# Effect of Early Versus Late Umbilical Cord Clamping of Term Infants on Maternal and Neonatal Outcomes

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**Abstract: Background:** The umbilical cord is usually clamped immediately after birth. There is no sound evidence to support this approach, which might deprive the newborn of some benefits such as an increase in iron storage. however, there is very little evidence to suggest that the timing of cord clamping and cutting has an impact on the incidence of postpartum hemorrhage and other maternal outcomes. **Design:** This study utilized an experimental research design to identify the effect of early versus late cord clamping at of term infants on the maternal and neonatal outcomes. **Setting:** The study was conducted at labor & delivery units EL-Minia University hospital, Egypt. **Methodology:** A total sample of 100 parturient and their newborns comprised the study sample after gaining the mothers' acceptance. They were equally divided and randomly assigned to two homogenous groups according to the time of cutting their newborn cord. Early cord clamping group (at < 1 min.) and late cord clamping group (at 1 to 3min.). Two tools were used for data collection namely: A structured interview questionnaire for assessing sociodemographic and obstetrical data and assessment tool for assessing maternal and neonatal haematological parameters and outcomes. **Results:** The findings of the present study were equivalent among both groups regards the mean maternal hemoglobin and hematocrit level, maternal blood loss, postpartum hemorrhage. For neonatal outcomes, the neonatal hematologic parameters were comparable and slightly elevated hematocrit and hemoglobin level among late cord clamping group compared to early group with no significant differences at birth and significant difference was observed at 24 hours later. This elevation was within the prespecified physiologic range. The prevalence of newborn with a hematocrit level of <45% at birth and after 24 hours was slightly higher among the early cord clamping group compared to late cord clamping with no significant differences. There were no significant differences in other neonatal and maternal outcomes. **Conclusion:** Delaying clamping of the cord for more than one minute to three minutes seems not to increase the risk of postpartum hemorrhage. In addition, late cord clamping can be advantageous for the infant by improving hematological values especially the status which may be of clinical value particularly in developing countries where infants access to good nutrition is poor.
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**Keywords:** Early cord clamping, late cord clamping, Term Infants, Maternal and Neonatal Outcomes

## 1. Introduction

Timing of umbilical cord clamping has been and is still a highly controversial issue.[1] Although The current obstetric approach in medicine is to clamp the cord within the first 10 to 15 seconds after birth. However, there has been no sound evidence in favor of this approach in comparison to the millennial practice of clamping the cord between 1 and 3 minutes after birth. [2]

In early cord clamping the umbilical cord is usually clamped shortly following birth of the infant; this is generally carried out in the first 30 seconds after birth; regardless of whether the cord pulsation has ceased [3]. Late cord clamping, or delayed clamping, a physiological approach, involves clamping the umbilical cord greater than one minute (1-3 minutes) after birth or when cord pulsation has ceased. However, definitions of what constitutes early and late cord clamping vary, if the cord is not clamped, the umbilical circulation usually ceases when the umbilical arteries close and the cord stops pulsating [4] . There are studies showed different points in the time of cord clamping worldwide and there is little agreement among doctors and midwives about the optimal time to clamp the umbilical cord after birth .The most important points of differences are related to maternal and infant safety. Many healthcare workers worldwide tend to clamp the cord and pass the baby off as quickly as possible.[5]

Early cord clamping may increase the likelihood of feto-maternal transfusion (the amount of blood that is forced back across the placental barrier into the maternal circulation), as a larger volume of blood remains in the placenta. Although active management leads to reduced risk of PPH, the risks of PPH on maternal morbidity are less well documented, but are likely to include interrelated outcomes such as anemia and fatigue [3]. Physiological studies have

shown that there is a transfer from the placenta of about 80 ml of blood at 1 minute after birth, reaching about 100 ml at 3 minutes after birth [6]. These additional volumes of blood can supply extra iron amounting to 40–50 mg/kg of body weight. When this extra iron is added to the approximately 75 mg/kg of body iron that a full-term newborn is born with, the total amount of iron can reach 115–125 mg/kg of body weight, which may help prevent iron deficiency during the first year of life [1]. A delay in time before clamping the umbilical cord in healthy term infants appears to be less crucial as the cord ceases pulsation within the first two minutes of birth in the majority of cases [3]. Regarding maternal outcomes, there is very little evidence to suggest that the timing of cord clamping and cutting has an impact on the incidence of postpartum haemorrhage. [7]

Recently, World Health Organization (WHO) and International Confederation of Midwives (ICM) and International Federation of Gynecology and Obstetrics have updated their guidelines on preventing postpartum hemorrhage, and they refer to the benefits of delaying cord clamping. therefore, the amount of time between birth and cord clamping is a decision made by the individual health care provider based largely on personal preference, and It is fundamental for midwives and other health care providers to establish a clear definition of delayed cord clamping, along with a set of clinical guidelines on evidence based practices. [8]

**Hypothesis:**

Our hypothesis was that delayed cord clamping (at 1 to 3 minutes after birth) in healthy term newborns increases hematocrit within physiologic ranges without causing any maternal or neonatal harmful effects.

**Aim of the Study:**

The objective of the present study was to determine the effects of early versus late umbilical cord clamping on the maternal and neonatal outcomes.

**Ethical Consideration:**

After approval of the ethics committee, an official permission was obtained from director and head of Obstetrics & Gynecological Department at the Maternity University Hospital- El-Minia Governorate, Egypt. The significance and purpose of the study was explained to them. Confidentiality of any obtained information was ensured to them.

## 2. Subjects and Method:

**Research Design:**

An experimental research design was carried out in this study.

**Setting:**

The study was conducted at the Maternity University Hospital-EL Minia Governorate.

**Study Sample:**

A total sample of one hundred women from the previously mentioned setting were recruited and comprised the study subjects. They were divided equally and randomly into 50 each, group (1) selected as early cord clamping (at < 1 min.) after delivery and group (2) with late cord clamping (at 1-3 minutes) after birth, their newborns were selected according to the following criteria:

**Inclusions criteria:**

Birth weight > 2000-4000 gm, gestational age ≥ 37 wk, singleton birth , Healthy pregnant women, expected to give birth vaginally (cephalic vaginal birth).

**Exclusions criteria:**

Women who have given birth to a preterm infant (less than 37 weeks gestation), Breech presentation, Multiple pregnancies, Women who give birth by CS, Diabetes mellitus, pre-eclampsia, hypertension, anemia, evidence of IUGR or congenital malformation.

Tools of data collection: Two tools were used to achieve the objective of the study.

**Tool (I):**

An Interview questionnaire was designed and used by the researcher to collect the necessary data related to the study subjects as follows:

Part 1: Demographic data (woman's age, occupation, and educational level, …...etc.)

Part 2: Menstrual and obstetrical history (duration and amount of menstrual flow, regularity of menstruation, menstrual disorders, gravidity, parity, and gestational age, …….etc. ) .

**Tool II:**

Assessment tool was designed and used by the researcher to collect the necessary data as follows:

Part1: Maternal outcomes as assessing for (hemoglobin and hematocrit level, need for blood transfusion, postpartum hemorrage, ……etc.)

Part 2: Neonatal outcomes (hemoglobin and hematocrit level, RBCs count, bilirubin level, polythythemia, anemia and need for admission to NICU)

**Method:**

A randomized, controlled trial was conducted between Jan.2011 to June2011 at EL Minia Maternity University Hospital. 100 women were selected randomly from the previously mentioned setting, The tools of data collection were developed and used by the researcher after reviewing the related literature. A pilot study was conducted on 10% of the studied women & their newborns (10 women) to test feasibility of tools and time required to be applied.

Simple modification was done, the recruited women for pilot study were excluded from the study. Following the pilot study, the tools of data collection was reconstructed and made ready for use. The tool content validity was tested by 5 juries who are experts in the related field.

The present study was carried out through the following phases:

**Interviewing phase:** In which the researcher explained the purpose of the study to every woman, and then take her consent to participate in the study. Baseline maternal data with regards to, socioeconomic status, menstrual history, obstetrical history was taken by the researcher used tool I for the whole sample. The researchers filled the interviewing questionnaire form individually and assured that confidentiality was maintained.

**Intervention phase:** Women were randomized to two homogenous groups 50 for each, early or late cord clamping groups. Each group was randomly assigned to cord clamping at less than one minute for early clamping group, while the timing of late cord clamping and cutting was (1 to 3 min.), Random assignment was done by computer generated tables. Sealed opaque sequentially numbered envelopes that contained the assigned intervention used to conceal the allocation, If at the time of delivery the woman was still considered eligible for the trial, enrollment took place, and an envelope was drawn and opened accordingly in the delivery room after deciding to include those who have uneventful pregnancies according to the previously mentioned criteria. Labor and delivery were performed following the standard practice of care. the researcher assessed all women among both groups for duration of third stage of labor used tool 1 (part II). All women among both groups received uterotonics agents after cord clamping. After completion of these procedures, The obstetrician held the infant in a sterile towel or blanket approximately 10 to 15 inches below the mother's introitus at vaginal delivery, the assistant nurse who attended the delivery room and previously informed about the nature of research used a stopwatch to check the time at which clamping was effectively accomplished. Care was taken that no tension or traction was placed on the cord. For the measurement of maternal blood loss, all vaginal blood was collected immediately after the infant's delivery by placing a pan and pad under the woman's buttocks until she was transferred to the postpartum ward. Collected blood was poured in a graded jar, and blood volume was determined. Assessment of postpartum hemorrhage was determined if blood loss exceeds 500 ml, furthermore women were assessed for need for blood transfusion or manual removal of the placenta.

**Sample Collection**

Maternal venous blood (4 ml) was collected in plain tubes for hemoglobin and hematocrit estimation. Similarly, 4 ml of the infants' venous blood extracted from the newborn umbilical veins 1st and from antecubital vein after 24 hours by labor ward staff in 2 tubes sealed at one end with modeling clay, to measure hematocrit, hemoglobin level, RBCs count and Bilirubin level by cyanmethemoglobin method [9] the sample was sent immediately to the laboratory and all laboratory results were recorded and compared with normal levels to assess maternal and neonatal blood analysis, fetal anemia and outcomes used tool II by the researcher. The infant was warmly wrapped and held below the level of the mothers abdomen to prevent heat loss while awaiting cord clamping. Admission to the neonatal intensive care unit ( NICU ) within 24 hrs after birth was followed for assessing neonatal outcomes.

**Statistical Analysis**

Statistical analysis was carried out by using the computer package of SPSS version 17. Data were presented by using descriptive statistics in the form of numbers and percentages for qualitative variables, and means and standard deviations for quantitative variables. Statistical significance was considered at *p*-value <0.05.

**3. Results:**

A total of 100 women were recruited into the study, 50 each to early and late cord clamping groups, the findings of the present study revealed that both groups were comparable with no significant differences in respect to baseline characteristics as maternal age, occupation, education and residence **(Table 1)**.

As regards the menstrual pattern among early and late cord clamping. **Table (2)** presented that no significant difference was observed regarding regularity of menstruation, and history of menstrual disorders, however a significant difference was observed regarding duration of menstruation and amount of menstrual blood flow (5.02+1.13, 5.86+1.27 & 6.71±1.9 , 8.68±2.3 with *p.* value 0.001 respectively among early and late clamping group). Furthermore, both groups were comparable for the obstetric history in respect to gravidity, parity, previous delivery status and previous history of PPH.

**Table (3)** portrayed that no significant differences was observed among both groups regarding gestational age and neonate's birth weight, The vast majority among both groups revealed that their gestational age ranged 38-40 weeks, however a significant difference was observed regarding length of third stage of labor, the mean duration of third stage of labor took shorter time for the early cord

clamping group compared to late group (20.7+2.4 & 27.9+3.2 minutes respectively). All women among both groups received uterotonics agents after cord clamping.

**Table (4)** shows that no significant difference was observed regarding maternal outcomes among both groups in respect to estimated postpartum blood loss, hemoglobin and hematocrit level and need for blood transfusion and no one of them required manual removal of the placenta. The mean estimated postpartum blood loss within 24 hours of labor was within the normal average of blood loss for vaginal delivery among early and late cord clamping (421±67 & 435±125 respectively).

As regards the neonatal outcomes, the present study found that the neonatal hematologic parameters were comparable and slightly elevated hematocrit and hemoglobin level at birth especially among late cord clamping group compared to early group with no significant differences however a significant differences was observed regarding these levels after 24 hours, furthermore no significant difference was observed regarding other neonatal variables as total Billirubin count, polycythemia, anemia and need for admission to NICU. The prevalence of newborn with a hematocrit level of <45% at birth and after 24 hours among early and late group was slightly higher among the early cord clamping group compared to late cord clamping but with no statistically significant differences. (3%, 3% &1%, 0.0% respectively) **(Table 5).**

**Table 1: Distribution of study subjects according to their sociodemographic data**

| | Time of umbilical cord clamping | | | | *P.* value |
|---|---|---|---|---|---|
| | Group1 Early clamping (< 1 minute) N=50 | | Group2 Late clamping (1-3minutes) No=50 | | |
| | No | % | No | % | |
| **Women's age** | | | | | |
| Mean±SD | 28.43±6.3 | | 28.31±5.8 | | 0.921 |
| < 20 | 3 | 6.0 | 1 | 2.0 | 0.452 |
| 20-35 | 41 | 82.0 | 45 | 90.0 | |
| > 35 | 6 | 12.0 | 4 | 8.0 | |
| **Education** | | | | | |
| Illiterate | 5 | 10.0 | 3 | 6.0 | 0.659 |
| Read & write | 6 | 12.0 | 5 | 10.0 | |
| Secondary school | 22 | 44.0 | 28 | 56.0 | |
| High education | 17 | 34.0 | 14 | 28.0 | |
| **Residence** | | | | | |
| Urban | 30 | 60.0 | 35 | 70.0 | 0.294 |
| Rural | 20 | 40.0 | 15 | 30.0 | |
| **Occupation** | | | | | 0.339 |
| House wife | 46 | 92.0 | 48 | 96.0 | |
| Employer | 4 | 8.0 | 2 | 4.0 | |

**Table 2: Distribution of study subjects according to menstrual and obstetric history**

| | Time of umbilical cord clamping | | | | *P.* value |
|---|---|---|---|---|---|
| | Group1 Early clamping (< 1 minute) N=50 | | Group2 Late clamping (1-3minutes) No=50 | | |
| | No | % | No | % | |
| **Duration of menstruation (days)** | | | | | |
| Mean±SD | 5.02+1.13 | | 5.86+1.27 | | 0.001 |
| **Regularity of menstruation** | | | | | |
| Regular cycle | 39 | 78.0 | 36 | 72.0 | 0.322 |
| Irregular cycle | 11 | 22.0 | 14 | 28.0 | |
| **Amount of menstrual blood flow** | | | | | |
| Mean ± SD | 6.71±1.9 | | 8.68±2.3 | | 0.001** |
| Scanty (changed less than 4 pads during menstruation) | 9 | 18.0 | 6 | 12.0 | 0.050* |
| Moderate (4-9 pads changed) | 35 | 70.0 | 28 | 56.0 | |
| Excessive (more than 9 pads changed) | 6 | 12.0 | 16 | 32.0 | |
| **Menstrual disorders** | | | | | |
| No | 45 | 90.0 | 46 | 92.0 | 0.501 |
| Yes | 5 | 10.0 | 4 | 8.0 | |
| **Gravidity** | | | | | |
| Primigravida | 8 | 16.0 | 5 | 10.0 | 0.545 |

| | | | | | |
|---|---|---|---|---|---|
| 2nd gravida | 16 | 32.0 | 13 | 26.0 | |
| 3rd gravida | 6 | 12.0 | 5 | 10.0 | |
| Grand multi gravida | 20 | 40.0 | 27 | 54.0 | |
| **Parity** | | | | | |
| Nullipara | 8 | 16.0 | 5 | 10.0 | 0.277 |
| Multi para | 42 | 84.0 | 45 | 90.0 | |
| **Previous history of PPH** | | | | | |
| No | 46 | 92.0 | 50 | 100.0 | 0.059 |
| Yes | 4 | 8.0 | 0 | 0.0 | |

**Table 3: Distribution of study subjects according to their current natal data**

| | Time of umbilical cord clamping | | | | *P.* value |
|---|---|---|---|---|---|
| | Group1 Early clamping (< 1 minute) N=50 | | Group2 Late clamping (1-3minutes) No=50 | | |
| | No | % | No | % | |
| **Gestational age (weeks)** | | | | | |
| Mean ± SD | 39.1±2.1 | | 38.9±2.4 | | 0.658 |
| 37 weeks | 0 | 0.0 | 2 | 4.0 | 0.311 |
| 38-40 weeks | 48 | 96.0 | 47 | 94.0 | |
| > 40 weeks | 2 | 4.0 | 1 | 2.0 | |
| **Length of 3rd stage of labor (min)** | | | | | |
| Mean ± SD | 20.7+2.4 | | 27.9+3.2 | | 0.001** |
| Less than 20 min | 31 | 62.0 | 8 | 16.0 | 0.001 |
| 20 - 30 min | 19 | 38.0 | 22 | 44.0 | |
| More than 30 min | 0 | 0.0 | 20 | 40.0 | |
| **Woman received uterotonics after cord clamping** | | | | | |
| Yes | 50 | 100.0 | 50 | 100.0 | NA |
| No | 0 | 0.0 | 0 | 0.0 | |
| **Baby weight** | | | | | |
| Mean ± SD | 3.4±0.4 | | 3.5±0.5 | | 0.272 |
| 2.5 -3 kg | 17 | 34.0 | 10 | 20.0 | 0.175 |
| 3-4 kg | 24 | 48.0 | 33 | 66.0 | |
| More than 4 kg | 9 | 18.0 | 7 | 14.0 | |

**Table 4: Distribution of study subjects according to their maternal outcomes data**

| | Time of umbilical cord clamping | | | | *P.* value |
|---|---|---|---|---|---|
| | Group1 Early clamping (< 1 minute) N=50 | | Group2 Late clamping (1-3minutes) No=50 | | |
| | No | % | No | % | |
| **Estimated postpartum blood loss** | | | | | |
| Maternal blood loss (Mean ± SD) | 421±67 | | 435±125 | | 0.486 |
| No (blood loss < 500 ml) | 47 | 94.0 | 45 | 90.0 | 0.461 |
| Moderate (blood loss 500<1000ml) | 3 | 6.0 | 5 | 10.0 | |
| Severe (blood loss >1000ml) | 0 | 0.0 | 0 | 0.0 | |
| **Maternal hemoglobin level** | | | | | 0.186 |
| Mean ± SD | 12.01±0.97 | | 11.7±1.35 | | |
| **Maternal hematocrit level** | | | | | |
| Mean ± SD | 33.59±3.57 | | 33.52±4.44 | | 0.931 |
| **Women need for blood transfusion** | | | | | |
| No | 47 | 94.0 | 50 | 100.0 | 0.121 |
| Yes | 3 | 6.0 | 0 | 0.0 | |
| **Need for manual removal of the placenta** | | | | | |
| No | 50 | 100.0 | 50 | 100.0 | NA |
| Yes | 0 | 0.0 | 0 | 0.0 | |

**Table 5: Distribution of neonates according to their hematological parameters and neonatal outcomes**

| | Time of umbilical cord clamping | | | | *P.* value |
|---|---|---|---|---|---|
| | **Group1** Early clamping (< 1 minute) N=50 | | **Group2** Late clamping (1-3minutes) No=50 | | |
| **Neonatal Hematocrit level** | | | | | |
| Mean ± SD At birth | 53.5 ± SD 5.0 | | 55.6 ± SD 5.9 | | 0.057 |
| Mean ± SD After 24 hours | 53.0 ± SD 5.7 | | 55.4 ± SD 4.7 | | 0.023 |
| **Neonatal hemoglobin level** | | | | | |
| Mean ± SD At birth | 17.2 ± SD 2.1 | | 17.6± SD 1.6 | | 0.286 |
| Mean + SD After 24 hours | 16.8 + SD 2.7 | | 17.7± SD 1.7 | | 0.048 |
| **Neonatal RBCs counts** | | | | | |
| Mean ± SD At birth | 5.2 % SD ± 0.50 | | 5.4 % SD ± 0.55 | | 0.054 |
| Mean + SD After 24 hours | 6.1 % SD + 6.1 | | 5.52 % SD ± 0.54 | | 0.49 |
| **Total Billirubin count** | | | | | |
| Mean ± SD At birth | 2.44 % SD ±1.3 | | 3.1 % SD ± 2.3 | | 0.07 |
| Mean + SD After 24 hours | 3.8 % SD ±2.3 | | 4.4 % SD ± 2.4 | | 0.17 |
| **Polycythemia** | | | | | |
| HCT>65% At birth | 2 | | 1 | | 0.986 |
| HCT>65% After 24 hours | 2 | | 1 | | |
| **Anemia** | | | | | |
| HCT<45% At birth | 3 | | 1 | | 0.087 |
| HCT<45% After 24 hours | 3 | | 0 | | |
| **Need for admission to NICU** | **No** | **%** | **No** | **%** | |
| No | 50 | 100.0 | 50 | 100.0 | NA |
| Yes | 0 | 0.0 | 0 | 0.0 | |

## 4. Discussion

Women experiencing ill health postpartum may be ultimately reflects on the health and wellbeing of the newborn infant and family life in general. Recent reviews of **Hutton [10] and Van Rheenen [11]** have highlighted beneficial effects from delayed cord clamping compared with early cord clamping, but these reviews did not encompass maternal outcomes (which have been rarely measured in trials of the timing of cord clamping) and only few studies included in this review reported on maternal wellbeing. This randomized clinical study highlighted mainly the effect of early versus late cord clamping on maternal and neonatal outcomes. The randomized nature of this study and the equivalence of the groups at baseline support the conclusion that this effect was causal and the values still within physiologic ranges, and without harmful effects in comparison to early cord clamping group. The studied groups were similar with respect to demographic, menstrual and obstetric variables with no significant differences, **(Table 1-3).** In addition, both groups were comparable with no significant difference regarding menstrual and obstetric history parameters however the only significant difference in this respect was observed for the mean of duration and amount of menstrual blood flow among early and late groups (5.02+1.13, 5.86+1.27 & 6.71+1.9, 8.68+2.3 respectively). In spite of these differences, the previous history of increased duration and amount of menstrual blood flow among the late cord clamping group didn't affect on maternal or neonatal outcomes adversely. **(Table 2)**

Furthermore, a significant difference was observed regarding length of third stage of labor as the duration of third stage took shorter time for the early cord clamping group compared to late group with statistical significance however, the mean values were still within physiologic ranges (20.7+2.4 & 27.9+3.2 respectively $p$= 0.001) this differences might be attributed to the hastening effect of early cord clamping as a part of active management of third stage of labor on the duration of third stage. **( Table 3)**. This finding was in line with **Inch [12]** who emphasized that early cord clamping has been associated with a reduction in the length of the third stage of labour. As of the aims of active management is to reduce the length of the third stage because the longer the placenta remains undelivered, the greater is the likelihood of maternal bleeding. On the contrary, **Abalos [7]** who studied the effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes found no differences between both groups in respect to duration of the third stage of labour.

Uterotonics agents administered following birth and prior to cord clamping have been shown to increase the rate of placental transfusion and are thus likely to enhance the effect of delayed clamping. [10] Our study revealed that all women among both

groups received uterotonics after cord clamping. **(Table 3)** In this respect, **McDonald** [13] showed no significant differences in need for therapeutic administration of uterotonics between the early and late cord clamping groups (RR 0.94, 95% CI 0.74 to 1.20; 963 women). Furthermore, with respect to maternal variables, the present study reported that the timing of cord clamping was not shown to be of any statistical significance with regard to estimated mean blood loss between early and late cord clamping and in turn to postpartum hemorrhage **Table (4)** These data are in agreement with what other authors have reported [11, 13-17] and in disagreement with the belief that late clamping is associated with greater postpartum bleeding.[4]

As regards the maternal hemoglobin and hematocrit levels, The findings of the present study revealed no significant difference was observed among early and late cord clamping groups (12.01+0.97 &11.7+1.35 and 33.59+3.57 & 33.52+4.44 respectively). **Table (4).** These findings were in line with **Geethanath** [18]**; Gupta** [19]**and McDonald** [13] who studied early and late cord clamping in three trials for 1128 women, found that maternal hemoglobin values were similar between the early and late cord clamping groups (WMD -0.12 g/dL; 95% CI -0.30 to 0.06) at 24 to 72 hours after birth. Concerning need for blood transfusion, the finding of the present study portrayed that the majority among early group compared to all women among late group not need blood transfusion with no significant difference as shown in **table (4).** This result was in line with **McDonald** [13] **and Abalos** [7] who reported that there were no statistically significant differences in need for blood transfusion between the early and late cord clamping groups (RR 0.79, 95% CI 0.20 to 3.15; 963 women). In concordance with the present study, a study that investigated differences between early and late cord clamping and cutting in terms of risk for manual removal of the placenta emphasized that there was no significant differences between the two groups in this respect. [7]

Concerning the neonatal outcomes, recently several theories about the potential benefits of late clamping of umbilical cord have been postulated and studied the benefits of late cord clamping, specifically increased hemoglobin (Hb) and hematocrit (HCT) levels for the neonate with a subsequent reduction in rates of anemia and iron deficiency that may extend into the infant period. [17]. In this respect, an increase in venous hematocrit level was observed in late cord clamping (at 1 to 3 minutes after birth) compared to early group but this increase was within physiologic ranges and without harmful effects [20,21] **Table (5).** As regards newborn's mean hemoglobin level measured after 24 hours, the findings of the present study showed a correlation between cord-clamping time and the slight increase observed in the hemoglobin value this difference in favour of late clamping persisted for 24 hours with significant differences between both groups. (p=0.023 & 0.048 for hematocrit and hemoglobin respectively) and consecutively newborn's mean of RBCs after 24 hours, Furthermore, no significant differences were observed in neonates adverse event rates and no cases admitted to NICU as a case of hyperbilirubinumia.

As described in other studies [11, 17, 20, 21] and in agreement with the findings of the present study no polycythemia related harmful effects were observed, and all polycythemic newborns were free of symptoms. The hematocrit value of > 65% among early group seems to be found more frequent in early than late group with no significant differences. (2.0%, 1.0% at birth & 2.0%, 0.0% after 24 hours of birth among both groups, respectively) However these findings were in contrast with **Jose *et al.*** [21] who found a significant difference between early (<1 minute) and late cord clamping group (at 1-3 minutes) clamping (14.1% vs 4.4%) as regards prevalence of polycythemic newborns. In the other neonatal variables evaluated in our study as RBCs count and bilirubin level at birth and 24 hours of birth revealed no differences were found among the 2 groups. The present study observed a remarkable increase of anemia in the group with early cord clamping, The hematocrit value < 45 % as cases of anemia were more likely to occur in the group with early cord clamping (3 out of 50) compared with (0/50) in late cord clamping group after 24 hours of birth.

Although well-designed randomized, controlled trials have not shown any harmful effects related to delayed cord clamping, immediate clamping is still the common practice. However, its value is highly controversial, especially because the newborn is deprived from a large quantity of blood, iron, and other benefits.

**Conclusions**

In the light of the main study findings, it was concluded that delaying clamping of the cord for at one to three minutes seems not to increase the risk of postpartum hemorrhage. In addition, late cord clamping can be advantageous for the infant by improving hematological values especially the status which may be of clinical value particularly for infants in developing countries where access to good nutrition is poor. Thus, this intervention seems to be safe, effective and of particular importance for developing countries in which anemia during infancy and childhood is highly prevalent, it is likely to have

an important impact on all newborns, regardless of birth setting and could be implemented easily

**Recommendations**

Based on the findings of the present study, it is recommended that

1. Delayed cord clamping should be standardized practice and supported by ministry of health and hospital administration.
2. Increasing awareness of the routine delayed clamping by obstetricians and midwives and consider this practice as one of the total quality standers to achieve the mothers & babies benefits
3. Future research should also be aimed at women's views related to this intervention.
4. Future research should also be implemented on large numbers of parturient and their neonates
5. Additional research may be helpful in refining the timing of clamping by determining the minimum time required to provide maximum benefit associated with placental transfusion.

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