

Original Research Article

Effect of Placental Cord Drainage on the Third Stage of Labour Progress and Incidence of Postpartum Hemorrhage: Randomized Controlled Clinical Trial

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Abstract: *Background:* Postpartum hemorrhage (PPH) is accountable for around 25% of maternal mortality in the developing countries. Management of 3rd stage of labour is the cornerstone in PPH prevention. The effect of Placenta Cord Drainage (PCD) on the 3rd progress and PPH prevention is still controversy. *Aim of the study:* This study aims to investigate the effect of placental drainage on the third stage of labour progress and incidence of postpartum hemorrhage. *Research design:* randomized controlled clinical trial. *Setting:* This study is conducted at normal labour unit at Damanhour educational institution affiliated to ministry of health at Elbehira governorate/Egypt. *Sampling:* A purposive sample of 120 women undergoing normal easy vaginal delivery. *Tools:* two tools were used for data collection. Tool I: sociodemographic characteristics and obstetric history interview schedule. Tool II: Labour assessment sheet it consists of three main parts. Part I: Summary of the first and second stage of labor. Part II: third stage assessment sheet. Part III: 3. Early postpartum assessment sheet. *Results:* The present study results shows no statistical significant differences between PCD and control group regarding vital signs during the 3rd stage, uterus condition after placenta delivery, type, dose and route of uterotonic drugs given during 3rd stage. On the contrary, a statistical significant reduction in the time elapsed until appearance of placenta separation signs (3.5583 ± 0.83915), 3rd stage duration (5.1417 ± 1.03138), amount of blood loss during 3rd stage (195.45 ± 13.994), placenta weight (580.333 ± 64.97631) and incidence of retained placenta ((0%)) in the PCD group than control. In the early postpartum assessment, the mean pulse (88.27667 ± 3.11022) is higher among control group compared to PCD (83.4667 ± 2.78292) group. Control group needs higher dose of uterotonic (8.6780 ± 2.62902) drugs than PCD (5.0566 ± 1.41985) group. In addition, maternal hemoglobin (9.5234 ± 0.6087) is slightly higher in PCD group compared to control (8.458 ± 0.873). *Conclusion:* PCD is safe, effective noninvasive intervention that may help in improving 3rd stage progress. *Recommendation:* PCD should be added to third stage of labour intervention protocol.

Keywords: Placenta Cord Drainage, Third Stage of Labour, Postpartum Hemorrhage.

INTRODUCTION

Although, pregnancy is normal physiological event, it is still threaten women life. Every morning 830 woman die worldwide due to pregnancy and labour complications leaving 830 family without mother. Nearly, all (99%) of them occurs in the developing world [1]. In Egypt, 1400 mothers and 50% of their neonates die every year from pregnancy and child birth complications. Maternal mortality rate (MMR) is still high in Egypt compared to worldwide norms. Therefore, further attempts should be created to implement major health strategies for its reduction [2]. The availability of standardized emergency obstetric care is considered the first most important strategy to decrease maternal mortality [3]. Furthermore, One of the targets under Sustainable Development Goal III is to decrease worldwide MMR to lower than 70 per 100 000 births between 2016 and 2030. Hemorrhage (especially intra and post-partum), sepsis and eclampsia are the chief causes of maternal deaths. Furthermore, the preexisting diseases that are triggered by pregnancy play indirect role in increasing maternal mortality [4].

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Postpartum hemorrhage (PPH) is a critical obstetric emergency, particularly in the presence of pre-existing maternal anemia and/or antepartum hemorrhage. Internationally, it is the central cause of around 25% of all maternal mortality. PPH is the first direct leading cause of maternal deaths in developing countries. It is accountable for one-third of all pregnancy-related mortalities in Africa, Asia, and roughly 140,000 mortalities per year in Egypt [5-7]. The 3rd stage prolongation is considered the first cause of PPH. Preventive measures to reduce 3rd stage complications are suggested for all women undergoing childbirth [8].

The 3rd stage of labour started after fetus complete expulsion and ends by placenta complete expulsion. The 3rd stage prolongation leads to enhanced probability of sever maternal complications and death as well. These complications include uterine atony, retained placenta, postpartum hemorrhage (PPH), hemorrhagic shock, and even maternal death [9, 10]. Uterine atony is the chief cause of PPH [11]. Timely placenta expulsion and an effective uterine contraction to stop bleeding are key element to prevent 3rd stage complications [12].

Placental expulsion depends its separation from uterine wall, capillary hemorrhage, contractility of the uterine muscle, maternal effort, and gravity effect on the placenta [12]. Placenta delivery is generally completed within 15 minutes following the fetus delivery in 90% of parturient [10, 13]. Two distinct methods are usually used to manage the 3rd stage of labor. They are active and physiological/expectant management. The active management includes oxytocic administration, umbilical cord early clamping and cutting, and the controlled cord traction [7, 11]. The physiological or expectant management primarily includes maternal effort supported by gravity, nipple stimulation through breast feeding and skin-to-skin contact rapidly after birth, nipple stimulation increasing maternal oxytocin concentrations and strengthening the uterine contractions that will assist the placental separation and control bleeding [14, 15]. In females at low PPH risk, several researches have reported that active pharmacological management does not decrease blood loss when compared with physiological expectant management [16].

Nowadays, it is prevalent practice in the active 3rd stage management to clamp umbilical cord at both maternal and fetus sides and then cut it. After appearance of placenta separation signs it is delivered through controlled cord traction (Andrews brand maneuver) [17]. The new trend in 3rd stage management is placenta cord drainage (PCD). The hypothesis behind this technique is that low weight of the placenta may facilitate its delivery. From the physiological point of view, PCD may decrease its bulkiness, consequently, it increase the uterine contractility and make it more efficient. Effective uterine contraction mostly will shorten the 3rd stage duration and decrease the risk for PPH [17]. PCD includes clamping the umbilical cord immediately after fetus delivery from maternal and fetus side until cutting the cord and then unclamping the maternal side to allow placental blood drainage. Complete flow of the placental blood should be maintained into suitable container [18, 19].

Although the researches about PCD have long history, no clear conclusion had been drawn on its beneficial or harmful effects. In 1999, Razmkhah [18] first noted that, when using the PCD technique, the length of 3rd stage of labor was considerably shorter. Equivalent findings were revealed by other investigators [16, 20]. A Cochrane review also reported a decrease in the 3rd stage duration with PCD [19]. However, other one study [21] discovered no additional advantage from PCD. As regard postpartum complications, most trials discovered no important rise in post-partum complication with PCD [16, 18, 20]. However, PPH was increased in one study [21]. In addition, in clinical practice, PCD is still not commonly used. These contradictory results necessitate several studies to fill the knowledge and practice gap in this respect.

METHODOLOGY

Aim of the Study

This study aims to investigate the effect of Placental Cord Drainage (PCD) on the third stage of labour progress and incidence of postpartum hemorrhage.

Operational Definition

3rd stage labour progress in this study refers to the 3rd stage duration, time elapsed until appearance of placental separation signs, amount of blood loss during the 3rd stage of labour, incidence of retained placenta, and need for blood transfusion during the early postpartum period.

Research Hypothesis

H0: Women who are exposed to PCD have the same 3rd stage progress and incidence of PPH as control group.

H1: Women who are exposed to PCD have more favorable 3rd stage progress and lower incidence of PPH than control group.

Research Design: Randomized controlled clinical trial.

Setting: This study is conducted at normal labour unit at Damanhour educational institution affiliated to ministry of health at Elbehira governorate/Egypt.

Sampling

A purposive sample composed of 120 women undergoing normal easy vaginal delivery. Inclusion criteria are normal pregnancy, aged 20 to 35 years, full term singleton pregnancy, normal first and second stage of labour and agree to participate in the study. Women who exposed to any pregnancy or labour (first and second stage) complications were excluded from the study.

Sample Size

Sample size was calculated using Epi-info program using the following data: target population 920 in the last 6 months, acceptable error 5%, expected frequency 50%, confidence coefficient 95%. Sample size =120 women.

Sampling Technique

The selected participants were assigned randomly to either PCD or control group using randomization block technique. This technique was done manually according the subsequent flowing steps: A list was prepared on the computer that contained numbers from 1 to 120. Two copies were printed from this list.

One of the two lists was cut to small pieces. Each piece contained one number from 1 to 120. The papers pieces are rolled up until all numbers become investable then they were put in large ball. The 120 pieces of papers were randomly allocated to six blocks, each one contain 20 random pieces of paper. From each block, 10 pieces of papers were randomly picked to be cases and the remaining 10 are considered control. Finally, the researchers register in front of each number, in the previously prepared list, it will be case or control. This list was used as a guide during data collection process. A total of 60 participants were considered potential cases and 60 participants were considered potential control. The list is saved in closed envelop that is opened immediately at time of data collection.

Tools of Data Collection

Tool I: sociodemographic characteristics and obstetric history interview schedule.

The researchers developed it after reviewing the current literatures to collect basic data. It composed of two main parts. Part I: include sociodemographic characteristics as age residence, occupation and level of education. Part II: Obstetrical history, it include gravidity, parity, gestational age, pre-delivery Hb, pre-delivery HCT, history of postpartum hemorrhage, retained placenta, and previous labour complications. It also includes weight and height.

Tool II: Labour assessment sheet

It consists of three main parts. Part I: Summary of the first and second stage of labor. It collect data like duration of the 1st stage of labor, duration of the 2ndstage of labor, newborn birth weight and incidence of episiotomy or tears. Part II: third stage assessment sheet. It composed of eleven open and close-ended questions those asses the labour progress during 3rd stage of labour and intervention done. Part III: Early postpartum assessment sheet. It encompass eight questions to assess the maternal condition during the first 24 hours postpartum and incidence of PPH. It also describe the intervention done in the first 24 as blood transfusion.

FILED WORK

1. The study purpose had been clarified to the responsible authority in the college of nursing to obtain their agreement. An official letter was taken from nursing college at Damanhour University and directed to Damanhour National Medical institute to gain their permission to carry out the research after explanation of its purpose and scientific background.
2. The researchers developed all tools after intensive reviewing of the relevant literatures.
3. Tools content validity has been tested by jury of five expertise in the filled of obstetrics and gynecology nursing and one of the statistics filed. Tools reliability has been tested using Cronbach alpha coefficient test ($r=0.81$).
4. Clinical work:
 - Data were collected over a period of 6 months from the beginning of March until end of August 2019.
 - The study had been conducted on women undergoing normal vaginal deliveries who fulfilled the inclusion criteria.
 - **Ethical consideration:** Oral consent was taken from each woman in the study and control group after clarification of the study purpose. Each woman is interviewed in complete privacy and assured that all her data are confidential and will be used only for research purpose only. She was informed about her right to reject participation without any consequences.

- Tool I was collected from the woman record at time of first stage of labour.
- 1st and 2nd stage of labour care were performed as routine for both PCD and control group. Early cord clamping and cutting is the routine procedure followed in both groups. All required data from the 1st and 2nd stage is collected by direct observation.
- Duration of 1st, 2nd and 3rd stage of labour were calculated using stopwatch.
- Immediately at the time of fetus expulsion, the closed envelop is opened to know if the case is PCD or control group.
- Immediately after birth, the woman is injected with 5 IU of oxytocin intramuscular as routine after exclusion of its contraindications.
- For PCD group, few second after cord cutting its unclamped from the maternal side and put in container to receive drained blood. The cord is let to drain placental blood until it is stopped. The container used to collect blood is different from that was used to estimate the amount of blood loss during third stage of labour.
- For the control group: the cord remains clamped until the end of the third stage.
- For both group, placenta is delivered by controlled cord traction after appearance of placental separation signs. Once the uterus become hard, contracted and bleeding is stopped the remaining blood is removed from vagina. The doctor performed episiotomy repair and sterile sanitary pad was provided.
- Blood loss is collected in both groups using Kelly's pad, which is used from the beginning of the 3rd stage. It is put under the woman buttocks and its tail is drained in clean metal bowel to collect blood loss. No cotton or gauze used at this time.
- The primary outcomes which was assessed in the two groups include: vital signs, time elapsed between fetus delivery and placenta separation signs, 3rd stage duration, amount of blood loss during 3rd stage, uterus condition after placenta separation, placenta weight, incidence of retained placenta.
- Secondary outcomes are assessed after the first 24 hours postpartum. The secondary outcomes include vital signs, PPH incidence, condition of the uterus, need of uterotonic drugs, type and dose of uterotonic drugs given, blood transfusion need.

DATA ANALYSIS

After completion of data collection it was feed to SPSS version 24. Data was explored using descriptive statistics such as number, percentage means±SD. Differences between the two group are examined using chi-square and fisher exact test.

RESULTS

Table-1: Distribution of the study participants according to their sociodemographic characteristics and BMI

Sociodemographic characteristics and BMI	PCD N= 60		Control N= 60		Significance test	P value
		%		%		
Age (Mean ±SD)	28.28±5.400		27.70±6.461		t=0.537	P=0.593
Working status						
– Housewife	48	80	45	75	X ² =0.430	P=0.662
– Working	12	20	15	25		
Education					FET=4.214	P=0.241
– Read & write	10	16.7	16	26.7		
– Primary & Prepratory	17	28.3	9	15.0		
– Secondary /University	33	55.0	35	58.3		
Residence					X ² =1.656	P=0.198
– Rural	23	38.3	30	50.0		
– Urban	37	61.7	30	50.0		
BMI						
– 18.6-24.9	3	5.0	9	15.0	FET=3.473	P=0.128
– 25 and more	57	95.0	51	85.0		
Mean ±	27.6755±1.96688		27.4177± 2.42948		t=0.639	P=0.524

X²= chi-square; F= Fisher exact test; ^a significant at 0.05

Table-1 shows no statistically significant differences between the PCD and control group regarding their sociodemographic characteristics. The mean age is 28.28±5.400 in PCD group compared to 27.70±6.461 in control. At the same time, 80% the PCD group are housewives compared to 75% of the control group. In addition, around half of both PCD (55%) and control (58.3%) group had secondary school or university education. Furthermore, 61.7% of the

PCD group are urban area residence compared to 50% of the control group. The vast majority of PCD group (95%) has BMI 25 and more compared to 85% among control group.

Table-2: Distribution of the study participants according to their obstetrical history and pre-delivery investigations

Obstetrical history and predelivery investigations	PCD		Control		t test	P value
	Mean ± SD		Mean ± SD			
Gravidity:	2.48±1.490		2.55±1.651		0.232	0.817
Parity	1.467±1.5781		1.517±1.7123		0.166	0.868
Gestational age	39.187±0.8123		39.148±0.8123		0.248	0.805
Pre-delivery Hb	11.103±0.8093		11.103±0.7385		0.059	0.953
Pre-delivery HCT	32.533±2.1821		31.950±2.1267		1.483	0.141
	N(60)	%	N(60)	%		
History of PPH						
– Yes	9	15.0	12	20.0	X ² =0.519	P=0.471
– No	51	85.0	48	80.0		
History of retained placenta						
– Yes	5	8.3	10	16.7	X ² =1.905	P=0.269
– No	55	91.7	50	83.3		
History of other labour complications						
– Yes	2	3.3	8	13.3	FET=3.927	P=0.039 ^a
– No	58	96.7	52	86.7		

X²= chi-square; F= Fisher exact; test t= independent samples; t test ^a significant at 0.05.

Table-2 shows no statistically significant differences between both groups in relation to their obstetrics history and pre-delivery investigation except for history of other labour complications. The mean gravidity, parity, and gestational age is 2.48±1.490, 1.467±1.5781 and 39.187±0.8123 among PCD compared to 2.55±1.651, 1.517±1.7123 and 39.148±0.8123 among control group, respectively. Furthermore, the Pre-delivery Hb and HCT is 11.103±0.8093 and 32.533±2.1821 for PCD compared to 11.103±0.7385 and 31.950±2.1267 for control group, respectively. History of PPH, retained placenta and other delivery complications is absent among 85%, 91.7% and 96.7% of the PCD group compared to 80%, 83.3% and 86.7% of the control group.

Table-3: Distribution of the study participants according to first and second stage of labour summary

First and second stage of labour summary	PCD (N=50)	Control (N=50)	Significance test	P value
	Mean ± SD	Mean ± SD		
Duration of the 1st stage (hours)	8.9533±4.05915	9.4683±4.41954	0.665	0.507
Duration of 2nd stage (minutes)	54.5117±20.94502	54.6217±17.35741	0.31	0.975
Newborn weight (grams)	4060.83±268.121	3520.83±0.412	1.009	0.315
Episiotomy or tear N (%)				
– Yes	24 (40)	32(53.3)	X ² =0.134	0.200
– No	36(60)	28(46.7)		

t= independent samples t test; X²= chi-square; ^a significant at 0.05

Table-3 shows no statistically significant differences between PCD and control group regarding the first and second stage of labour summary. Where, the mean duration of the 1st and 2nd stage of labour is 8.9533±4.05915 and 54.5117±20.94502 for PCD group compared to, 9.4683±4.41954 and 54.6217±17.35741 for the control group, respectively. In addition, 60% of the PCD group not performed episiotomy compared to, 46.7% among control group.

Table-4: Distribution of the study participants according to third stage assessment progress

Third stage of labour progress	PCD		Control		Significance test	P value
	Mean ± SD		Mean ± SD			
Vital signs						
– Systolic BP	120.00±8.636		121.00±8.916		t=0.624	0.534
– Diastolic BP	78.00±6.120		77.75±5.706		t=0.231	0.817
– Pulse	75.88±7.762		74.74±8.752		t=2.814	0.092
– Respiration	13.70±0.73		13.48±0.792		t=1.545	0.125
Time elapsed until appearance of placenta separation signs/Minutes	3.5583±0.83915		5.7067±0.89393		t=13.572	0.000 ^a
3rd stage duration / Minutes	5.1417±1.03138		7.4583±1.19877		t=11.572	0.000 ^a
Amount of blood loss /ml	195.45±13.994		265.45±21.920		t=20.849	0.000 ^a
Placenta weight/ g	580.333±64.97631		630.9167±65.61632		t=4.243	0.000 ^a
Uterotonic drugs dose	7.6167±3.05371		7.0333±3.26754		t=0.722	0.472
	N(60)	%	N(60)	%		
Uterotonic drug type						
– Syntocinon	51	85	55	91.7		
– Syntocinon + methargin	9	15	5	8.3	FET=1.573	0.716
Uterus condition after placenta delivery						
– Contracted	58	96.7	55	91.7	FET=1.672	P=0.437
– Relaxed	2	3.3	5	8.3		
Route of uterotonic drugs						
– IM	2	3.3	5	8.3	FET=1.408	P=0.235
– IV	58	96.7	55	91.7		
Retained placenta						
– No	60	100	57	95	FET=4.662	P=0.001 ^a
– Yes	0	0.0	3	5		

t= independent samples t test; F= Fisher exact test; a significant at 0.05

Table-4 shows no statistical significant differences between PCD and control group regarding vital signs during the 3rd stage of labour, uterus condition after placenta delivery, type, dose and route of uterotonic drugs given during 3rd stage. On the contrary, a statistical significant reduction in time elapsed until appearance of placenta separation signs, 3rd stage duration, amount of blood loss during 3rd stage, placenta weight and incidence of retained placenta in the PCD than the control group.

Table-5: Distribution of the study participants according to first 24 hours assessment parameters

First 24 hours assessment parameters	PCD		Control		Significance test	P value
	N= 50	%	N= 50	%		
Uterus condition						
– Contracted	57	95.0	49	81.7	X2=11.88	P=0.001 ^a
– Relaxed	3	5.0	11	18.3		
Incidence of PPH						
– No	58	96.7	50	83.3	FET=10.623	P=0.002 ^a
– Yes	2	3.3	10	16.7		
Need for blood transfusion						
– No	58	96.7	50	83.3	FET=13.623	P=0.001 ^a
– Yes	2	3.3	10	16.7		
Need for extra routine uterotonic drugs						
– No	57	95.0	49	81.7	X2=12.88	P=0.001 ^a
– Yes	3	5.0	11	18.3		
Type of routine uterotonic drugs used						
– Syntocinon	49	81.7	52	86.7	FET=9.78	P=0.002 ^a
– Syntocinon + methargin	11	18.3	8	13.3		
Route of uterotonic drugs used						
– IM	11	18.3	13	21.7	FET=11.788	P=0.004 ^a
– IV	49	81.7	47	78.3		
	Mean ±SD		Mean ±SD			
Dose of uterotonic drugs	5.0566±1.41985		8.6780±2.62902		t=1.577	P= 0.118
Vital signs						
– Systolic BP	104.3333±7.55913		100.2500±6.91504		t=11.667	P=0.000 ^a
– Diastolic BP	64.9167±4.36586		60.3000±4.97213		t=10.745	P=0.001 ^a
– Pulse	83.4667±2.78292		88.27667±3.11022		t=13.879	P=0.000 ^a
– Temperature	36.20±1.345		36.5±1.233		t=1.002	P= 0.103
– Respiration	14.4000±0.99490		14.2833±0.97584		t=0.648	P= 0.518
Maternal hemoglobin(mg/dl)	9.5234±0.6087		8.458±0.873		t=11.679	P=0.000 ^a

t= independent samples t test X^2 = chi-square F= Fisher exact test a significant at 0.05.

Table-5 shows statistically significant differences between PCD and control group in all parameters assessed after 24 hours postpartum except for temperature and respiration. Where, 18.3% of the control group have relaxed uterus, and needs extra dose of uterotonic drugs compared to only 5% of the PCD group. Furthermore, only, 3.3% complained from PPH and need blood transfusion among PCD group compared to, 16.7% of the control group. Syntocinon was the most common uterotonic drug used and mostly injected in intravenous solution in 81.7% in PCD group compared to, 86.7% among control group, respectively. The PCD group have lower systolic and diastolic BP with mean 104.3333 ± 7.55913 and 64.9167 ± 4.36586 compared to, 100.2500 ± 6.91504 and 60.3000 ± 4.97213 in the control group. Furthermore, the mean pulse is higher among control (88.27667 ± 3.11022), compared to PCD (83.4667 ± 2.78292). Control group needs higher dose of uterotonic drugs (8.6780 ± 2.62902) than PCD group (5.0566 ± 1.41985). In addition, maternal hemoglobin is slightly higher in PCD group (9.5234 ± 0.6087) compared to, control (8.458 ± 0.873).

DISCUSSION

In the third stage current practices, early clamping of the umbilical cord from both sides and placenta delivery after appearance of placenta separation signs is common practice (brandet Andrews maneuver). Recently, WHO recommended PCD. This include unclamping the umbilical cord from the maternal side to drain the blood. Physiologically, it is supposed to decrease bulkiness of the placenta and allow the uterus to contract in more effective way. Consequently, decrease the 3rd stage duration and decrease incidence and severity of PPH [17, 18].

The current study results revealed that there is a significant difference between PCD and control groups in relation to the 3rd stage duration. This finding is consistent with the results of at least five recent studies. *First*, Afzal *et al.*, [22] who investigated the impact of PCD on the third stage progress after normal vaginal delivery. They concluded that PCD significantly reduced 3rd stage duration after spontaneous vaginal delivery. *Second*, Mithala *et al.*, [23] who had conducted a randomized controlled trial in Buddhachinaraj Phitsanulok Hospital. They compared the amount of blood loss and the duration elapsed between fetus delivery and placenta delivery in PCD with early cord clamping group. They found that median duration of the 3rd stage in the PCD group was significantly shorter than the control group. They concluded that PCD could reduce 3rd stage duration and consequently reduced the amount of blood loss. *Third*, Mohamed *et al.*, [24] who had conducted randomized controlled trial on 180 women who underwent normal vaginal delivery. They compared the PCD with no PCD on the 3rd stage progress. They stated that the 3rd stage duration was significantly lower in PCD than no PCD group. *Fourth*, Kaba *et al.*, [25] who studied the combination of PCD with 20 IU oxytocin on the 3rd stage duration. They stated that the median 3rd stage duration in the study group was 3.40 minutes compared to 5.10 minutes in the control group. This difference between the groups was statistically significant ($p < 0.01$). *Fifth*, Al-Jeborri *et al.*, 2010 [26] who had evaluated PCD after normal vaginal delivery as a part of the 3rd stage management. They indicated that, PCD is simple, safe, and non-invasive method that can significantly reduce the 3rd stage duration. Where, the mean duration of 3rd stage was (5.35 ± 2.3 minutes) in the PCD group compared to (8.9 ± 4.9 minutes) in control group. Moreover, another eight randomized controlled clinical trials conducted in the duration ranged from 2005 to 2017 reported similar results with the current study [17, 20, 27-32].

The results of the present study are also supported by a recent meta-analysis including nine studies on 2653 patients. It is found that the 3rd stage duration is significantly shortened (2.28 minutes) with PCD [33]. Furthermore, other three cochrane database of systemic reviews, which are, Hofmeyr 2015 [15], Begley *et al.*, 2011 [34], Soltani 2005 [18] studied the effect of PCD on the 3rd stage. All of them have shown that PCD significantly reduced the 3rd stage duration.

On the contrary, a recent study conducted by Vasconcelos *et al.*, [35] has concluded that PCD had no effect in reducing the 3rd stage duration. The 3rd stage duration was approximately 14 minutes in both study and control group ($p = 0.66$). In addition, Amorim 2015 [36] and Lankeshwara, 2008 [37] concluded that PCD had no effect on reducing the 3rd stage duration. They reported opposite results by pointing out that PCD as a part of the 3rd stage management increased the 3rd stage duration. The differences between the current study and the latter group studies may be due to different intervention used in combination with PCD. For example if expectant placenta delivery is applied, the third stage duration will be longer than if active delivery of placenta is applied. In the current study, controlled cord traction in combination with oxytocin injection is applied after appearance of placenta separation signs. In addition, detailed information and data about 460 women in Amorim's trial [36] and Lankeshwara [37] are lacking, and this lack of information might be a source of deviation. One very old study done by Thomas *et al.*, [21] has reported that no benefit of PCD on reducing the 3rd stage duration.

The current study results pointed out that both blood loss and PPH incidence were lower among PCD group than control. This means that PCD may decrease amount of blood loss during third stage of labour and consequently decreasing PPH risk.

These findings are in the same line with the results of at least five previously mentioned recent studies. *First*, Afzal *et al.*, 2019 [22] who concluded that the mean blood loss in PCD group was statistically lower compared to the other group ($p < 0.001$). *Second*, Meena *et al.*, 2017 [27] they revealed that blood loss and postpartum hemorrhage during 3rd stage were significantly reduced in the study group compared to control group. *Third*, Royet *et al.*, 2016 [28] that included 200 women who are randomized between PCD versus active management or active management only groups. The results showed that blood loss during the 3rd stage of labour and incidence of PPH were significantly lower in the PCD compared to the other two groups. *Fourth*, Al-Jeborry *et al.*, 2010 [26] revealed that PCD is simple, safe, and non-invasive method in reducing blood-loss during 3rd stage of labour, thereby, preventing PPH. *Fifth*, Shrivage and Silpa, 2007 [32], who found that the mean blood loss in PCD group was statistically lower compared to the control group. Furthermore, PCD reduced PPH incidence to 3% compared to 10% in the control group.

The results of the present study are also supported by two randomized controlled trials. They are Asicioglu *et al.*, 2015 [30] and Sreelatha *et al.*, 2013 [31]. Both of them shown that the average amount of blood-loss and incidence of PPH were significantly lower in the PCD group ($p < 0.05$ each). Furthermore, two Cochrane database of systemic reviews, which are Hofmeyr *et al.*, 2015 [15] and Begley *et al.*, 2011 [34] studied the effect of PCD during the 3rd stage of labor. Both of them shown that PCD resulted in statistically significant reduction of blood loss during the 3rd stage of labor. In addition, Mithala *et al.*, 2018 [23] and Mohamed *et al.*, 2017 [24] reported that the median blood loss in study group was lower than the control group. They also added, PPH was non-significantly less frequent among study group than among control group.

Furthermore, a recent 2017 meta-analysis including nine studies performed on 2653 women found that PCD reduced PPH incidence to 3%. This finding is surprising since the same meta-analysis reported no reduction in amount of blood loss. The included studies in this meta-analysis were very heterogeneous; caution is needed before drawing definitive conclusions. The meta-analysis suggests that PCD is a simple and noninvasive procedure that seems to add to labour management, but more studies are still necessary to clarify its importance [33].

On the contrary, a recent study conducted by Vasconcelos *et al.*, 2018 [35] has concluded that PCD had no effect in reducing blood loss or frequency of PPH during the 3rd stage of labor. One explanation for the contradictory finding might be that the present study sample consisted of pregnant women at little risk of developing hemorrhage. Furthermore, all participants received prophylactic oxytocin for preventing postpartum hemorrhage. In addition, Amorim 2015 [36] concluded that PCD had no effect on reducing blood loss during the 3rd stage of labour. Lankeshwara 2008 [37] also reported opposite results by pointing out that PCD as a part of the 3rd stage management increased blood loss and PPH incidence.

The present study results showed that 3rd stage duration was 5.1417 ± 1.03138 in PCD group compared to 7.4583 ± 1.19877 in the control group with a statistically significant difference between the two groups. The previously discussed, Wu H *et al.*, 2017 [33] meta-analysis reported similar results to the current study as regard the duration of the 3rd stage. The third stage duration among their participants was 2.28 minutes shorter than the control group. In addition, the previously discussed Mohamed A 2017 [24] is online with the present study finding. They reported that the 3rd stage duration was 4.4 minute in PCD group compared to 7.7 minute in the control group.

On the contrary, Taebi *et al.*, 2012 [38] results, they reported that 3rd stage was longer among PCD group than control. This discrepancy between the present study findings and the findings of Taebi *et al.*, 2012 [38] might be attributed to the gestational age of study participants. Where, in the current study, mean gestational age was 39.187 ± 0.8123 while in the contradictory study was lower than 37 weeks. Based on previous literatures, 3rd stage duration is longer among preterm deliveries. As with placenta aging at the end of pregnancy, it will be ready to separate. Combs and Laros [39] study shown some evidence of placenta aging hypothesis. They concluded that 3rd stage duration at labour occurred on 32 to 35 weeks is significantly longer than that occurred at 36 weeks or more with p value less than 0.05.

The present study revealed that postpartum hemoglobin is significantly higher in PCD group compared to control group. This result is in line with the previously mentioned studies conducted by Meena *et al.*, 2017 [27] Mohamed *et al.*, 2017 [24] Roy *et al.*, 2016 [28] Mohammed & Jeborry 2010 [40], and Giacalone 2000 [16]. All of them showed PCD significantly saves hemoglobin. They reported significance difference in postpartum hemoglobin level in PCD group than control group. In contrast, in a study done by Soltani *et al.*, [18] there was no significant change in mean postpartum hemoglobin. Although Soltani *et al.*, [18] reported no significance difference between PCD and control group regarding hemoglobin level, it is not lower than control group.

The present study revealed that there were significant difference between both groups regarding postpartum systolic BP, diastolic BP and pulse. This result is congruent with the previously mentioned study conducted by Mohamed

et al., [24]. They concluded that the postpartum systolic blood pressure, diastolic blood pressure and pulse were affected among PCD group compared to control. No other trials had been found in this respect.

The current study results revealed that there were significant differences were observed between the PCD and control group in relation to the manual removal of placenta, need for blood transfusion, and uterine condition during postpartum period. These findings are partially in the same line with the previously mentioned studies conducted by Mithala *et al.*, [23] and Mohamed *et al.*, [24] they reported that the retained placenta was less frequent among PCD group than control. They further added that the need for postpartum blood transfusion was lower in PCD group compared to control without significant differences. Furthermore, Jongkolsiri & Manotaya 2009 [17] concluded that no need for manual placental removal in PCD group. On the contrary, Soltani *et al.*, [19] reported no difference in the need for a blood transfusion during postpartum period between PCD and control group. Furthermore, Sharma *et al.*, [20] reported that the need for blood transfusion was not statistically significant differ among PCD group compared to control group and there was no case of retained placenta in either groups. Overall, the presented data showed that PCD could significantly shorten the 3rd stage and the amount of blood loss. The method is easy to perform, safe, and does not increase in cadence of postpartum hemorrhage.

CONCLUSION

The present study results shows no statistical significant differences between PCD and control group regarding vital signs during the 3rd stage, uterus condition after placenta delivery, type, dose and route of uterotonic drugs given during 3rd stage. On the contrary, a statistical significant reduction in time elapsed until appearance of placenta separation signs, 3rd stage duration, amount of blood loss during 3rd stage, placenta weight and incidence of retained placenta in the PCD than control group. In the early postpartum assessment, the mean pulse is higher among control compared to PCD group. Control group needs higher dose of uterotonic drugs than PCD group. In addition, maternal hemoglobin is slightly higher in PCD group compared to control group.

RECOMMENDATION

PCD is safe, effective noninvasive intervention that may help in improving 3rd stage progress and reduce PPH incidence. PCD should be added to third stage of labour intervention protocol. Future researches should be done to investigate benefits of PCD versus its harm.

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