Original Article

A Comparative Study of Bupivacaine Alone and Bupivacaine-Ketamine Combination for Subarachnoid Block in Myomectomies

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ABSTRACT

Ketamine is a highly liposoluble phenylcyclohexylamine derivative consisting of an (R) and (S) enantiomer. Ketamine can be administered through intravenous, intramuscular, intrarectal, oral, intranasal, intrathecal, or epidural routes. Intravenous ketamine has been studied as an adjunct in multimodal analgesia, but there are still knowledge and experience gaps regarding neuraxial ketamine. This study aimed at studying the anaethetic and analgesic potency of ketamine when administered intrathecally as adjunct to bupivacaine in subarachnoid blocks. Sixty patients after ethical approval and consent were randomized into two groups of thirty patients each; B (bupivacaine only) and BK (bupivacaine plus Ketamine). Intervention medications were prepared in two syringes 2.5mls each with the researcher blinded of the contents... The contents were given intrathecally during institution of subarachnoid blocks. Variables like onset of sensory and motor blocks, duration of blocks, time to first analgesic request, frequently of analgesics and incidence of side effects were sought for. The bupivacaine plus Ketamine group had a faster and longer duration of sensory and motor blocks with longer time to first analgesic request and minimal frequency of rescue analgesics. There was no incidence of serious side effects except for few incidences of elevated systolic / diastolic pressures. Ketamine when given intrathecally as adjuvants to bupivacaine during subarachnoid blocks offers anaesthetic and analgesic potency.

Keywords: Bupivacaine, Ketamine, Myomectomy. Subarachnoid blocks

INTRODUCTION

Spinal anesthesia or regional anesthesia is a potent anesthetic procedure. It is widely used as it has a number of advantages compared with general anesthesia, such as reduction of stress responses, reduced amount of blood loss, low cost and decreased morbidity and mortality rates in high-risk patient[1]. It is used for both emergency and elective surgeries, and involves the injection of a local anesthetic agent into the cerebrospinal fluid, thereby blocking nerve transmission [1].

Bupivacaine which is the most commonly used local anaesthetic agent for subarachnoid blocks have very short action (average of ninety minutes to two hours). Several adjunct drugs have been added to bupivacaine to extend its duration of action. Adjuncts such as benzodiazepines, opioids, and neostigmine and α2-receptor agonists have been employed [2].

In this study, we evaluated the effects of intrathecal ketamine added to a small dose of bupivacaine in patients undergoing myomectomies under

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subarachnoid block.

MATERIALS AND METHODS

After obtaining approval from our Institutional Ethics Committee and informed patient consent, Sixty (60) American Society of Anaesthetist (ASA) 1 and 11 patients undergoing myomectomy under subarachnoid block were recruited. Patients were randomly allocated to receive either intrathecal hyperbaric bupivacaine2mls(10mg) and 0.5ml of normal saline or bupivacaine 2mls(10mg) with preservative-free ketamine 25mg(0.5ml) through two labelled syringes A and B containing (2.5mls)mls content . The patients and the researcher were blinded as to the contents of the syringes A and B.

Baseline vital signs were checked and all patients received an intravenous preload of 15ml.kg^{-1} compound Normal saline before subarachnoid block. Lumbar puncture was performed in the sitting position with a 25-gauge spinal needle at the $L_{2/3}$ or $L_{3/4}$ interspace using a midline technique under aseptic precautions. Immediately after injection, the patients were placed supine, sensory level of block were checked and vital signs were checked and then every 10minutes till the end of procedure using a multiparameter monitor. Sensory block was assessed by pinprick. Motor block was assessed by modified Bromage scores (0, no motor loss; 1, inability to flex the hip; 2, inability to flex the knee; 3, inability to flex the ankle). Sedation was assessed every 15 min using a four-point scale (1, awake; 2, drowsy but responsive to verbal stimulus; 3, drowsy but responsive to physical stimulus; 4, unresponsive to verbal and physical stimulus). The onset of anaesthesia from injection of contents of the syringes intrathecally to motor loss were noted while offset of sensory block was assumed when bilateral sensation to pinprick at the S_2 dermatome was recovered. Complete motor recovery was assumed when the modified Bromage score was zero. Incidence of hypotension were also noted as 20% below baseline blood pressures and treated with 5mg incremental doses of ephedrine. Offset of sensory block was assumed when bilateral sensation to pinprick at the S_2 dermatome was recovered. Complete motor recovery was assumed when the modified Bromage score was zero. Duration of spinal analgesia was measured from the time of spinal administration to the first time at which the patient complained of pain in the postoperative period.

Postoperatively, Visual Analogue Scale (VNS) for pain at rest and on movement (0–10) were assessed every 2h for 24hours. Pentazocine 30mg IV was given when VAS was more than 5 but was not given if interval is less than 6hours. Incidence of vomiting, dissociative symptoms and dreams were sought for in all patients.

RESULTS

Both groups were similar in biodata and duration of procedure (Table 1). Onset of sensory and motor block were faster in the BK group (3.8 vs. 4.6) and (4.6 vs. 6.0). The duration of blocks were also significant for both motor and sensory in the BK and BO group with p values 0.05 and 0.04 for motor and sensory blocks respectively (Table 2). The VAS at first analgesic request and the average VAS during the study was lower in the BK group compared to the BO group with p values 0.05 and 0.04 respectively (Table 3). Time to first analgesic request was prolonged significantly in BK (p value 0.04). Frequency of supplemental analgesic was more in the BO group when compared to the BK group (p value 0.03). Both groups were comparable in postoperative vital signs except the systolic and diastolic pressures which were statistically higher in the BK group (p values 0.04 and 0.05 respectively Table 5. No nausea or vomiting or dissociative symptoms were seen in any of the patients.

Table 1: Baseline data. Results are given as mean (SD)

	Bupivacaine (n =30)	Bupivacaine + ketamine (n = 30)
Age; years	43.7 (10.6)	48.6 (9.7)
Weight; kg	67.9 (5.6)	68.0 (5.2)
Duration of procedure; min	54.0 (11.9)	48.7 (10.8)

Table 2. Sensory and motor blockade. Results are given as mean (SD) and median

	Bupivacaine(B) (n = 30)	Bupivacaine + ketamine(BK) (n = 30)	p
Sensory block			
Onset time; min	4.6(1.4)	3.8 (0.8)	0.042
Duration of block; min	184.6(24.8)	246.7 (35.4.)	0.054
Motor block			
Onset time; min	8.0 (1.5)	4.6 (0.7)	0.052
Duration of block; min	142.0 (21.4)	115.7 (26.1)	0.044
Number of supplemental analgesic doses required	3	1	0.03

Table 3: Visual Analogue Scale (VAS) pain scores at first analgesic request and average VAS score in the study.

	VAS at rest			VAS at movement		
First Analgesic Request	6(2.4)	4((1.6)	0.056	7 (2.8)	5(1.4)	0.058
Average VAS	5.5 (2.7)	4.2 (2.1)	0.366	5.8 (2.8)	4.4 (2.3)	0.297

Table 4: Time to First Analgesic Request

	Bupivacaine (n = 30)(B)	Bupivacaine + ketamine (n = 30)(BK)	p
Time; min	55(1.4)	86(0.8)	0.042

Table 5: Average hemodynamic data over study period. Results are given as mean (SD)

	Bupivacaine (n = 30)(B)	Bupivacaine + ketamine (n = 30)(BK)	p
HR; beat.min^{-1}	78 (14)	84 (16)	0.4119
SBP; mmHg	124 (9)	140(16)	0.0054
DBP; mmHg	82 (9)	94 (11)	0.0048
RR; breath.min^{-1}	17 (1.2)	17 (1.2)	0.3838

DISCUSSION

This study has shown that ketamine administered with a lower dose of bupivacaine had a local anaesthetic and analgesic sparing effects. In this study, postoperative analgesia in terms of time to first requirement of analgesic supplement and total analgesic supplementation required in the first 24h was improved by the addition of ketamine, suggesting that ketamine has anaethetic and analgesic potentials when given intrathecally with bupivacaine.

Bion[3] in his study showed that intrathecal ketamine 50mg produced significant analgesia without interfering with cardiovascular and respiratory function. This is in keeping with our study, however our study showed that ketamine resulted in increment in diastolic and systolic blood pressures.

Samatha[4] et al in their study on single dose

perioperative intrathecal ketamine as an adjuvant to intrathecal bupivacaine. In the systematic review and meta-analysis of adult human randomized controlled trials they found out that intrathecal ketamine provided better outcome in terms of anaesthesia and analgesi[4]. This in keeping with our study using same variables like onset of motor and sensory block, duration of anaesthesia and time to first analgesic request which were favorable for the group with intrathecal ketamine. No major side effect was recorded in the study too.

In a Comparative study between ketamine and bupivacaine intrathecally in lower abdomen and lower limb surgery Sunandra[5] et al found out that intrathecal ketamine produced a faster onset of sensory and motor blockage with longer time of request of analgesia compared to the bupivacaine group[5] . The study concluded that ketamine when given alone produced more anaesthesia and analgesia than bupivacaine. There is higher sedation in the ketamine group which is not in keeping with our study this may not be unconnected with the high dose of ketamine used in their study as against it been used as an adjuvant in our own study.

Hawksworth *et al* [6] . studied intrathecal ketamine $0.75–0.9 mg.kg^{-1}$ in patients undergoing transurethral resection of prostate. Of the 10 patients studied, six required general anaesthesia because of insufficient surgical analgesia. The difference in the outcome might be due to the fact that ketamine was used as a sole agent as against an adjuvant to bupivacaine as used in our study. There were high rate of side effects which might be connected to the aforementioned reason too.

CONCLUSSION

Ketamine when given as adjuvant with bupivacaine in subarachnoid block offers better anaesthethic and analgesic potential with no major side effect.

Recommendation

Based on the result of our study we wish to recommend Ketamine as a potent adjuvant in subarachnoid block using bupivacaine. We also recommend further studies on subarachnoid use of ketamine alone for anaesthesia and analgesia

Limitation

Potential limitation to the use of Ketamine is the need for preservative free ketamine as most of the readily available and cheap ketamine are not preservative free and are associated with side effects.

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We acknowledge previous efforts in the past by researchers who has explored the potentials of ketamine for perioperative anaesthetic/analgesic adjuvant which laid foundation for this study.

Conflicts of Interest

None.

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