

Evaluation of the Role of Induced Uterine Contraction on Blood Loss during Caesarean Section under Different Types of Anesthesia: A Double Blind Controlled Study

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Received date: November 26, 2017; Accepted date: December 22, 2017; Published date: December 29, 2017

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Abstract

Background: Delivery by Caesarean section (CS) can cause more complications than normal vaginal delivery and one of its common complications is postpartum bleeding which can be life threatening. To reduce maternal mortality and morbidity caused by bleeding, it is important to reduce the extent of bleeding during and after CS.

Objectives: To compare between the efficacy of using prostaglandin F2 α under spinal or general anesthesia on decreasing the amount of blood loss during elective caesarean section.

Settings and design: A prospective, double blind controlled randomized and comparative study.

Methods: 60 patients undergoing elective lower segment caesarean section were divided into two groups: Group A received general anesthesia with subtypes A1 (general anesthesia=control group), and A2 (general anesthesia +prostaglandin F2 α) and Group B received spinal anesthesia with subtypes B1 (spinal anesthesia=control group), and B2 (spinal anesthesia+prostaglandin F2 α), hemodynamics, total blood loss, Hemoglobin Hb (gm/dl) and hematocrit Hct (%) values were recorded before and after the operation.

Results: There was significant difference in total blood loss (ml) between general and spinal anesthesia groups which was 772.333 \pm 144.287 in group A and 623.667 \pm 119.779 in group B and significant increase in total blood loss in group A1 when compared with other three groups, significant increase in group A2 when compared with B2, insignificant changes between A2 and B1 and significant increase in total blood loss in group B1 when compared with group B2.

Also the same manner present in MAP and HR where there was significant difference in MAP and HR in group A1 when compared with other three groups, significant difference in group A2 when compared with B2, insignificant changes between A2 and B1 and significant difference in MAP and HR in group B1 when compared with group B2 at 10 and 20 min but there was insignificant changes at preoperative and immediately postoperative measurements between 4 subgroups.

Conclusion: PGF2 α under spinal anesthesia decreases the amount of blood loss during cesarean section.

Keywords: Blood loss; Caesarean section; Uterine contraction

Introduction

Caesarean section (CS) rate has increased to as high as 25-30% in many regions of the world [1]. Delivery by CS can cause more problems than normal vaginal delivery and one of its common complications is postpartum bleeding which can be life threatening. To decrease maternal mortality and morbidity caused by bleeding, it is important to reduce the extent of bleeding during and after CS [2].

To control bleeding after CS, some medications such as prostaglandins (E2 and F2 α) and ordinary drugs which induced uterine contraction (oxytocin, and ergot alkaloid have been used) [3,4].

Prostaglandins are the natural tonic of the myometrial activity and have proven to be effective in induction of labour and abortion. Use of

prostaglandins in the active management of labour is an addition of their use in obstetrics, PGF2 α , a synthetic derivative of prostaglandin, has an advantage that it can be given intramuscularly, is more potent and is longer acting than natural prostaglandin [5].

In cesarean section, it is known that women receiving spinal anesthesia have decreased intraoperative blood loss compared to women receiving general anesthesia, but few researches discussed the effects of combination of the medications which induced uterine contraction and type of anesthesia in decreasing blood loss in CS.

The aim of our study was to evaluate the effects of spinal or general anesthesia and medications induced uterine contraction in the form of prostaglandin F2 α and ordinary drugs, on blood loss during and after CS by comparing the changes in Hb (gm/dl), Hct (%) values and total amount of blood loss in patients undergoing cesarean section.

Materials and Methods

A double blinded, randomized, controlled study was carried out with the approval of the Ethics and Research Committee of the Institution. A written informed consent was obtained after explanation regarding the purpose, methods, effects and complications from sixty patients who scheduled for elective or urgent lower segment caesarean section and of ASA grade I/II, with a mean age of 25 (24-27) years were selected during a two year period.

Patients with severe blood disorders such as anemia, allergy, history of thrombo-embolic disorders, abnormal placenta such as placenta previa, placenta abruption, pregnancy complications such as severe pre-eclampsia, multiple pregnancies, those requiring blood transfusion and patients who refuse spinal anesthesia were excluded from the study.

On arrival at the Operating Room, two peripheral venous cannulae and a urinary catheter were inserted and all the patients were preloaded with 10 ml/kg Lactated Ringer's solution. Monitoring consisted of echocardiogram (ECG), pulse oximeter and non-invasive blood pressure recording

In the general anaesthesia group, pre-oxygenation was administered with 10 L/min for at least 3 min, followed by intravenous induction of anaesthesia using propofol at a dose of 2 mg/kg, followed by 2 mg/kg suxamethonium. Cricoid pressure was applied as awareness was lost and maintained until tracheal intubation and cuff inflation was done and confirmed to be leak free. Further, 100% oxygen was administered with 0.75% isoflurane which was continued until the end of the procedure.

Muscle relaxation was attained with 0.5 mg/kg of atracurium after the suxamethonium was weaned off, and a peripheral nerve stimulator was used to evaluate the neuromuscular blockade. Following delivery of the baby, the anaesthesia was deepened with 0.1 mg/kg morphine i.v., reducing the inspired oxygen concentration to 33%, and removing the wedge.

Finally, any residual neuromuscular block was reversed by neostigmine 0.08 mg/kg and atropine 0.02 mg/kg, and the patient was given 100% oxygen, extubated lying sideways, and kept awake after thorough suction of the pharynx.

The risks of aspiration were reduced by evacuating the stomach before extubation. In the spinal anaesthesia group, spinal anaesthesia was administered with 10 mg (2 ml) heavy bupivacaine 0.5% in the sitting position with a 25 G needle, under sterile aseptic conditions in the L3-4 space.

Patients randomly divided using sealed envelopes into two groups according to type of anesthesia and subgroups according to medications given to them as follows:

Group A: 30 patients received (general anesthesia) and allocated to 2 equal subgroups:

Group A1: (15 patients) control group (free 500 ml ringer slowly IV infusion after fetal extraction).

Group A2: (15 patients) received prostaglandin F2 α ampule (Prostin[®] F2 Alpha is a clear colorless sterile solution containing 5 mg/mL dinoprost (as 6.71 mg/mL dinoprost tromethamine) in 1 mL ampoules) on 500 ml ringer slowly IV infusion after fetal extraction.

Group B: 30 patients received (spinal anesthesia) and allocated to 2 equal groups:

Group B1: (15 patients) control group (free 500 ml ringer slowly IV infusion after fetal extraction).

Group B2: (15 patients) received prostaglandin F2 α ampule on 500 ml ringer slowly IV infusion after fetal extraction.

Injections were prepared by an anesthesiologist who was not involved in any other aspect of the study. All syringes were identical and had similar volumes. The investigator who administered the drug, the anesthesiologist who performed the injections and the patients, were unaware of the group allocated and the drug that was received by the patient.

After this, all measurements were made by another observer who was blinded to the patient group. All subgroups received oxytocin 10 units on 500 ml normal saline immediately after fetal delivery.

Measurements

Primary clinical outcome is postpartum blood loss which will be measured by weighting soaked towels after the operation and volume of blood aspirated by suction while secondary outcome is hemoglobin and hematocrit values which will be measured by blood samples taken from all patients before and immediately after operation.

Also MAP and HR will be measured at 5 min before anaesthesia, immediately after anaesthesia, 10 and 20 min after drug. Side effects observed in both groups during 24 h after surgery will be recorded.

Statistical analysis

The sample size was chosen after reviewing many randomized. Control studies on the same subject. The full detailed form is: SPSS 20, IBM, Armonk, NY, United States of America.

Quantitative data were expressed as mean \pm standard deviation (SD). Qualitative data were expressed as frequency and percentage as follows:

1. Independent-samples t-test of significance was used when comparing between two means.

2. Chi-square (χ^2) test of significance was used in order to compare proportions between two qualitative parameters.

Results

Both groups were statistically comparable with respect to demographic data like age and gestational age (GA) (Table 1).

Table 2 showed that there was insignificant difference of Hb% (gm/dl) and HCT% before and after CS in general and spinal anesthesia in all subgroups except group A1, where there was significant decrease in postoperative value when compared with preoperative value.

Table 3 showed significant difference in total blood loss (ml) between general and spinal anesthesia groups which was 772.333 \pm 144.287 in group A and 623.667 \pm 119.779 in group B.

Table 4 showed significant increase in total blood loss in group A1 when compared with other three groups, significant increase in group A2 when compared with B2, insignificant changes between A2 and B1 and significant increase in total blood loss in group B1 when compared with group B2.

		Subgroup 1	Subgroup 2	F test	P value
Age	Group A	26.600 ± 1.682	27.000 ± 3.140	1.423	0.211
	Group B	24.200 ± 2.111	25.600 ± 3.180	1.279	0.289
GA	Group A	38.800 ± 0.775	38.400 ± 0.828	1.037	0.363
	Group B	39.000 ± 0.926	39.000 ± 0.926	1.000	0.376

GA: Gestational Age; Group A: General anesthesia; Group B: spinal anesthesia; Subgroup 1: control group; Subgroup 2: PGF2α group.

Table 1: Age and gestational age in both group (Statistically significant when p<0.05).

			Before operation	After operation	T test	P value
Hb%	Group A	A1	11.480 ± 0.792	10.260 ± 0.925	3.872	0.006*
		A2	10.900 ± 0.796	10.700 ± 0.856	0.663	0.515
	Group B	B1	11.620 ± 1.92	10.96 ± 1.400	1.392	0.175
		B2	11.900 ± 1.041	11.360 ± 0.988	1.462	0.156
Hct%	Group A	A1	32.040 ± 4.088	27.420 ± 5.751	2.543	0.017*
		A2	31.260 ± 3.714	28.180 ± 4.889	1.942	0.062
	Group B	B1	32.980 ± 3.490	29.940 ± 5.201	1.883	0.071
		B2	32.960 ± 2.940	30.120 ± 3.058	1.683	0.104

Hb: Hemoglobin; Hct: Hematocrite; Group A: General anesthesia; Group B: spinal anesthesia; A1 and B1: control subgroups; A2 and B2: PGF2α subgroups.

Table 2: The difference of Hb (gm/dl) before and after CS between the subgroups of general and spinal anesthesia (Statistically significant when p<0.05).

		Group A		Group B		P1	P2	P3	P4	P5	P6
		Group A1	Group A2	Group B1	Group B2						
5 min before anaesthesia		93.46 ± 7.48	95.20 ± 9.25	96.33 ± 6.1	92.03 ± 6.1	0.123	0.098	0.153	0.352	0.274	0.126
Immediately after anaesthesia		93.00 ± 5.57	94.63 ± 7.7	95.20 ± 7.25	92.46 ± 7.93	0.236	0.231	0.286	0.412	0.218	0.223
10 min after drug		102.11 ± 7.3	96.87 ± 9.25	96.56 ± 6.9	86.36 ± 5.83	0.015*	0.016*	0.008*	0.408	0.001*	0.001*
20 min after drug		101.26 ± 3.7	95.54 ± 3.8	95.25 ± 5.8	85.2 ± 7.05	0.017*	0.018*	0.013*	0.642	0.001*	0.001*

Group A: General anesthesia; Group B: Spinal anesthesia; A1 and B1: Control subgroups; A2 and B2: PGF2α subgroups.

Table 5: H.R changes in subgroups in general and spinal anesthesia (Statistically significant when p<0.05).

	Group A	Group B	T test	P value
Total blood loss	772.333 ± 144.287	623.667 ± 119.779	-5.318	<0.001*

Group A: General anesthesia; Group B: spinal anesthesia.

Table 3: The difference of total blood loss (ml) between general and spinal anesthesia groups (Statistically significant when p<0.05).

		Group A		Group B	
Total blood loss		A1	A2	B1	B2
		875.000 ± 86.355	692.000 ± 126.841	699.000 ± 108.434	548.000 ± 84.701
P 1	P 2	P 3	P 4	P 5	P 6
0.001*	0.001*	0.001*	0.872	0.001*	0.001*

Group A: General anesthesia; Group B: spinal anesthesia; A1 and B1: Control Subgroups; A2 and B2: PGF2α subgroups.

Table 4: Total blood loss in subgroups in general and spinal anesthesia (Statistically significant when p<0.05).

Tables 5 and 6 showed haemodynamic changes during the study i.e MAP and HR, there was significant difference in MAP and HR in group A1 when compared with other three groups, significant difference in group A2 when compared with B2, insignificant changes between A2 and B1.

There is a significant difference in MAP and HR in group B1 when compared with group B2 at 10 and 20 min but there was insignificant changes at preoperative and immediately postoperative measurements between 4 subgroups.

Table 7 showed side effects in all subgroups during 24 h after surgery, there was significant increase in both subgroups A2 and B2 in nausea, vomiting and diarrhea when compared with A1 and B1 respectively.

	Group A		Group B		P1	P2	P3	P4	P5	P6
	Group A1	Group A2	Group B1	Group B2						
5 min before anaesthesia	82.08 ± 6.36	79.40 ± 7.58	80.76 ± 8.4	79.8 ± 8.58	0.108	0.217	0.112	0.357	0.632	0.209
Immediately after anaesthesia	79.64 ± 6.49	80.23 ± 5.41	79.10 ± 7.68	82.23 ± 5.41	0.248	0.524	0.110	0.269	0.132	0.104
10 min after drug	65.70 ± 5.40	75.55 ± 6.70	73.94 ± 5.7	79.64 ± 6.49	0.028*	0.014*	0.001*	0.751	0.035*	0.029*
20 min after drug	67.70 ± 5.00	76.14 ± 7.6	75.57 ± 6.58	80.4 ± 8.58	0.003*	0.001*	0.001*	0.631	0.042*	0.039*

Group A: General anesthesia; Group B: Spinal anesthesia; A1 and B1: Control subgroups; A2 and B2: PGF2α subgroups.

Table 6: MAP in subgroups in general and spinal anesthesia (Statistically significant when p<0.05).

	Group A		Group B		P1	P2
	Group A1	Group A2	Group B1	Group B2		
Nausea, vomiting	1	6	3	9	0.031*	0.025*
Fever	1	3	1	3	0.283	0.283
diarrhea	0	4	0	4	0.032*	0.032*
Syncope or dizziness	1	1	1	2	1.0	0.543
Chest pain	0	0	0	1	1.0	0.309

Table 7: Side effects observed in both groups during 24 h after surgery (Statistically significant when p<0.05).

Discussion

The main result of our study revealed that the amount of blood loss was significantly decreased during cesarean section with PGF2α under spinal anesthesia. There was a statistically insignificant difference between subgroups in general and spinal anesthesia groups regarding Hb (gm/dl) and HCT% except in group A1, where there was significant decrease in postoperative value when compared with preoperative value (p<0.001). As regard haemodynamic changes, there was a significant difference in group B2, when compared with other subgroups i.e PGF2α under spinal anesthesia is superior in stabilization of haemodynamic state in contrast with others.

As regarding type of anesthesia, the current study has shown that total blood loss was less in spinal anesthesia than general anesthesia (623.667 ± 119.779 ml vs. 772.333 ± 144.287 ml respectively), this study is agree with Andrews et al. [6] who reported that the use of halogenated agents during balanced general anesthesia may result in an increase in blood loss associated with cesarean section. Blood loss was evaluated in uncomplicated patients undergoing elective repeated cesarean section under either general anesthesia using a halogenated agent (isoflurane) or regional anesthesia (spinal/epidural). A greater proportion of women undergoing general anesthesia experienced a postoperative decrease in hematocrit of 5% or more compared with patients receiving regional anesthesia (10 of 42 vs. 5 of 75, p=0.018).

Thus, they conclude that women undergoing uncomplicated elective repeated cesarean section under general anesthesia supplemented with a halogenated agent are at risk for increased blood loss compared with

those women receiving regional anesthesia. However, the increased blood loss was not clinically significant in this study, since none of the patients required transfusion.

Contrary to Hood DP and Holubec DM [7] the incidence of low postoperative hematocrits (less than 32%) following surgery was similar with all the anesthetic methods. Low-dose halothane supplementation of general anesthesia for elective cesarean section did not increase blood loss.

We found that PGF2α under spinal anesthesia is the most effective in decreasing total blood loss during CS compared with other subgroups as PGF2α under general anesthesia (623.667 ± 119.779 ml vs. 772.333 ± 144.287 ml p<0.0001), this result agree with Khurshid et al. [8] this study they also observed a significant reduction in the duration of the 3rd stage of labor in the PGF2α group as compared to that in methergin group. The mean blood loss was 63.6 ± 10.1 ml in the prostaglandin group as compared to 83.6 ± 14.1 ml in the methergin group (p=0.000).

Similar results were obtained by various other authors as Singh and Megh [9] observed nearly 50% reduction in the mean blood loss using 250 µg of PGF2α in comparison to that of PGF2α with methergin. In our study, the side effects observed with prostaglandin were nausea and vomiting in 6 cases in group A2 and 9 cases in group B2 which were significant when compared with control group. Also, diarrhea was observed with prostaglandin groups' i.e A2 and B2 in 4 cases in each which were significant when compared with control group.

Ajaneyulu et al. [10] and Bhattacharaya et al. [11] noted diarrhea as the most common side effect with vomiting in only 2% of the cases receiving prostaglandin while Singh and Megh, [9] observed vomiting as the main side effect in the prostaglandin treated group. PGF2α 125 µg given intramuscularly is a safe and effective alternative to methergin for the active management of third stage of labor. It results in significant reduction in the blood loss which is so important in the anemic women of our country. Chou and MacKenzie [12] concluded that intramyometrial 15-methyl prostaglandin F2α, 125 micrograms, does not offer any obvious advantage over intravenous oxytocin, 20 U, in reducing operative blood loss at elective lower-segment CS. The mean estimated blood loss was similar in both groups, with 645 ml (SD 278, range 400 to 1500) in the 15-methyl prostaglandin F2α group compared with 605 ml (SD 303, range 200 to 1750) in the oxytocin group. The mean fall in hemoglobin and hematocrit was greater in the 15-methyl prostaglandin F2α group than in the oxytocin group, 0.98 gm/dl (SD 0.95) versus 0.65 gm/dl (SD 0.79) for hemoglobin and

2.58% (SD 2.96) versus 2% (SD 2.96) for hematocrit. None of these differences reached statistical significance which disagrees with our study which showed significant change in subgroup A1.

Prostaglandin F₂α promotes smooth muscle contractility by increasing intramyometrial calcium concentrations carried through G-proteins and calcium channel activation. It has a longer half-life which can describe the rapid action and side effects of this drug over oxytocin. Also, based on the study by Phaneuf et al. receptor desensitization seems to be comparable in nature; hence administration of a non-oxytocin-derived agent such as prostaglandin F₂α will still produce the anticipated action and effect [13,14].

With intrapartum hemorrhage as the primary clinical outcome measured in this study, results can be summarized as follows: prostaglandin F₂α under spinal anesthesia significantly reduced intrapartum blood loss when compared with other subgroups. The other outcome measures such as change in hematocrit levels, HB value did not significantly differentiate between the compared groups, most likely requiring large numbers of study members to further show statistically significant changes among the various interventions. Also, there were no significant changes in haemodynamic parameters before 10 min because the human body has several compensatory mechanisms.

Our study has an important limitation of small sample size. The study included only 60 participants who fulfilled all the inclusion criteria and had undergone elective lower-segment CS. The sample size was restricted to 60 cases because of logistical reasons that was the study drug was provided free of cost to all the study participants, limiting the inclusion of more cases.

Conclusion

PGF₂α under spinal anesthesia decreases the amount of blood loss during cesarean section.

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