DOI -10.21276/obgyn.2025.v12.i1.09 *ISSN Print – 2454-2334; ISSN Online – 2454-2342*

RESEARCH ARTICLE

Timing of oxytocin injection during lower segment caesarean section and its relation to uterine contractility and patient hemodynamics

Hemapriya L, Anil Kumar, Hiteshi V Murthy

Corresponding author: Dr Hemapriya L, Associate professor, Dept of OBG, JSS Medical College & Hospital, Mysore, India; Email : drpriya_911@hotmail.com

ABSTRACT

Objectives: Oxytocin is the first line uterotonic recommended by the WHO for prevention of postpartum haemorrhage. Our study aims to determine the best time of oxytocin administration during lower segment caesarean section and its effect on hemodynamic parameters and neonatal APGAR scores. **Methodology:** We conducted a prospective randomised trial at JSS hospital, Mysore, from April to September 2021, after obtaining approval from the institutional ethical committee. All women between 18 and 35 years of age undergoing LSCS at >34 weeks of gestation were randomised into three groups, where 10 IU oxytocin was given intramuscular just before skin incision, just before uterine incision and soon after baby extraction. The uterine tone, pulse rate, blood pressure and neonatal APGAR scores were documented. **Results:** Oxytocin administered just before uterine incision or after baby extraction was associated with better uterine contractility than administration before skin incision. There was no significant difference in hemodynamic parameters or neonatal APGAR in any of the groups. **Conclusion:** Oxytocin as the first line uterotonic administered 10 IU intramuscular at the time of uterine incision or soon after foetal extraction is effective in maintaining adequate uterine tonicity and preventing postpartum haemorrhage.

Keywords: Oxytocin, uterotonic, postpartum haemorrhage.

Oxytocin is a polypeptide hormone released from the posterior pituitary, which induces uterine contractions. Synthetic oxytocin is recommended as the first line drug to maintain uterine contractility and prevent postpartum haemorrhage (PPH) following both vaginal delivery and caesarean section. Postpartum haemorrhage is defined as blood loss greater than or equal to one litre or showing signs of hemodynamic instability within 24 hours of delivery. It includes intrapartum blood loss, irrespective of the route of delivery, as proposed by the American College of Obstetricians and Gynaecologists (ACOG).[1] Various uterotonic agents are used prophylactically, such as oxytocin, methyl ergonovine, prostaglandin E1, and prostaglandin F2-alpha. Active management of the third stage of labour decreases the risk of PPH by 60 %.[2,3] According to the Royal College of Obstetricians and Gynaecologists (RCOG) guidelines, 5 IU of oxytocin should be routinely used by slow intravenous (IV) injection in women undergoing caesarean section to reduce blood loss via the improvement of uterine contractions.[4] Routine use of oxytocin (10 IU, IV/IM) is recommended by the World Health Organization for the prevention of PPH during the third stage of labour.[3]

However, despite being widely used, the optimal dose and infusion rates of oxytocin have yet to be established in the literature. The administration of oxytocin is recommended only by intramuscular or intravenous infusion and not by IV push until after umbilical cord clamping or delivery of the placenta. Early administration of oxytocin during caesarean section was not recommended for fear of reduction or interruption of the blood flow to the intervillous

Received: 4th August 2022, Peer review completed: 4th October 2023, Accepted: 7th November 2024.

Hemapriya L, Kumar A, Murthy HV. Timing of oxytocin injection during lower segment caesarean section and its relation to uterine contractility and patient hemodynamics. The New Indian Journal of OBGYN. 2025; 12(1): 50 - 4.

space leading to changes in foetal heart rate, hypoxia and higher incidence of neonatal acidosis.[5] However, during caesarean section there is only a short interval between the initiation of oxytocin infusion before uterine incision and the delivery of the foetus.

Intravenous infusion of high dose oxytocin is associated with various adverse effects like nausea, vomiting, hypotension, chest pain, flushing, headache, myocardial ischemia, pulmonary oedema, and severe water retention with convulsions.[6] Intramuscular administration or an iv infusion may mitigate these effects.

The purpose of our study was to evaluate the effect of intramuscular oxytocin on uterine contractility, patient hemodynamics and neonatal APGAR score at 1 and 5 minutes when it was administered just before skin incision, just before uterine incision and soon after extraction of the foetus (before umbilical cord clamping).

Materials and methods

A prospective randomised study was conducted over a period of six months, from April to September 2021, in the department of OBG at JSS hospital, Mysore. Institutional ethical committee approval was obtained, and the trial was registered with the clinical trials registry of India, with registration no.CTRI/2021/03/031925. All women between 18 and 35 years of age undergoing LSCS at >34 weeks of gestation were randomised into three groups using a computer generated random number table after taking written, informed consent.

Exclusion criteria: Women with severe pre-eclampsia/eclampsia/HELLP syndrome, antepartum haemorrhage, maternal or foetal compromise, over distended uterus such as poly hydramnios, multiple pregnancy, severe anaemia (Hb $\leq$ 7gm%), cardiac disease complicating pregnancy, hematologic disorders leading to low platelet count, antiphospholipid antibody syndrome, and SLE complicating pregnancy were excluded from the study.

Group S: Inj Oxytocin 10 IU was administered intramuscular at the time of skin incision.

Group U: Inj Oxytocin 10 IU was administered intramuscular at the time of uterine incision.

Group E: Inj Oxytocin 10 IU was administered intramuscular within 60 seconds of extraction of the baby.

The uterine contractility was assessed by the operating surgeon at 0, 2, 5 and 10 minutes after extraction of the baby. Uterine contractility was measured with a subjective scoring on a scale of 1 to 10 similar to the visual analogue scale used for pain assessment. This was done by the same obstetrician in order to avoid inter observer variation. Intraoperative blood loss was measured using gravimetric method by weighing the drapes and mops before and after the procedure, and also measuring the amount of blood in the suction container. However, liquor volume could not be accounted for hemodynamic parameters, ie, pulse rate, systolic, diastolic and mean arterial pressures were recorded just before, immediately after administration of oxytocin, and after uterine closure. The need for additional uterotonics, if any, was documented. Neonatal APGAR scores at 1 and 5 minutes after birth were recorded. Assuming the type 1 error at 50% and type 2 error at 20%, clinically significance difference as 0.5 and standard deviation as 0.47, using the formula the sample size required was 20 in each group.

$$n = \frac{2(Z_{\left(1-\frac{\alpha}{2k}\right)}+Z_{(1-\beta)})^2\sigma^2}{d^2}$$

We conducted the study with 30 women in each group, making a total sample size of 90.

Statistical analysis: Descriptive analysis, diagrammatic and graphical representation and inferential statistics – one way ANOVA, paired t test / repeated measures ANOVA were used.

Results

The demographic details of our patients are mentioned in table 1. Regarding indications for LSCS, 25.5% were for failed induction, 20% for non-reassuring fetal heart rate, 15% for secondary cervical dystocia, 6% for mal-presentations, 10.5% for cephalo pelvic disproportion, 6% for contracted pelvis, 12% for severe oligohydramnios, 3% for previous 2 LSCS and 2% for maternal request.

Table 1: Demographic parameters

Variable	Minimum	Maximum	Mean/SD
Age	18.00	37.00	26.47/4.55
POG (in days)	33 weeks 2 days	40 weeks 4 days	38 weeks 3 days/1 week 1 day
BMI	20.30	36.45	26.65/3.57
Baby weight	2.02 kg	4.04 kg	3.05/0.39
Parameter		**Frequency**	**Percentage**
Education	School Education	20	22.22
	PU / Diploma	29	32.22
	Graduate and above	41	45.56
Occupation	House wife	83	92.22
	Working	7	7.78
Maturity	moderate to late preterm	5	5.56
	Term	78	86.67
	post dated	7	7.78
Timing of LSCS	Elective	56	62.22
	Emergency	34	37.78

On comparing the uterine contractility, we found a significant difference within each group at various time intervals (table 2). On comparison among the three groups,

we determined that oxytocin administered just before uterine incision or after baby extraction was associated with better uterine contractility than administration before skin incision. There was no significant difference (p=0.74) in uterine contractility between the U and E groups.

Intra operative blood loss was measured by gravimetric method, and no statistically significant difference was found among the three groups. On comparing the hemodynamic parameters, there was no statistically significant difference in pulse rate, systolic, diastolic and mean arterial pressures within each group; just before, immediately after administration of oxytocin, and after uterine closure. However, a significant difference in pulse rate and mean arterial pressure was seen on comparing groups S and U. A similar significant difference was seen on comparing groups U and E. This statistical significant difference was not associated with clinical problems, as no patient reported any adverse effect. There was no significant difference in the hemodynamic parameters on comparing groups S and E.

Table 2: Comparison of uterine tone

Group	Time	No	Minimum tone	Maximum tone	Mean	Std Deviation	P value	Conclusion
S	0 mins	30	5	9	7.4667	1.0417	1.03e-11	Significant
	2 mins	30	5	9	7.7333	0.9803		
	5 mins	30	5	10	8.4667	1.0742		
	10 mins	30	8	10	9.000	0.8710		
U	0 mins	30	5	10	7.8000	0.9965	<2e-06	Significant
	2 mins	30	6	10	8.4333	0.9353		
	5 mins	30	5	10	8.9000	1.0289		
	10 mins	30	8	10	9.8000	0.5509		
E	0 mins	30	6	9	7.9000	0.7588	<2e-19	Significant
	2 mins	30	6	10	8.4333	0.8584		
	5 mins	30	8	10	9.0333	0.7649		
	10 mins	30	9	10	9.9000	0.3051		

Table 3: Post Hoc test

Time	Group S		Group U		Group E	
	p-value	Conclusion	p-value	Conclusion	p-value	Conclusion
0 mins –2 mins	1.0000	Not Significant	0.044	Significant	0.0246	Significant
0 mins – 5 mins	0.0009	Significant	3.7e-05	Significant	4.8e-08	Significant
0 mins – 10 mins	1.6e-07	Significant	2.4e-13	Significant	<2e-16	Significant
2 mins -5 mins	0.0306	Significant	0.280	Not Significant	0.0079	Significant
2 mins - 10 mins	1.6e-05	Significant	2.3e-07	Significant	4.8e-12	Significant
5 mins - 10 mins	0.2404	Not Significant	0.001	Significant	3.4e-5	Significant

The neonatal APGAR scores at 1 and 5 minutes showed no significant difference (p=0.23) among the three groups.

Five patients (16.6%) in group S and 3 patients in group E (10%) required additional uterotonic support in the form of oxytocin infusion or prostaglandin F 2 alpha. There were no instances of atonic post-partum haemorrhage requiring medical or surgical intervention.

Discussion

Oxytocin is routinely administered prophylactically during caesarean section to prevent PPH by causing strong uterine contractions. However there are no specific guidelines on the ideal time, route, or regimen of oxytocin administration for prevention of PPH, even after 60 years of oxytocin synthesis and routine use in obstetric practice. Therefore, researchers are trying to determine the best use of oxytocin to prevent PPH by achieving satisfactory uterine contractility during caesarean section with the prevention of the maternal and foetal side effects of oxytocin.

Abdelaleem et al from Egypt conducted a prospective single blind randomized trial on 200 women, where one group was administered 30 units of oxytocin as an intravenous infusion just before uterine incision, and the other group was given the same soon after extraction of the foetus. They found significantly lower blood loss and less need for additional uterotonics when oxytocin was administered before uterine incision. There were no significant neonatal adverse effects when oxytocin was administered before uterine incision.[7]

Takmaz et al studied 101 women undergoing caesarean section where they found that starting the IV infusion of oxytocin early (just before incision of the uterus) could decrease the loss of intraoperative blood at the time of CS compared to initiating IV oxytocin infusion later, after umbilical cord clamping or delivery of the placenta. The change of hemoglobin and hematocrit from the preoperative to postoperative assessments and the intraoperative blood loss during caesarean section were significantly lower when starting the IV infusion of oxytocin just before incision of the uterus.[8]

The WHO updated its guidelines in 2018. It recommends 10 IU of oxytocin administered intramuscular or as

intravenous infusion, but does not mention the specific the time of adminstration.[3]

In our study we found that 10 IU of oxytocin administered intramuscular at the time of uterine incision or soon after extraction of the foetus was associated with significantly better uterine contractility than when administered at the time of skin incision.

Kovacheva et al hypothesized a "rule of threes" algorithm, featuring oxytocin 3 IU, timed uterine tone evaluations, and a systematic approach to alternative uterotonic agents, would reduce the oxytocin dose required to obtain adequate uterine tone. Sixty women undergoing elective caesarean delivery were randomized to receive a low-dose bolus or continuous infusion of oxytocin. To blind participants, the rule group simultaneously received intravenous oxytocin (3 IU/3 ml) and a "wide- open" infusion of 0.9% normal saline (500 ml); the standard care group received intravenous 0.9% normal saline (3 ml) and a "wide-open" infusion of oxytocin (30 IU in 0.9% normal saline/500 ml). Uterine tone was assessed at 3, 6, 9, and 12 min, and if inadequate, additional uterotonic agents were administered. They found that adequate uterine tone was achieved with lower oxytocin doses in the rule versus standard care group. No additional oxytocin or alternative uterotonic agents were needed in either group after 6 min. Therefore they recommended the use of "timed inquiry" as a mechanism to limit the dose of oxytocin and potential use of alternative uterotonic agents.

Thomas et al indicated that the intravenous administration of oxytocin 5 IU as a rapid versus slow bolus in healthy term parturients undergoing elective caesarean delivery produced more cardiovascular instability; similar findings have been observed with an intravenous bolus or infusion of oxytocin 3 IU.[10,11] These findings suggest that even small bolus doses should be administered slowly (15 to 30 s) to minimize the hemodynamic effects.[12] However, slow infusion or intramuscular administration is not commonly associated with adverse events.[13]

No adverse hemodynamic effects or changes in neonatal APGAR score were noted in our study.

Conclusion

Oxytocin as the first line uterotonic administered 10 IU intramuscular at the time of uterine incision or soon after foetal extraction is effective in maintaining adequate uterine tonicity and preventing postpartum haemorrhage. Injection of oxytocin before baby extraction is not associated with respiratory depression in the new born. No significant hemodynamic changes are associated with administration of 10 IU IM administration of oxytocin.

Conflict of interest: None. **Disclaimer:** Nil.

References

1. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 183: Postpartum-Hemorrhage. Obstet Gynecol. 2017; 130: 168 – 86.
2. Westhoff G, Cotter AM, Tolosa JE. Prophylactic oxytocin for the third stage of labour to prevent postpartum haemorrhage. Cochrane Database Syst Rev. 2013; 10: CD001808
3. World Health Organization. WHO recommendations: Uterotonics for the prevention of postpartum haemorrhage. Geneva: WHO; 2018.
4. Mavrides E, Allard S, Chandraharan E, et al. Prevention and management of postpartum haemorrhage: Green-top Guideline No 52. BJOG. 2016; 358: 106 – 49.
5. Simpson KR, James DC. Effects of oxytocin-induced uterine hyperstimulation during labor on fetal oxygen status and fetal heart rate patterns. Am J Obstet Gynecol. 2008; 199: 34.e1 – 5.
6. Devikarani D, Harsoor SS. Are we using right dose of oxytocin? Indian J Anaesth. 2010; 54: 371 – 73.
7. Abdelaleem AA, Abbas AM, Thabet AL, et al. The effect of initiating intravenous oxytocin infusion before uterine incision on the blood loss during elective cesarean section: a randomized clinical trial. J Matern Fetal Neonatal Med. 2019; 32: 3723 – 28.
8. Takmaz T, Ozcan P, Sevket O, et al. Less Blood Loss by Earlier Oxytocin Infusion in Cesarean Sections? A Randomized Controlled Trial. Zeitschrift fur Geburtshilfe und Neonatologie. March 2020. 224(5): 275-80.
9. Kovacheva VP, Soens MA, Tsen LC. A Randomized, Double-blinded Trial of a "Rule of Threes" Algorithm versus Continuous Infusion of Oxytocin during Elective Cesarean Delivery. Anesthesiology. 2015; 123: 92-100.
10. Thomas JS, Koh SH, Cooper GM. Haemodynamic effects of oxytocin given as i.v. bolus or infusion on women undergoing caesarean section. Br J Anaesth. 2007; 98: 116 – 9.
11. Bhattacharya S, Ghosh S, Ray D, Mallik S, Laha A. Oxytocin administration during cesarean delivery: Randomized con- trolled trial to compare intravenous

bolus with intravenous infusion regimen. J Anaesthesiol Clin Pharmacol. 2013; 29: 32 – 5.
12. Balki M, Tsen L. Oxytocin protocols for cesarean delivery. Int Anesthesiol Clin. 2014; 52: 48 – 66.
13. Akinaga C, Uchizaki S, Kurita T, Taniguchi M, Makino H, Suzuki A, et al. Randomized double-blind comparison of the effects of intramyometrial and intravenous oxytocin during elective caesarean section. J Obstet Gynaecol Res. 2016; 42(4): 404 – 9.

Hemapriya L [1], Anil Kumar [2], Hiteshi V Murthy [3]
[1] Associate professor, Dept of OBG, JSS Medical College & Hospital, Mysore; [2] Associate Professor, Department of Anaesthesiology, JSS Medical College & Hospital, JSSAHER, Mysuru; [3] Resident, Department of OBG, JSS Medical College & Hospital, JSSAHER, Mysuru.