OXYTOCIN IV BOLUS VS INFUSION; HAEMODYNAMIC EFFECTS IN WOMEN UNDERGOING CAESAREAN SECTION

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ABSTRACT... Introduction: Obstetric texts advocate the use of oxytocin, either intramuscularly or as a dilute infusion, but warn against the use of intravenous bolus oxytocin, fearing significant maternal hemodynamic consequences. **Objective:** To compare the hemodynamic effects of oxytocin given intravenous bolus versus infusion form. **Study design:** Randomized clinical trial. **Setting:** Study was conducted in main operation theatre and OPD of Combined Military Hospital, Rawalpindi. **Duration of study:** Study was carried out over a period of six months from 24-03-2009 to 23-09-2009. **Subjects and methods:** Total 138 patients were included in this study. Patients were divided into two groups (Group-A received oxytocin as bolus of 5 iu given as quickly as possible (approximately over 1 s) and in group-B 5 iu diluted to 20ml normal saline given over 5 minute using an infusion pump). Each group comprised of 69 patients. **Results:** Mean age of the patients in group-A was 27.3±1.8 and in group-B, 26.9±1.7. Heart rate (beast/min) effect of oxytocin given intravenous bolus vs infusion showed statistically significant difference from 1 minute to 15 minute (P<0.001). Similarly mean arterial pressure (MAP) rate (beast/min) effect of oxytocin given intravenous bolus vs infusion also showed statistically significant difference from 1 minute to 15 minute (P<0.001). **Conclusions:** In conclusion, we found that at elective Caesarean section, 5 iu of i.v. oxytocin results in less haemodynamic change than 5 iu diluted to 20ml normal saline given over 5 min using as an infusion pump.

Key words: Hemodynamic changes, Oxytocin, Caesarean section

INTRODUCTION

Oxytocin is naturally occurring hormone secreted by posterior pituitary gland. Synthetic oxytocics commonly used in obstetric practice as uterotonic drug for induction and augmentation of labour, and remains the drug of choice for facilitating uterine contraction during vaginal and operative delivery as well as postpartum hemorrhage prophylaxis. Oxytocin reduces the risk of postpartum haemorrhage after vaginal delivery[1].

Oxytocin is routinely administered as intravenous bolus of 5 U given at the time of delivery of fetus at caesarian section[2]. Intravenous administration of oxytocin, may result in maternal hypotension, cardiac arrhythmias which may lead to myocardial ischemia[3,4]. These haemodynamic changes are usually well tolerated in healthy women but at times may be of severe consequences especially in patients with underlying cardiac disease[5].

The objective of this study was to compare the haemodynamic effects of oxytocin given as intravenous bolus injection with intravenous infusion in women undergoing caesarean section. This study is first of its kind in our set up and will help to plan an appropriate oxytocin regimen, to avoid its adverse cardiovascular side effects to reduce hospital stay, better recovery, outcome and benefit to patient.

MATERIAL AND METHODS

Study was conducted in main operation theatre and OPD of Combined Military Hospital, Lahore. It was randomized clinical trial and was carried out over a period of six months from 24-03-2009 to 23-09-2009. A total of 138 patients divided into two groups (group A and group B) were included in the study. Sample size was calculated by using WHO sample size calculator taking level of significance 5%, power of test 80% population standard deviation 10, test value of population mean 955 and anticipated population mean 985. All booked female

patients between the ages 20 to 40 undergoing elective caesarean sections, who were American Society of Anesthesiology (ASA) class I and II patients (attached as Annexure C) were included in the study. Patients with past history of PPH, placenta previa, placenta accrete, twin pregnancy, pregnancy with fibroid uterus, pregnancy with hypertension, pregnancy with diabetes mellitus and pre-eclampsia were excluded from the study.

The study was conducted after approval of the hospital ethical committee and all data were recorded on the proforma after informed written consent and explaining the risks and benefits to the patients. Patients were randomly allocated in to two groups using lottery method. Single blind technique was used. The monitoring and anesthetic techniques were the same for all women (blood pressure monitoring, pulse oximetry and ECG).

Hartman's solution 500ml was infused, and thereafter, spinal anesthesia was established in sitting position at L3/4 using 25G pencil point needle by hyperbaric bupivacaine 0.75% (1.5ml) intrathecally. Surgery was started once the block reaches T4 or above to cold sensation, and to T6 to fine touch. Hypotension was treated with ephedrine 3mg boluses aiming to restore mean arterial pressure to within 20% preoperative values. Oxytocin was administered at delivery in patients group-A as bolus of 5 iu given as quickly as possible (approximately over 1 s), and in patients of group-B 5 iu diluted to 20ml normal saline given over 5 minute using an infusion pump. For both groups mean arterial pressure (MAP) and heart rate was noted and recorded at 0,1,2,3,4,5,10,15 minute.

Data recorded was analyzed using statistical package for social sciences (SPSS) version 10.0. Mean and standard deviation was calculated for quantitative data as age, heart rate and mean arterial blood pressure and qualitative data i.e. gender and ASA status was presented as frequency and percentages. Independent sample t test was used to compare heart rate and blood pressure in groups given oxytocin as intravenous bolus and intravenous infusion value. P<0.05 was considered significant.

RESULTS

Regarding age distribution, majority of the patients were between ages 20-25 year. In group A, 43 (62.4%) and in group-B 38 (55.0%) while minimum patients were between 36-40 years of age i.e. 2 (2.9%) and 3 (4.4%) in group-A and B, respectively. Mean age of the patients in group-A was 27.3±1.8 and in group-B 26.9±1.7. Most of the patients belonged to ASA-I. In group-A, 62 (89.9%) and in group-B 60 (87.0%) (Table I).

Table-I. Distribution of cases by ASA status

ASA	Number	%	Number	%
ASA-I	62	89.9	60	87.0
ASA-II	07	10.1	09	13.0
Total	69	100.0	69	100.0

Effects on heart rate (beast/min) in group A and B is given in table II, while effect on mean arterial pressure is given in table III.

Table-II. Heart rate (beast/min) effect of oxytocin given intravenous bolus vs infusion

Time (min)	Group-A Oxytocin	Group-B Infusion	P-Value
0	80.1±0.9	80.0±1.2	0.58
1	98.4±2.1	86.3±3.5	<0.001
2	102.8±4.5	87.7±2.7	<0.001
3	106.0±1.7	90.3±5.1	<0.001
4	107.5±2.8	91.9±2.2	<0.001
5	100.1±3.9	86.8±1.1	<0.001
10	90.5±2.2	82.0±3.6	<0.001
15	85.6±1.9	81.2±2.7	<0.001

DISCUSSION

Although maternal hemodynamic changes after delivery at Caesarean section have many potential causes, including removal of aorto-caval compression, autotransfusion from uterine contraction, blood loss, vasopressors, and emotional excitement, previous studies have shown that uterotonic drugs are a dominant

Table-III. Mean arterial pressure (MAP) rate (beast/min) effect of oxytocin given intravenous bolus vs infusion

Time (min)	Group-A Oxytocin	Group-B Infusion	P-Value
0	75.2±8.1	75.4±3.3	0.85
1	52.5±5.2	77.7±2.7	<0.001
2	60.3±2.7	67.3±4.9	<0.001
3	70.7±1.9	69.5±1.5	<0.001
4	72.4±3.2	70.1±5.2	<0.001
5	74.0±1.1	69.2±1.7	<0.001
10	76.2±0.9	74.6±1.3	<0.001
15	77.8±2.7	76.0±0.7	<0.001

factor[6]. The most consistent cardiovascular changes observed after oxytocin are a dose-related decrease in arterial pressure due to peripheral vasodilation, with a compensatory increase in HR and cardiac output[7].

The clinical importance of hemodynamic changes after oxytocin remains unclear 8. Although maternal death has been attributed to the effects of a 10 u bolus of oxytocin, catastrophic outcomes appear rare. The (usually transient) hemodynamic effects may only be important in the event of pre-existing heart disease or hypovolaemia, when patients may be unable to compensate for the sudden vasodilation[8].

Although decreasing (or omitting) the oxytocin bolus minimizes hemodynamic changes and many doctors may be cautious about doing so because of concerns about poor uterine contraction and resultant increased bleeding [9]. The assessment of uterotonic efficacy at Caesarean section has been attempted by estimation of blood loss, the measurement of postoperative haemoglobin, assessment of uterine tone, and requests for supplementary uterotonic drugs. The last two measures, though subjective, appear to be more sensitive, and less likely to be confounded by other causes of obstetric bleeding. For instance, two studies comparing different oxytocic regimens at Caesarean section, with 694 and 321 patients, reported differences in uterine tone and the need for further uterotonics, but were unable to detect differences in blood loss or change in haemoglobin[10].

Current obstetric teaching warns against the use of bolus intravenous oxytocin for prophylaxis against postpartum hemorrhage as it may cause unexpected hypotension[11].

Our data demonstrate the haemodynamic effects of oxytocin 5 u i.v. in healthy parturients during caesarean section, confirming the results from previously published trials[6,12].

Delivery may contribute to the circulatory changes, but the main effects are due to oxytocin. This was demonstrated by Thomas et al[6] comparing a bolus of oxytocin with an infusion. To examine the effect of delivery itself, one must design a study in which the oxytocin injection is delayed some minutes after delivery of the baby. An implication of the findings reported here is that administration of oxytocin 5 u as a bolus should probably be abandoned since the large haemodynamic effects could be dangerous to vulnerable parturients. An infusion, or smaller repeated doses, might be a better choice[6].

The cardiovascular effects of oxytocin have been described previously but the extent of physiological compromise had not been described using intra-arterial measurements. Our study demonstrated decrease in MAP in healthy women having an elective Caesarean section who received 5 u of oxytocin as a rapid bolus. Two women had decreases in MAP of 45 mm Hg. The women in our study took more than 90s for their MAP to return to baseline after the bolus injection. Whilst this magnitude of decrease in MAP may be well tolerated normally, it may not be desirable if there is concomitant severe blood loss or when there is unsuspected myocardial disease. It is interesting to note that during this reduction in MAP there were no complaints of nausea or faintness. We have no explanation for this other than the short period of time that these women experienced the maximal reduction in MAP.

The changes in HR were significantly different in the two groups. The increase in the bolus group at 30 s could be expected. It was interesting that it decreased to below

baseline at recovery of MAP. However, the greater increase of HR in the infusion group is preferable clinically. It is reassuring to the anaesthetist who prefers to maintain cardiovascular equipoise that this physiological insult can be avoided simply by giving the oxytocin over 5 min. The decrease in MAP and the small increase in HR are certainly clinically preferable.

CONCLUSIONS

In conclusion, we found that at elective Caesarean section, intravenous infusion results in less haemodynamic change than 5 iu of i.v. oxytocin.

It is recommend that bolus doses should be used with caution, and further studies should ascertain if oxytocin is equally effective in reducing blood loss when given.

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