MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.959.965

A Simple Step to Minimize Atonic Postpartum Haemorrhage During Caesarian Section

[1]Sannyasi Charan Barman, [2]Pratima Garain, [3]Malay Kumar Nandy, [4]Kajal Kumar Patra and [5]Kishore P. Madhwani

[1,2,3]Department of Gynae and Obstetrics, Bankura Sammilani Medical College, Bankura, West Bengal, India

[4]Department of Gynae and Obstetrics, Gouri Devi Institute of Medical Science, Durgapur, West Bengal, India

[5]Mumbai, Maharashtra, India

OPEN ACCESS

Key Words
Atonic post partum haemorrhage, cesarean section, uterine atone

Corresponding Author
Kajal Kumar Patra,
Department of Gynae and Obstetrics, Gouri Devi Institute of Medical Science, GT Road, National Highway 2, Rajbandh, Durgapur, West Bengal, India
drmch2000@gmail.com

Author Designation
[1]Assistant Professor
[2,3]Associate Professor
[4]Ex-Professor and Head
[5]Senior Medical Consultant

Received: 5 August 2023
Accepted: 19 August 2023
Published: 20 August 2023

Citation: Sannyasi Charan Barman, Pratima Garain, Malay Kumar Nandy, Kajal Kumar Patra, Kishore P. Madhwani, 2023. A Simple Step to Minimize Atonic Postpartum Haemorrhage During Caesarian Section. Res. J. Med. Sci., 17: 959-965, doi: 10.59218/ makrjms.2023.959.965

ABSTRACT

A frequent and potentially fatal labour complication is postpartum haemorrhage. More blood is lost during a caesarean section than during a vaginal delivery. Despite this, both in affluent and developing nations, there is a tendency towards rising caesarean section rates, which raises the risk of morbidity and mortality, particularly in anaemic women. The main goal was to determine how effective this approach was at preventing PPH. Our secondary goal was to assess how much surgical interference how long the procedure took and whether a uterotonic drug was necessary. The department of gynaecology and obstetrics at Bankura sammilani medical college in bankura, west bengal, India conducted this prospective case control study of PPH in caesarean section from October 2021 to March 2023. About 610 instances in the study group and 606 cases in the control group, totaling 1216 mothers who were scheduled for caesarean sections from the labour room and prenatal ward were included in this study. Mean maternal age was 23.08±3.67 years in study group and 23.12±4.02 years in control group. Prime para and multi para was 304 (49.83%) and 1306 (50.16%) vs. 324 (53.47%) and 282 (46.53%) in study and control group, respectively. Indication of emergency and non emergency cesarean section (CS) were 304 (49.84%) and 306 (50.16%) vs. 316 (52.15%) and 290 (47.85%) in study group and control group, respectively. Uterine contraction felt definitely in 578 (94.75%) cases and 510 (84.16%) cases and not felt definitely in 32 (5.25%) cases and 96 (15.84%) cases. In study group there is no requirement of relaparotomy but in control group 4 cases needed relaparotomy. In study group, average and more than average blood loss was 560 (91.80%) and 50 (8.20%) cases and in control group it was 440 (72.61%) and 166 (27.39%) cases, respectively. Oxytocin and additional uterotonic agent needed in 574 (94.10%) and 36 (5.90%) vs. 468 (77.23%) and 138 (22.77%) cases. In addition to the standard procedures in AMTSL, the placement of a fan-shaped hand inside the uterine cavity during caesarean delivery following the delivery of the foetus would improve the confirmation of uterine contraction more specifically. The result is a reduction in maternal morbidity and death as well as the prevention of atonic PPH. It also limits or reduces the need for extra uterotonic agents, operating time and operative interference. A larger, randomised control trial is necessary for further analysis.

INTRODUCTION

PPH is characterised by a >10% reduction in hematocrit[1]. Primary PPH is defined as bleeding that starts within 24 hrs of birth and secondary PPH is described as bleeding that continues past 24 hrs and continues for up to 6 weeks following delivery[2-4].

According to data from the world health organisation (WHO), PPH accounts for 25% of all maternal fatalities and is the leading global cause of maternal mortality and morbidity[5,6]. According to the WHO, PPH complicates 10.5% of live deliveries and in 2000, there were 13,200 maternal fatalities and 13,795,000 PPH cases among women[7]. The incidence of PPH in India is 2-4% for vaginal deliveries and 6% for caesarean deliveries. PPH is a significant contributor to 19.9% of maternal deaths in India[8]. Uterine atony is to blame for 75-90% of PPH patients. Active management of the third stage of labour can prevent between 60 and 70% of atonic PPH occurrence. During the fourth stage of labour, blood pressure, pulse and haemorrhage are monitored and bedside[9].

More than 21000 babies are delivered annually at our tertiary maternity care teaching hospital in West Bengal's Bankura, Purulia and Paschim Medinipur districts, with a 36% caesarean section rate. PPH is one of the leading causes of maternal death in our institution. PPH can have a variety of causes, which can be categorised under the following four headings:

- Uterine atony, including "grand multipara", "over distended uterus in multiple pregnancy", "poly hydramnios", "big baby", malnutrition and anaemia, "ante partum haemorrhage", "prolonged labour", "augmentation of labour with oxytocin", "placental bits or retained placenta", "uterine malformation"
- Trauma (Lacerations, haemorrhages, tears, ruptured wombs and inversion of wombs)
- Atone and traumatic combo
- A problem with blood coagulation. Atonic PPH make up 70% of PPH (6), 7-9 and 25% of PPH are traumatic

Obstetricians are familiar with risk factors. Rapid team-based therapy and prompt diagnosis reduce PPH-related morbidity and mortality while paying less attention to underlying causes. But 20% of PPH cases are in women who don't have any risk factors. In order to handle this condition during every delivery or better yet to have enough experience to prevent the PPH, obstetricians must be prepared.

MATERIALS AND METHODS

This prospective case control research was carried out at the Bankura Sammilani Medical College in Bankura, West Bengal by the department of gynaecology and obstetrics. From October 2021 to March 2023, this research was conducted among mothers who had C-sections.

Inclusion criteria: A random sample of mothers who were scheduled for caesarean sections in the labour room and prenatal ward.

Exclusion criteria: Placenta praevia cases were excluded from study.

Sample size: This study comprised a total of 1216 mothers who were prepared for caesarean section in the labour room and antenatal ward and were randomly selected 610 cases in the study group and 606 instances in the control group.

In the study group, we established uterine contraction not only by inspecting and palpating the uterus but also by inserting the surgeon's hand within the uterine cavity in a fan-shaped manner over the placental surface following foetus delivery. When uterine contractions are confirmed, the placenta is extracted using control cord traction. Except for the entry of the hand inside the uterine cavity, all three steps of the third stage management of labour (AMTSL) were maintained in the control group.

We make an incision for a caesarean section at the lower uterine portion. Baby was delivered as per standard practise and given to the assistant for first care of the newborn baby. The surgeon carefully examined the incision uterine edge for any big vascular injuries (such as uterine artery tears) and if necessary, temporary hemostasis was established by grabbing the arterial with hemostatic forceps. The surgeon next inserted his or her right hand into the uterine cavity and put it over the placenta in the shape of a fan. Gradually, the uterus begins to contract over the fan-shaped hand (a grabbing sensation over the hand), which confirms the uterine contraction and retraction in real time. Here, we confirmed uterine contraction both visually and physically (the uterus takes on a pyriform or globular shape has numerous rugosities over its surface and is firm in consistency) as well as in real time by placing the surgeon's hand inside the uterine cavity. Once there is proof of uterine contraction, the placenta is extracted using control cord traction. Our main goal was to determine how effective this strategy was at preventing PPH. Evaluation of surgical interference, surgical time and the need for a uterotonic drug were our secondary goals.

With the exception of placing the hand within the uterus to feel uterine contractions in real time, all three phases of the third step management of labour (AMTSL) were maintained in the control group. For 10 units of oxytocin were administered intravenously during caesarean sections and 5 units were administered as an infusion drip after the delivery of

the baby's anterior shoulder in each group. All patients in the postoperative ward received 10 units of syntocinon for the first two bottles. In PPH cases, misoprostol, inj. methergin and inj. prostodin are used as necessary. The majority of caesarean sections were performed by SA. Blood loss for this study is determined clinically during cesarean delivery and number of vulval pad used in first 24 hrs after operation.

"Postpartum haemorrhage in caesarean section: A preventive measure-Does it help?" is the title of our current prospective case control research. The uterus and uterine cavity are easily accessible while the patient is under anaesthesia and the abdomen has been opened for a caesarean section. Before controlling cord traction for placental delivery, we here make use of direct inspection, palpation of uterine contraction and it is validated by real-time feeling of uterine contraction and retraction. In addition to visual inspection and uterine palpation, we also felt actual uterine contraction and retraction (study group) and their subsequent impact on PPH as compared to standard AMTSL techniques (control group). Our secondary goal was to assess how much surgical interference how long the procedure took and whether a uterotonic drug was necessary.

Statistical analysis: With the aid of excel and the Epi-Info version 3.5 software, statistical calculations such as descriptive statistics and chi-square tests were carried out. p-values of 0.05 or lower were considered statistically significant.

Ethical considerations: After receiving informed consents from the participants and approval from the institutional ethical committee, the study was launched.

RESULTS

Table 1 provides a summary of the maternal characteristics of the study group and control group. In the research group, the mean maternal age was 23.08±3.67 years, whereas in the control group, it was 23.12±4.02. In the study and control groups, respectively, prime para and multipara were 304 (49.83%) and 1306 (50.16%) vs. 324 (53.47%) and 282 (46.53%). In the research and control groups, 484 (79.34%) cases and 500 (82.50%) cases, respectively had gestational ages between 37-40 weeks (Table 1).

In the study group and control group, respectively, the indications for emergency and non-emergency caesarean sections (CS) were 304 (49.84%) and 306 (50.16%) vs. 316 (52.15%) and 290 (47.85%). Most caesarean sections were performed while the patient was under spinal anaesthesia. Both the study group and the control group experienced similar per abdominal and per vaginal findings (Table 2).

Events that occurred during and after surgery were compiled in Table 3. In the study group and control group, respectively, uterine contraction was definitely felt in 578 (94.75%) instances and 510 (84.16%) cases but was not definitely felt in 32 (5.25%) cases and 96 (15.84%) cases. This is statistically significant ($p<0.001$). The difference in the operation completion times of 398 (65.25%), 120 (19.67%) and 92 (15.08%) in the study and control groups compared to 472 (44.89%), 212 (34.98%) and 212 (20.13%) is statistically significant ($p = 0.001$). In the post-operative period, 514 (84.26%), 78 (12.79%) and 18 (2.95%) vulval pads were required, compared to 388 (64.03%), 114 (18.81%) and 104 (17.16%) in the control group, which is statistically significant ($p = 0.001$). In the post-operative period, 18 (2.96%) vs. 70 (11.55%) or $p = 0.001$ in the study and control groups, respectively, required vaginal examination for PPH. Relaparotomy is not necessary in the study group but it is in the control group in 4 cases. Post-operative febrile illness occurred in 28 (4.60%) and 34 (5.61%) cases in the study group and control group, respectively and was not statistically significant ($p = 0.56$) (Table 3).

Table 4 summarised intraoperative, postoperative and transfusional blood loss. Statistically significant blood loss occurred in 560 (91.80%) and 50 (8.20%) cases in the study group and 440 (72.61%) and 166 (27.39%) cases in the control group, respectively. In the study and control groups, respectively, 10 (1.64%) and 8 (1.31%) cases required two units or

Table 1: Maternal profile

	Study group (n = 610)		Control group (n = 606)	
Maternal Profile	No.	Percentage	No.	Percentage
Age				
<20	94	15.41	94	15.51
20-30	482	79.02	460	75.91
>30	34	05.57	52	08.58
Mean age±SD	23.08±3.67		23.12±4.02	
Parity				
Prime para	304	49.83	324	53.47
Multi para	306	50.16	282	46.53
Gestational age				
<37 weeks	32	05.25	46	07.60
37-40 weeks	484	79.34	500	82.50
>40 weeks	94	15.40	60	09.90

Table 2: Pre-operative findings and events

	Study group (n = 610)		Control group (n = 606)	
Pre-operative findings and events	No.	Percentage	No.	Percentage
Indication of LUCS				
Emergency	304	49.84	316	52.15
Non emergency	306	50.16	290	47.85
Types of anaesthesia				
Spinal (SA)	610	100.00	606	100.00
General (GA)	0	0.00	0	0.00
Par abdominal				
Uterine contraction				
Contraction+	306	50.16	312	51.49
Contraction-	304	49.84	294	48.51
Presentation				
Cephalic	580	95.08	560	92.41
Breech	12	1.97	30	4.94
Others	18	2.95	12	2.64
Per vaginal				
OS				
Closed	304	49.83	290	47.85
<4 cm	246	40.33	256	42.25
≥4 cm	60	9.84	60	9.90
Cervix				
<Fully taken up (<FTU)	264	43.27	284	46.86
Fully taken up (FTU)	42	6.89	28	4.63
No taken up	304	49.84	294	18.51
Station (St)				
(-1) or above	572	93.77	562	92.74
0 or below	38	6.23	44	77.26
Membrane				
Present (+)	418	68.52	446	73.60
Absent (-)	192	31.48	160	26.40

Table 3: Pre and Post-operative event

	Study group (n = 610)		Control group (n = 606)		
Pre-operative and post-operative events	No.	Percentage	No.	Percentage	p-value
Uterine contraction feel definitely					
Yes	578	94.75	510	84.16	<0.001
No	32	5.25	96	15.84	
Incision to OT completion time	0		0		
<45 min	398	65.25	472	44.89	<0.001
45-60 min	120	19.67	212	34.98	
>60 min	92	15.08	122	20.13	
Post operative no. of vulval pad use					
<6	514	84.26	388	64.03	<0.001
6-12	78	12.79	114	18.81	
>12	18	2.95	104	17.16	
Post operative exploration of vagina					
No	592	97.04	536	88.45	<0.001
Yes	18	2.96	70	11.55	
Re laparotomy	0		0		
No	610	100.00	602	99.34	0.47
Yes	0	0.00	4	0.66	
Post-operative fever					
No	582	95.40	572	94.39	0.56
Yes	28	4.60	34	5.61	

Table 4: Pre and post operative blood loss and blood transfusion

	Study group (n = 610)		Control group (n = 606)		
Pre and post operative blood loss and blood transfusion	No.	Percentage	No.	Percentage	p-value
Blood loss					
Average	560	91.80	440	72.61	<0.0001
>Average	50	8.20	166	27.39	
Blood transfusion					
No	592	97.05	546	90.09	0.00024
2 units	10	1.64	38	6.23	
>2 units	8	1.31	22	3.61	

more of blood transfusion, compared to 38 (6.23%) and 22 (3.61%) cases, p = 0.67, which is not statistically significant (Table 4).

The necessity for pre and post-operative uterotonic drugs was summarised in Table 5. Oxytocin and a second uterotonic drug were required in 574 (94.10) and 36 (5.90%) instances vs. 468 (77.23%) and 138 (22.77%) cases, respectively for the control of PPH in the study and control groups (Chi square 35.28, p = 0.0001). Less than 40 units and more than 60 units of oxytocin were required in 464 (76.07%) cases, 36 (5.90%) cases and 280 (46.20%) cases, respectively, in the study group and in the control group. P<0.001 indicates that these differences are statistically significant (Table 5).

Table 5: Pre and post operative uterotonic agent needed

Pre and post operative uterotonic agent needed	Study group (n = 610)		Control group (n = 606)		
	No.	Percentage	No.	Percentage	p-value
Uterotonic agent					
Oxytocin	574	94.10	468	77.23	<0.0001
Oxytocin and others	36	5.90	138	22.77	
Oxytocin units					
<40 units	464	76.07	280	46.20	
40-60 units	110	18.03	122	20.13	<0.0001
>60 units	36	5.90	204	33.64	

Table 6: Uterine contraction and subsequent effect

	Uterine contraction felt				
Study group (n = 610)	Contraction felt definitely Yes (n = 578, 94.75%)	Contraction felt definitely No (n = 32, 5.25%)	Control group (n = 606)	Contraction felt definitely yes (n = 510, 84.16%)	Contraction felt definitely No. (n = 96, 15.84%)
Blood loss					
Average (560)	560	0	Average (440)	438	02
>Average (50)	18	32	>Average(166)	72	94
p-value		<0.001			<0.001
Uterotonic agent					
Oxytocin (574)	574	0	Oxytocin (468)	452	16
Oxytocin+others (36)	04	32	Oxytocin + Others (138)	58	80
p-value		<0.001			<0.001
Oxytocin units					
<40 IU (464)	462	2	<40 IU (280)	275	04
40-60 IU (110)	108	2	40-60 IU (122)	116	06
>60 IU (36)	08	28	>60 IU (204)	118	86
p-value		<0.001			<0.001
Operation completion time					
<45 min (398)	390	08	< 45 mins (472)	260	12
45-60 min (120)	114	06	45 – 60 mins (212)	200	12
>60 min (92)	74	18	>60 mins (122)	50	72
p-value		<0.001			<0.001

Uterine constriction and its subsequent consequences were summarised in Table 6. In 18 of the 560 study group cases and 72 of the 438 control group cases, where uterine contraction was definitely felt, blood loss was above average in 32 of the 32 study group cases and 94 of the 96 control group cases where uterine contraction was not definitely felt, p<0.001 vs. p<0.001, which is statistically significant.

Only oxytocin was adequate to treat or prevent PPH in 574 of 578 cases versus 452 of 510 cases in the study and control groups, respectively, when uterine contraction was definitely felt. However, in 32 of 32 study group cases and 80 of 96 control group cases where uterine contraction was not clearly felt, oxytocin and additional uterotonic drug were required, p = 0.001 vs. P = 0.001, which is statistically significant. When uterine contraction was not clearly felt, more than 60 units of oxytocin were required in 28 out of 32 instances in the research group and 86 out of 96 cases in the control group. p<0.001 is statistically significant when compared to p<0.001.

When uterine contraction was not felt properly, the operation took longer than 60 min in 18 out of 322 patients in the study group and 72 out of 96 cases in the control group was statistically significant at p<0.001 vs. p<0.001 (Table 6).

DISCUSSIONS

Parity and gestational age were equivalent between the study and control groups at the time of the current study. Both groups had similar reasons for emergency and elective caesarean sections. Both group's vaginal and abdominal findings were comparable.

In comparison to 32 (5.25%) cases in the study group, uterine contraction was not felt in 96 (15.84%) cases in the control group, p<0.001. This statistically significant difference suggests that adding fan-shaped hands to the uterine cavity during a caesarean section, in addition to the standard AMTSL procedures will help confirm uterine contractions more strongly in the study group. Operative time was 120 (19.67%) and 92 (15.08%) vs. 212 (34.98%) and 122 (20.13%) in the study and control groups, respectively with a significant difference between 45-60 min and >60 min time. In comparison to the study group, the post-operative need for vulval pads and vaginal examination were statistically higher in the control group. It was discovered that there had been significantly less blood loss in the study group than in the control group when we compared intra and post-operative blood loss and blood transfusion 50 (8.20%) vs. 166 (27.39%) p = 0.0001. In comparison to only 18 (2.95%) instances in the

experimental group, 60 (12.84%) cases in the control group required two or more blood transfusions.

A case-control research reveals a 2.5% incidence of severe postpartum haemorrhage (PPH) (blood loss 1500 mL and requirement for blood transfusion), according to Lill Trine Nyflot *et al*.[10] study on risk factors for severe PPH. Risk factors for severe postpartum haemorrhage after caesarean delivery. Case-control studies, Butwick *et al*.[11] demonstrates that 3-5% of all pregnant patients will develop PPH. According to Fukami *et al*.[12] study, 2.1% of women with severe PPH (>1500 mL) and 8.7% of women with PPH 1000 mL. Ahmad [13]. The incidence of PPH after natural delivery is 2-4% and the incidence after caesarean section is 6% according to a comparative study on the infusion of ordinary dose of oxytocin and 80 units dose of oxytocin in the prevention of postpartum haemorrhage in caesarean section. Montufar-Rueda *et al*.[14] Severe postpartum hemorrhage reported from uterine atony reported from a multicentric Study that 15% PPH at birth in Hondura.

Our study also corroborates the prior study's finding that patients in the control group required blood transfusions in 25.68% of instances but only in 5.96% of cases in the study group.

About 138 (22.77%) patients in the control group in our study required extra uterotonic agents other than oxytocin, compared to just 36 (5.90%) cases in the study group, p<0.0001 (per and post-operative uterotonic agent requirement review). More oxytocin units were needed in the control group than in the study group (>60 units-36 (5.90%) vs. 204 (33.64%), p<0.0001 in the study and control groups, respectively)[15].

About 20% PPH occurs in women without any risk factors, according to Eversen *et al*.[16] study. To lower PPH, AMTSL should be used often. The most crucial and useful part of AMTSL is the use of oxytocin following anterior shoulder delivery. The first line drug for PPH prevention and therapy is oxytocin. Misoprostol is less effective than oxytocin, which also produces less side effects. According to Ahmad[13] study, there was no significant difference in the reduction in blood pressure between the group 80 units and the group 30 units for supplementary uterotonic medication.

Our research demonstrated that adding a second phase in addition to AMTSL ensures unequivocal confirmation of uterine contraction, which decreases the need for additional uterotonic drugs and oxytocin dosage. According to Lill Trine Nyflot *et al*.[10], uterine atony (60%) and placental complications (36%), respectively were the most frequent aetiologies for severe PPH. According to Butwick *et al*.[11] 2017 study, 20% of PPH cases in women have no risk factors. To lower PPH, AMTSL should be used often. According to Montufar-Rueda *et al*.[14] 2013 study, 75% of PPH cases required further uterotonic treatment since, they were caused by atonic PPH. According to Breathnach and Geary[15], the most common cause of PPH was uterine atony or the failure of the uterus to contract after birth.

These studies and ours are related in some way. We found that when uterine contraction was correctly felt before to placenta delivery, blood loss, the need for more uterotonic agents, the need for oxytocin units and the length of time it took for OT to be completed all decreased. It applied to both the study group and the control group.

CONCLUSION

PPH is the primary cause of maternal morbidity and mortality, with atonic PPH accounting for 60-70% of all cases. The most crucial factor in PPH prevention is AMTSL. The most crucial step in the delivery of the placenta is the confirmation of uterine contraction, which the surgeon must do using all available means. It will improve the confirmation of uterine contraction more particularly if we include the real-time feeling of uterine contraction and retraction by inserting a fan-shaped hand within the uterus cavity during caesarean section following birth of the foetus. Thus, it reduces maternal morbidity and mortality by preventing atonic PPH as well as restricting or eliminating the need for extra uterotonic agents, uterotonic agents, operating time and operative interference. A larger, randomised control trial is necessary for further analysis.

ACKNOWLEDGEMENTS

Authors would like to acknowledge the patients who participated in this research study.

REFERENCES

1. Wainsco, M.P., 2004. Pregnancy, postpartum hemorrhage.
2. WHO., 2008. Reducing the global burden.
3. Khan, K.S., D. Wojdyla, L. Say, A.M. Gülmezoglu and P.F.V. Look, 2006. Who analysis of causes of maternal death: A systematic review. Lancet., 367: 1066-1074.
4. Magann, E.F., S. Evans, S.P. Chauhan, G. Lanneau, A.D. Fisk and J.C. Morrison, 2005. The length of the third stage of labor and the risk of postpartum hemorrhage. Obstet. Gynecol., 105: 290-293.
5. WHO., 2012. WHO recommendations for the prevention and treatment of postpartum haemorrhage., https://pubmed.ncbi.nlm.nih.gov/23586122/

6. WHO., 2005. Maternal mortality in 2005: Estimates developed by WHO, UNICEF, UNFPA, and the World Bank. World Health Organization, Switzerland, ISBN-13: 9789241596213, Pages: 40.
7. Cameron, M.J. and S.C. Robson, 2006. Vital statistics: An overview in a text book of post partum haemorrhage. In: A textbook of postpartum hemorrhage: A comprehensive guide to evaluation, management and surgical intervention., C.B-Lynch, L. G. Keith, A. B. Lalonde and M. Karoshi, (Eds.)., 2006, pp: 17-34.
8. RGI., 2003. Trends, causes and risk factors., https://ideas.repec.org/p/ess/wpaper/id753.html
9. Haeri, S. and G.A. Dildy, 2012. Maternal mortality from hemorrhage. Seminars. Perinatology., 36: 48-55.
10. Nyflot, L.T., I. Sandven, B. Stray-Pedersen, S. Pettersen and I. Al-Zirqi *et al*., 2017. Risk factors for severe postpartum hemorrhage: A case-control study. BMC Pregnancy Childbirth, Vol. 17, No. 12884. 10.1186/s12884-016-1217-0.
11. Butwick, A.J., B. Ramachandran, P. Hegde, E.T. Riley, Y.Y. El-Sayed and L.M. Nelson, 2017. Risk factors for severe postpartum hemorrhage after cesarean delivery: Case-control studies. Anesthesia. Analg., 125: 523-532.
12. Fukami, T., H. Koga, M. Goto, M. Ando and S. Matsuoka *et al*., 2019. Incidence and risk factors for postpartum hemorrhage among transvaginal deliveries at a tertiary perinatal medical facility in Japan. PLOS. ONE., Vol. 14. 10.1371/journal.pone.0208873
13. Ahmadi, F., 2018. A comparative study on infusion of usual dose of oxytocin and 80 units dose of oxytocin in the prevention of postpartum hemorrhage in cesarean section. J. Adv. Pharm. Technol. and Res., 9: 102-218.
14. Montufar-Rueda, C., L. Rodriguez, J.D. Jarquin, A. Barboza and M.C. Bustillo *et al*., 2013. Severe postpartum hemorrhage from uterine atony: A multicentric study. J. Pregnancy., 2013: 1-6.
15. Breathnach, F. and M. Geary, 2009. Uterine atony: Definition, prevention, nonsurgical management, and uterine tamponade. Seminars. Perinatology., 33: 82-87.
16. Evensen, A., J.M. Anderson and P. Fontaine, 2017. Postpartum hemorrhage: Prevention and treatment. Am. Fam. Physician., 95: 442-449.