Rapid sequence spinal anaesthesia with 11mg and 12.5mg of hyperbaric bupivacaine for Category 1 caesarean section

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Introduction

To minimize the time factor of spinal anaesthesia as well as to avoid the side effects of general anaesthesia, 'rapid sequence spinal' (RSS) anaesthesia has developed as a novel approach in cases of Category 1 caesarean sections. The aim of this study was to determine the efficacy of different doses of hyperbaric bupivacaine effective for RSS.

Method

Eighty parturients of Category 1 caesarean sections were allocated into two groups. Group A received 11mg and Group B received 12.5mg of 0.5% hyperbaric bupivacaine intrathecally. Time of arrival to the operation theatre, time of positioning for the subarachnoid block, time of administration of the drug, time of skin incision, time of delivery of the baby and time to attain block up to T_4 dermatome were noted.

Results

The median time to surgery were 8mins (IQR= 7.25-10) in group A and 8mins in group B (IQR= 8-10) and that to delivery were 12mins (IQR= 10-14.75) in group A and 11mins (IQR= 10-13) in group B, both being statistically insignificant (p value= 0.47 and 0.19). Other time limits were also comparable in both the groups. The haemodynamic parameters did not reveal any significant difference between the groups.

Conclusion

Category 1 caesarean section can be performed effectively adopting rapid sequence spinal anaesthesia in comparable lower doses as used during routine caesarean section.

Keywords: rapid sequence spinal; category 1 caesarean section; hyperbaric bupivacaine

Introduction

Neuraxial anaesthetic techniques have several advantages which include low risk of aspiration and failed intubation, avoidance of central nervous system (CNS) and respiratory depressant drugs, the ability to maintain a wakeful state of mother enjoying the experience of delivery of baby and also lower incidence of blood loss.[1]

Amongst the various neuraxial techniques, spinal anaesthesia has been popular for caesarean delivery because of ease of administration, effectivity and faster onset providing dense motor block with minimum drug toxicity to mother and to fetus due to limited placental transfer.

However, the recommended dose of bupivacaine for appropriate sensory anaesthesia often lead to maternal hypotension in a range of 69% to more than 80% with resultant neonatal morbidity.[2] Thereby, lower doses of the local anaesthetic with desired clinical efficacy had been sought for so as to minimize the complications.

Again, to minimize the time factor, especially in cases of Category 1 caesarean sections, 'rapid sequence spinal anaesthesia' has developed as a novel approach,[3] Category-1 caesarean section is done when there is an immediate threat to life of the mother or fetus[4].This consists of a no-touch spinal technique, consideration of omission of the

spinal opioid, limiting spinal attempts, allowing the start of surgery before full establishment of the spinal block, and being prepared for conversion to general anaesthesia if there are delays or problems.[3] The concept of 'rapid sequence spinal' evolved as an alternative to both emergency general anaesthesia, which carries the risk of several fatal complications and also the conventional spinal anaesthesia, which is time consuming. It is actually a conjugation of the two which is based on the principle of performing the subarachnoid block as fast as possible carrying out only the absolute essential steps thereby cutting the permissible time and on the other hand, limiting the attempts of administering the block or even abandoning it in favour of other alternative techniques as is done during rapid sequence induction. Infact, giving a subarachnoid block in rapid sequence is a common practice in the field of emergency obstetric anaesthesia; but it often goes undocumented as regards to the rapidity, dose and effects of the whole procedure. Kinsella et al[3] compiled this event with proper documentation initially, based on which several further studies were performed for obtaining a better outcome with minimum possible doses.

All these entails a comparatively higher dose of the drug to be given so as to achieve adequate block in the prescribed time, which again poses a serious threat to the development of maternal hypotension and its consequences. Hence, in this study, we tried to find out a lower possible dose of bupivacaine which would achieve an adequate block with minimal side effects during the rapid sequence spinal anaesthesia technique.

Methods

Following Institutional Ethics Committee approval and informed consent, 80 parturients of ASAI and II, between 20 – 35 years of age, weighing between 40 – 65 kg undergoing Category 1 caesarean section were randomly assigned to Group A (n=40), receiving 11 mg 0.5% hyperbaric bupivacaine or Group B (n=40), receiving 12.5 mg 0.5% hyperbaric bupivacaine intrathecally. Patients with heart disease, having severe haemodynamic instability or any other co-morbidities were not included in our study. The patients were taken to operating theatre and kept lying in left lateral position. Intravenous access with an 18G intravenous cannula was done with simultaneous supplemental oxygenation via face mask in all patients. Before injecting the spinal, co-loading with Lactated Ringer solution 15 ml/kg was done. Standard monitors were attached and preoperative blood pressure (BP), heart rate (HR) and saturation (SpO_2) were recorded. The above procedures were accomplished by a trainee anaesthetist.

The subarachnoid injection was administered in sitting position. The site of injection was prepared with 0.6% chlorhexidine in alcohol spray, which was done by another member of the theatre[5]. A 25G Quincke needle was introduced with 'no-touch' technique into the subarachnoid space, through the L_3-L_4 or L_2-L_3 interspace by median approach and confirmed by free flow of cerebrospinal fluid (CSF). Hyperbaric bupivacaine 0.5%, 11mg (2.2ml) and 12.5mg (2.5ml) were injected into the subarachnoid space in Group A and Group B respectively. The injections were administered by an anaesthesiologist who did not take part in the study further. At the completion of injection, patients were immediately returned to supine position, with left lateral tilt using a wedge under the right hip, for surgery. Surgery was allowed to start when upper level of sensory block was achieved up to at least T_{10} dermatome and was ascending.

Time of arrival to the operation theatre (T1), time of positioning for the subarachnoid block (T2), time of administration of the drug (T3), time of skin incision (T4), time of delivery of the baby (T5) and time to attain block up to T_4 dermatome(T6) were noted. Dermatomal involvement was assessed by pin-prick method. From induction to the delivery of the baby, maternal BP, HR and SpO_2 were monitored at regular intervals, with special considerations of the above-mentioned times and also thereafter. If maternal hypotension (Mean Arterial Pressure [MAP] < 60mmHg) occurred, it was treated with increase in the rate of fluid infusion; if hypotension persisted, phenylephrine 100µg was injected intravenously and repeated as and when required. In case of any bradycardia (HR <60/minute), atropine 0.6 mg was given intravenously. Other side effects like nausea, vomiting or shivering, if any, were also noted and managed accordingly. All mothers received oxytocin infusion after delivery of the baby.

The Apgar Scores were assessed by an independent paediatrician who was not aware of the study. All patients were assessed postoperatively for sensory and motor block and haemodynamic parameters in the post anaesthesia care unit (PACU).

Significance of data were analyzed using the't' test.

Results

The demographic profile of the patients in both groups was comparable in terms of age, weight and height (Table 1).

Table 1 Demographic profile of the two groups

	Group A (Mean ± SD)	Group B (Mean ± SD)	'p' value
Age(year)	23.83 ± 2.620	23.48 ± 3.021	0.667
Height(cm)	142.73 ± 7.306	143.30 ± 7.384	0.686
Weight(kg)	53.70 ± 7.283	51.68 ± 7.001	0.207

The median time to introduce spinal injection and that to surgery in group A and group B were statistically insignificant. (Table 2, Figure 1).

Table 2 Comparison of time taken from entry to theatre to spinal injection, skin incision and delivery

Time (mins)	Group A 2.2 ml(11mg)	Group B 2.5 ml(12.5mg)	'p' value
T1-T3 [Median(IQR)] (time from entry to OT to spinal injection)	5 (4-6)	5 (4-6)	0.30
T1-T4 [Median(IQR)] (time from entry to OT to skin incision)	8 (7.25-10)	8 (8-10)	0.47
T1-T5 [Median(IQR)] (time from entry to OT to delivery)	12 (10-14.75)	11 (10-13)	0.19

The median (IQR) time from introduction of spinal injection to achieve surgical block height was significantly longer in Group A. However, time from spinal to delivery of the baby and that to reach a block height upto T_4 dermatome did not differ statistically in the two groups. (Table 3, Figure 2).

Figure 1 Graphical comparison of time taken from entry to theatre to position, preparation, spinal injection, skin incision and delivery

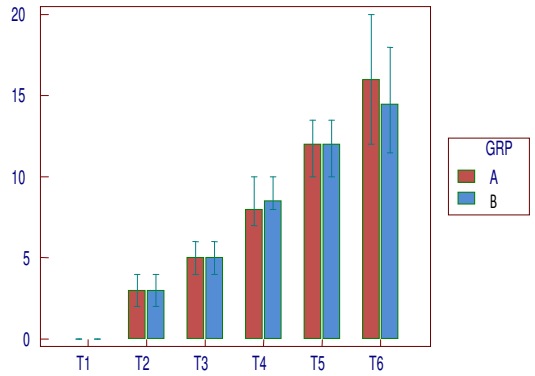
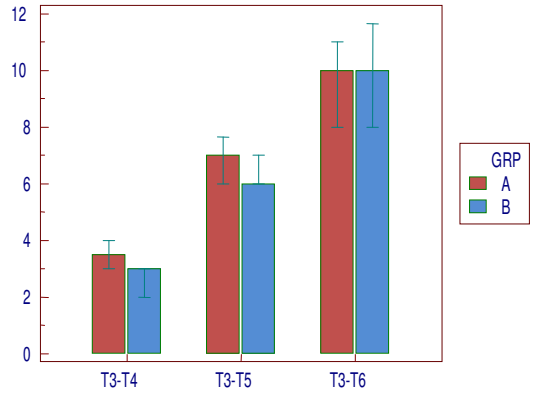


Table 3 Comparison of time taken since spinal injection to incision, delivery and achieving sensory block up to T_4 dermatome

Time (mins)	**Group A 2.2 ml(11mg)**	**Group B 2.5 ml(12.5mg)**	**'p' value**
T3-T4 [Median(IQR)] (time from spinal injection to skin incision)	3.5 (2.25-5)	3 (2-4)	0.02
T3-T5 [Median(IQR)] (time from spinal injection to delivery)	7 (5.25-9)	6 (5-7)	0.08
T3-T6 [Median(IQR)] (time from spinal injection to attain block upto T_4 dermatome)	10 (6.25-12.75)	10 (6.25-12.75)	0.87

Figure 2 Graphical comparison of time taken since spinal injection to incision, delivery and achieving sensory block up to T4 dermatome



The haemodynamic parameters also did not reveal any significant difference between the groups (Figure 3 and 4).

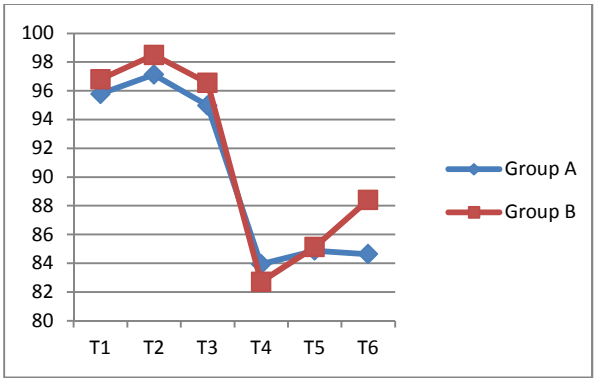


Figure 3 Comparison of heart rate between groups in mins

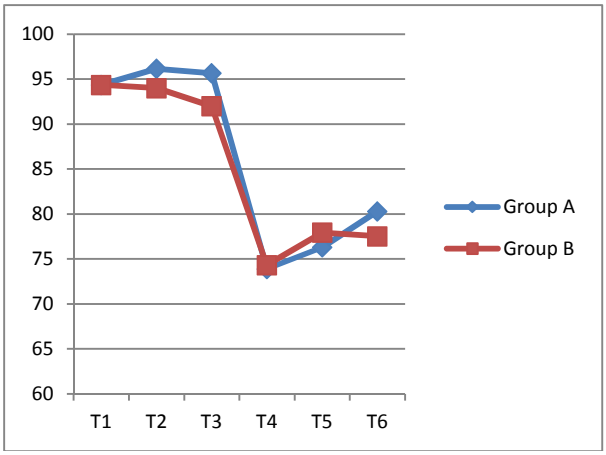


Figure 4 Comparison of Mean Arterial Pressure between groups in mmHg

Two patients in group A complained of discomfort during handling of the uterus at the time of delivery. The Apgar score of the babies were 8(7-9) and 10(8-10) at 1 and 5mins respectively in group A and 9(8-10) and 10(8-10) at 1 and 5mins respectively in group B.

Discussion

The minimum dose of bupivacaine required for adequate block during caesarean section has always been a controversial issue. In a case report on 25 patients undergoing Category 1 caesarean section under rapid sequence spinal anaesthesia, a mean volume of 2.6 ml of 0.5% hyperbaric bupivacaine was used by Kinsella et al in 2010[3], with a minimum of 2.4 ml with 300µg of diamorphine in 1 patient. They additionally used fentanyl and diamorphine in 6 and 2 other cases respectively. The aim of our study was to find a further lower dose of bupivacaine, without any adjuvant, to achieve adequate anaesthesia keeping the lowest dose as used in the study by Kinsella et al as the standard.

The median block height accepted for the start of surgery in their study was T_4 dermatome, which was attained within an average of 4(IQR 3-5) mins. In our study, surgical incision was allowed when dermatomal block height reached a level of T_{10} dermatome, which was achieved in 3.5 and 3 mins in the two groups, whereas T_4 dermatomal height block was achieved in 10mins in both the groups. This increased time to achieve T_4 dermatomal height block in our study as compared to the study by Kinsella et al. (10mins vs 4mins) was probably because of lesser volume of drug without any adjuvant.

The decision to delivery time in those cases was 22.5(SD 5.9)mins. In our study, rather than decision to delivery time, we documented the arrival to delivery time, which were 12 and 11mins respectively in the two groups. Three cases complained of pain during stretching of the rectus or incising the peritoneum.

Among other studies done on this topic, the systemic review and meta-analysis done by Arzola C et al compared the efficacy of spinal 0.5% bupivacaine in a dose <8mg (low dose) and >8 mg (conventional dose) for elective caesarean delivery. They concluded that low dose bupivacaine for spinal anaesthesia compromised anaesthetic efficacy despite giving the benefit of lower maternal complications. The only scope of using such a small dose was if an epidural catheter was already present.[6]

Similarly, Ginosar et al, in their study comparing the ED_{50} and ED_{95} of intrathecal hyperbaric bupivacaine co-administered with opioid for caesarean delivery concluded that successful anaesthesia for caesarean section could be done with low doses of the drug in the range of 5-9 mg if co-administered with opioids.[7] They also suggested that there was an inverse relationship between the speed of onset of anaesthesia with the dose of the drug.

Again, Nagata E et al in their study, compared 8mg and 10mg hyperbaric bupivacaine during spinal anaesthesia for caesarean section in 30 Japanese parturients and concluded that 79% of the 8mg group and in 88% of the 10mg group attained a sensory block level of T4 within 10mins after spinal injection, thereby showing that hyperbaric bupivacaine in a dose as low as 8 mg obtained adequate analgesic efficacy avoiding maternal hypotension.[8]

Hirao O et al studied the different doses of hyperbaric bupivacaine for caesarean section and documented that 10mg, 12.5mg or 15mg of hyperbaric bupivacaine could be safely and effectively used as a spinal agent for caesarean section and recommended higher doses in urgent cases and lower doses when maternal hypotension had to be avoided.[9]

Santos A et al evaluated 22 parturients who were undergoing caesarean section under spinal anaesthesia with hyperbaric bupivacaine in a dose ranging from 7.5 to 10mg with head-down tilt positioning and found that sensory block of T3 dermatome was reached in 10 – 15 mins.[10]

Conclusion:

It is evident from the results that bupivacaine in a dose as low as 11mg can be successfully used for rapid sequence spinal anaesthesia, as regards to onset, adequacy, level and duration of the block and haemodynamic stability and fetal outcome. However, the lowest dose that is suitable is not ascertained and scope for further studies with this endeavour remains wide open.

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