

Research Article

Effect of Early versus Delayed Cord Clamping on Hematological Parameters of Term Neonates

Pengaruh Penjepitan Tali Pusat Dini Dibandingkan dengan Tertunda pada Parameter Hematologi Neonatus Aterm

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Abstract

Objective: To compare the bilirubin serum, hemoglobin, and hematocrit in term infants undergoing delayed cord clamping with early cord clamping after normal and caesarean delivery.

Methods: This is a prospective observational study. The neonates in which cord clamping was done within 15 seconds were considered in early cord clamping (ECC) group and where cord clamping was done after 1 minute was considered in delayed cord clamping (DCC) group. The PCV, Hb, serum bilirubin were observed after 48 hours in both the groups and compared.

Result: There was statistically significant difference in means of Hb level ($p = 0.001$) and PCV level ($p = 0.001$) between DCC and ECC group whereas no statistically significant difference was present in total serum bilirubin level ($p = 0.359$).

Conclusion: There was no significant increase in risk of polycythaemia and hyperbilirubinemia between delayed cord clamping and early cord clamping group rather has beneficial effects in increasing the hemoglobin and hematocrit in the infants.

Keywords: delayed cord clamping, early cord clamping, hematocrit, hemoglobin, serum bilirubin, hyperbilirubinemia.

Abstrak

Tujuan: Untuk membandingkan serum bilirubin, hemoglobin, dan hematokrit pada bayi aterm yang dilakukan delayed cord clamping dan early cord clamping setelah persalinan normal dan seksio sesarea.

Metode: Studi ini merupakan studi prospektif. Neonatus yang dilakukan cord clamping dalam 15 detik dikelompokkan pada delayed cord clamping (DCC). PCV, Hb, bilirubin serum diobservasi dalam 48 jam pada kedua kelompok, kemudian dibandingkan.

Hasil: Terdapat perbedaan signifikan antara kadar Hb ($p = 0,001$) dan PCV ($p = 0,0010$) antara kelompok DCC dan ECC, sedangkan tidak terdapat perbedaan signifikan pada kadar bilirubin serum total ($p = 0,3590$).

Kesimpulan: Tidak terdapat peningkatan signifikan polisitemia dan hiperbilirubinemia antara DCC dan ECC.

Kata kunci: elayed cord clamping, early cord clamping, hematokrit, hemoglobin, serum bilirubin, hyperbilirubinemia.

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INTRODUCTION

Delayed cord clamping (DCC) has proven to be beneficial in both term and preterm infants. According to ACOG committee opinion clamping of cord should be delayed at least 30 to 60 seconds in term and preterm infants except in cases where neonatal and maternal conditions necessitates urgent cord clamping.¹ Researches shows higher hemoglobin, haematocrit and increase in iron store in the newborns²⁻⁴ and demonstrates lower rate of intraventricular hemorrhage in preterm infants^{5,6}.

In an Italian randomized controlled trial consisting of 132 new born shows increase in haematocrit and bilirubin level in DCC group.⁷ Physiologic placental transfusion is increased by DCC and this increases 20-30% blood volume and 50% red cell volume in infants(2). AOGO committee opinion says there is small increase in bilirubin level in DCC cases which requires photo therapy¹. Studies shows no increase in postpartum hemorrhage in delayed cord clamping.⁸ The aim of this study is to determine the effect of delayed cord clamping on hematological parameter of term neonates.

METHODS

After getting ethical clearance (DMR/IMSSH/ SOA/180274) this Prospective observational study was conducted in department of obstetrics and gynecology, IMS and SUM hospital between August 2019 – July 2020. Nonprobability convenient sampling was done. The labour patients admitted to the hospital meeting the following selection criteria were included in the study. The inclusion criteria's were gestational age between 37-42 weeks, expected birth weight > 2500gms, singleton birth, vertex presentation and good antenatal care and the exclusion criteria were mothers with haemorrhage, hemodynamic instability, preeclampsia or eclampsia, gestational diabetes mellitus, renal disease, cardiopathies or connective tissue diseases and foetal complications like Rh incompatibility, babies born asphyxiated, meconium-stained liquor, foetal congenital anomalies, malpresentation, nuchal cord and instrumental delivery.

The timing of cord clamping differs from surgeon to surgeon as there is no definite protocol in the hospital for the same. The timing of cord clamping was noted with the help of a stop watch by a single observer to avoid bias.

Injection oxytocin 10 units in iv infusion was given to each mother after the delivery of the baby as per the hospital protocol. Usually, the babies are kept at the level of the introitus in normal delivery and also in cesarean delivery. According to the timing of umbilical cord clamping neonates were divided into 2 groups. The neonates in which cord clamping was done within 15 seconds were considered in the ECC group and neonates in which cord clamping was performed after 1 min of delivery were considered in DCC group. As per our hospital protocol the neonates were observed for 48 hours for the estimation of PCV, hemoglobin and serum bilirubin (total, direct, indirect bilirubin). PCV more than 65 was considered as polycythaemia, Hb level more than 11 was considered normal. Serum bilirubin level was plotted in the Bhutani chart to screen the high-risk cases. For the cases in the high-risk zone a repeat serum bilirubin was done after 4-8 hours and the value plotted in the American academy of paediatrics phototherapy guideline chart and phototherapy started if required. The neonates requiring phototherapy and their outcomes were observed.

The data collected were statistically analysed by using SPSS version 20. Mean \pm standard deviation or rate (%) was used to express the results. Significance of the data was tested using ANOVA test. p value < 0.05 was considered statistically significant.

RESULTS

A total of 107 subjects were observed and analysed till discharge. Out of which 56 patients were in DCC group and 51 patients were in ECC group.

Table 1. Demography

Variables	DCC	ECC	P-value
Mean Age in Years	28.0 ± 4.929	29.06 ± 4.58	0.136
Primigravida	50	52.9	0.681
Multigravida	50	47.1	0.681
Mean gestational age in weeks	38.59 ± 1.05	38.68 ± 1.18	0.736
Cesarean section	51.8	58.8	0.318
Vaginal delivery	48.2	41.2	0.318
Mean Hb (gm%) of mother	11.78 ± 1.13	11.75 ± 1.09	0.874
Mean PCV (%) of mother	35.91 ± 3.43	36.14 ± 3.97	0.756

In Table 1 the demographic data are represented such as mean age of patients was 28.0 ± 4.929 years and 29.06 ± 4.58 years in the DCC and ECC group respectively which was statistically insignificant (p=0.136). In DCC group, 50% mothers were primigravida and 50% were multigravida, whereas in the ECC group primigravida was 52.9% and multigravida was 47.1%. The mean gestational age in DCC group was 38.59 ± 1.05 and 38.68 ± 1.18 weeks in ECC group (p = 0.736). 51.8% of patients underwent cesarean section and 48.2% underwent vaginal

delivery in DCC group whereas 58.8% underwent LSCS and 41.2% underwent vaginal delivery in ECC Group. The mean Hb of the mother in DCC group was 11.78 ± 1.13 gm% and the mean Hb of mother in ECC group was 11.75 gm% ± 1.09 while the mean PCV in DCC and ECC group was 35.91% ± 3.43 and 36.14% ± 3.97 respectively and the difference of mean Hb and mean PCV between both groups were not statistically significant. There was no significant demographic difference between both the groups.

Table 2. Distribution of Bilirubin of Neonate According to the Risk Category (Bhutani chart) and Phototherapy

Total bilirubin in neonate (mg/dl)	No of Cases	(%)	Mean (Total Bilirubin in mg/dl) ± SD	P-value	No of cases requiring photo therapy	(%)	P-value
DCC			12.36 ± 2.93	0.359	16	66.67	0.009
Low Risk (<11)	14	25.9					
Low Intermediate (11-13.2)	16	29.6					
High Intermediate (13.2-16)	21	38.9					
High (>16)	3	5.6					
Total	56	100					
ECC			11.82 ± 3.09		14	82.35	
Low Risk (<11)	21	41.2					
Low Intermediate (11-13.2)	15	29.2					
High Intermediate (13.2-16)	10	19.6					
High (>16)	5	9.8					
Total	51	100					

In the DCC group maximum number of neonates had total bilirubin between 13.16 mg/dl, that accounts for 38.9% which falls under high intermediate risk group of Bhutani chart while in the ECC group total bilirubin of maximum neonates was less than 11 mg/dl which accounts for 41.2% and they come under low-risk group of Bhutani chart. The mean of the total bilirubin in

the DCC group was 12.36 ± 2.93 mg/dl and the mean total bilirubin of neonate in ECC group was 11.82 ± 3.09 (p= 0.359) mg/dl. 66.67% neonates received phototherapy in the DCC group and 82.35% neonates received phototherapy in the ECC group which was statistically significant (p=0.009).

Table 3. Statistical Representation of Different Groups

Groups		Range	Mean \pm Standard Deviation	F-statistics	P-value
HB (gm%)	DCC	14.4-22.5	18.69 \pm 1.98	12.003	0.001*
	ECC	13.8 – 22.1	17.39 \pm 1.88		
PCV (%)	DCC	41.4 – 66.0	53.35 \pm 5.84	12.254	0.001*
	ECC	40.1 – 61.8	49.63 \pm 5.07		
Total Bilirubin(mg/dl)	DCC	4.97 – 66.0	12.36 \pm 2.93	0.851	0.359
	ECC	3.59 – 19.9	11.82 \pm 3.09		

*Significant at 5% level of significance

The two-way ANOVA test showed statistically significant difference between the DCC and ECC group means of Hb Samples (F=12.003, p = 0.001). There is statistically significant difference between the DCC and ECC group means of PCV Samples (F=12.254, p = 0.001). There is no statistically significant difference between the DCC and ECC group means of total bilirubin samples (F=0.851, p = 0.359).

DISCUSSION

The aim of this study was to compare the hemoglobin, haematocrit and serum bilirubin levels between early and delayed cord clamping groups in term infants. In our study, in both the groups maximum mothers were within the age group of 25-30years. The mean ages were 28.17 \pm 4.929 and 29.17 \pm 4.58 years in the DCC and ECC group, respectively. There was no statistically significant difference in mean age between the two groups(p = 0.136). Mean maternal age was 26.27 \pm 4.59 and 26.17 \pm 4.38 years in ECC and DCC group respectively.⁹ Mean maternal age of DCC group was 27.93 \pm 4.88 and ECC group it was 27.82 \pm 6.61. In both the studies the mean maternal age was similar to our studies.¹⁰

In this study the maximum number of patients delivered at 39-40 weeks period of gestation the mean gestational age at delivery being 38.59 weeks \pm 1.05 in the DCC group and maximum number of patients were delivered at 38-39 weeks in the ECC group and the mean gestational age being 38.68 weeks \pm 1.18 in the ECC group (p = 0.736) which was statistically insignificant.

In the present study we found that 50% are primigravida and 50% are multigravida in the DCC group whereas 52.9% are primigravida and 47.1% are multigravida in the ECC group. In our study in the DCC group 51.8% mothers delivered by cesarean section and 48.2% mothers delivered vaginally and in the ECC group 58.8%

mothers delivered by cesarean section and 41.2% mothers delivered vaginally, the rate of cesarean section is higher in our hospital being a tertiary care centre and receiving complicated cases.

In this study in the DCC group the mean hemoglobin level of mothers was 11.78 gm% \pm 1.13 and the mean Hb of mothers in ECC group was 11.75gm% \pm 1.09 (p=0.874) which was statistically insignificant. In our study maximum number of mothers (55.4%) had hematocrit between 35-40% and the mean hematocrit being 35.91% \pm 3.43 in the DCC group and maximum mothers (45.1%) in the ECC group had hematocrit between 35-40% and the mean hematocrit being 36.14% \pm 3.97 (p=0.756) which is not statistically significant. This was similar to the mothers mean hematocrit in the third trimester was 36.8 \pm 2.6% in the DCC group and 36.1 \pm 2.6% in the ECC group (p= 0.08)which is also statistically insignificant.¹¹

In the present study it is seen that in maximum number of neonates who underwent delayed cord clamping, the haemoglobin level was found to be between 19-22gm/dl (57.1%) and the mean hemoglobin being 18.69 \pm 1.98 gm%. In the infants who underwent early cord clamping, maximum number of infants had hemoglobin between 15-18gm/dl (70.6%) and the mean hemoglobin being 17.39 \pm 1.88 gm% (p=<0.001) which is statistically significant. This finding is similar to other ^{12,13}. Mean infant hemoglobin at 48hr after birth was 16.51 \pm 1.71 and 15.16 \pm 2.27 gm% respectively(p<0.001)¹⁰.

Venous hematocrit was found to be higher in the delayed cord clamping group than in infants who had undergone early cord clamping after birth. The mean hematocrit in DCC was found to be 53.35 \pm 5.84% and 49.63 \pm 5.07% in the ECC group and the difference was found to be statistically significant (p =<0.001). Polycythemia was seen only in one neonate who underwent DCC which was not statistically significant. This

did not result in any adverse outcome. Significant higher level of hematocrit⁹. A randomized controlled trial shows greater hematocrit level in delayed cord clamping group with statistical significance.⁷ In a randomized trial demonstrates increase in mean hematocrit level significantly in DCC group.¹⁴

DCC helps in placental blood transfusion. So chance of hyperbilirubinemia is expected which has prevented many obstetrician to adopt DCC. In our study in the DCC group maximum number of neonates (38.9%) had serum bilirubin level within 13.2mg/dl – 16mg/dl. They were in high intermediate risk zone of Bhutani chart and it was seen that three infants had total bilirubin above 16mg/dl which made them fall under high-risk group of Bhutani chart. They were managed by phototherapy and none of the neonates required exchange transfusion. In ECC group maximum number of neonates (29.2%) had total bilirubin serum between 11-13.2mg/dl which were in the low intermediate category of Bhutani chart and surprisingly five infants had total bilirubin more than 16 mg/dl in the ECC group which came under high-risk group. The mean total bilirubin in the DCC group was found to be 12.36±2.93 mg/dl and 11.82±3.09 mg/dl in the ECC group, (p=0.359) which is not statistically significant. In our study 66.67% neonates received phototherapy in the delayed clamping group and 82.35% neonates received phototherapy for hyperbilirubinemia in the ECC group

Significant difference in neonatal polycythemia, hyperbilirubinemia or rate of phototherapy.² While increased rate of neonatal jaundice and polycythemia.⁵ DCC has no significant effect on incidence of neonatal hyperbilirubinemia, or rate of phototherapy after cesarean delivery.¹⁵ Therefore we concluded that DCC improves the hematological outcome of the neonate without increasing the risk of polycythemia and hyperbilirubinemia. The limitation of our study is that this is a single centre study and only the immediate effect of DCC has been observed. Large multicentric studies with delayed effects of DCC should be carried out.

CONCLUSION

There is no significant increase risk of polycythemia between delayed cord clamping group and early cord clamping group. Delayed cord clamping is not associated with any harmful effects on new-born rather has beneficial effects

in increasing in hemoglobin and hematocrit.

Both the groups maximum mothers were within the age group of 25-30 years. The mean ages were 28.17 ± 4.929 years and 29.17 ± 4.58 years in the DCC and ECC group respectively. There was no statistically significant difference in mean age between the two groups (p = 0.136)

Conflict of interest: The authors declare no conflict among them.

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