official Journal of the California Perinatal Association. 2018; 38(3):251–257. Available:https://doi.org/10.1038/s41372-017-0001-y
15. Hutton EK, Hassa ES. Late vs early clamping of the umbilical cord in full- term neonates: Systematic review and meta-analysis of controlled trials. JAMA. 2007;297(11):1241–1252. Available:https://doi.org/10.1001/jama.297.11.1241
16. McDonald SJ, Middleton P, Dowswell T, Morris PS. Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. The Cochrane database of systematic reviews, 2013;2013(7):CD004074. Available:https://doi.org/10.1002/14651858.CD004074.pub3
17. Qian Y, Ying X, Wang P, Lu Z, Hua Y. Early versus delayed umbilical cord clamping on maternal and neonatal outcomes. Archives of gynecology and obstetrics. 2019;300(3):531–543. Available:https://doi.org/10.1007/s00404-019-05215-8
18. Nakagawa M, Ishida Y, Nagaoki Y, Ohta H, Shimabukuro R, Hirata M, Yamanaka M, Kusakawa I. Correlation between umbilical cord hemoglobin and rate of jaundice requiring phototherapy in healthy newborns. Pediatrics International: Official Journal of the Japan Pediatric Society. 2015;57(4):626–628. Available:https://doi.org/10.1111/ped.12583
19. Gupta R, Ramji S. Effect of delayed cord clamping on iron stores in infants born to anemic mothers: A randomized controlled trial. Indian pediatrics. 2002;39(2):130–135.
20. Das B, Sundaram V, Kumar P, Mordi WT, Dhaliwal LK, Das R. Effect of Placental Transfusion on Iron Stores in Moderately Preterm Neonates of 30-33 weeks Gestation. Indian journal of Pediatrics. 2018;85(3):172–178. Available:https://doi.org/10.1007/s12098-017-2490-2
21. Andersson O, Hellstrom-Westas L, Domellof M. Elective caesarean: Does delay in cord clamping for 30 s ensure sufficient iron stores at 4 months of age? A historical cohort control study. BMJ Open. 2016;6(11):e012995.
22. Garton T, Hua Y, Xiang J, Xi G, Keep RF. Challenges for intraventricular hemorrhage research and emerging therapeutic targets. Expert Opin Ther Targets. 2017;21(12):1111– 1122.
23. Mercer JS, Erickson-Owens DA, Vohr BR, Tucker RJ, Parker AB, Oh W, Padbury JF. Effects of placental transfusion on neonatal and 18 month outcomes in preterm infants: A randomized controlled trial. J Pediatr. 2016;168(50–55):e51.
24. Chiruvolu A, Tolia VN, Qin H, Stone GL, Rich D, Conant RJ, Inzer RW. Effect of delayed cord clamping on very preterm infants. American journal of obstetrics andgynecology. 2015;213(5): 676.e1–676.e6767. Available:https://doi.org/10.1016/j.ajog.2015.07.016
25. Dash MB, Murali R, Rajarajewari S. Effect of delayed cord clamping on Hemoglobin level among Newborns in Rajiv Gandi Government women & children Hospital,

Paducherry. American Journal of Nursing Research. 2014;2(1): 7-11. DOI:10.12691/ajnr-2-1-2 [Accessed 3rd July 2008].

26. Musa O. Busarira, orcid, Entesar Alasbaly, Maryam Sulayman Mbark. Effect of Delayed versus Early Cord Clamping on Neonatal Outcomes and Iron Status at 4 Months, Open Journal of Obstetrics and Gynecology. 2019;9(2).

27. Chaparro CM, Neufeld LM, Tena Alavez G, Eguia-Líz Cedillo R, Dewey KG. Effect of timing of umbilical cord clamping on iron status in Mexican infants: A randomised controlled trial. Lancet. 2006;367(9527):1997–2004.

28. Laflamme EM. Maternal hemoglobin concentration and pregnancy outcomes: A study of effects of elevation in el alto, Bolivia. McGill Journal of Medicine. 2011;13(1):47-54. Available:https://www.ncbi.nlm.nih.gov/pmc/articles /PMC3296152/pdf/mjm- 1301-047.pdf [Accessed 3rd July 2008].

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