Intrathecal Ketamine Versus Bupivacaine for Inguinal Hernia Surgery

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ABSTRACT:

BACKGROUND:

Ketamine shows beside its general anesthetic effect, a local anesthetic - like action; that is due to blocking of Na^+ channels mainly with other proposed mechanisms.

OBJECTIVE:

Comparison of ketamine local anesthetic action with that of bupivacaine in neuraxial blockage (spinal anesthesia) was done.

PATIENTS AND METHODS:

Hundred patients were scheduled according to American Society of Anesthesiologists (ASA) physical status classification I-II for elective inguinal hernia surgery under spinal anaesthesia, divided into 2 equal groups, the first group received 2 ml (0.5%) bupivacaine, second group received 2 ml [75 mg preservative free Ketamine (1.5 ml) mixed with 0.5 ml, 30%dextrose], comparison in the onset, duration of the sensory block and the central sedative effect between the two groups was done.

RESULTS:

Group II patients who received ketamine intrathecally demonstrated faster onset of block with longer duration of analgesia, 30% of them appeared sedated owing to the central sedative effect.

CONCLUSION:

As a new look to an old drug; ketamine can be used as a pure local anesthetic for spinal anesthesia with the advantage of longer period of analgesia and faster onset as compared with bupivacaine. Ketamine group appeared more hemodynamically stable.

KEY WORDS: ketamine, bupivacaine, intrathecal anesthesia, inguinal hernia surgery.

INTRODUCTION:

Series of recent studies have shown a potent analgesia after spinal administration of ketamine alone or in combination with opioids and α_2-agonists in both animals and humans suggesting that ketamine alters pain perception at the spinal level[1,2].

Ketamine acts on variety of receptors including opioids receptors, N-methyl-D-aspartate receptors (NMDA) complex channel, blocks peripheral and central nervous system Na^+ channels and voltage gated K^+ and Ca^{++} channels which are of eminent importance for suppressing pain transmission in peripheral nerves, dorsal root ganglion neurons and dorsal horn neurons of spinal cord [4,5,6,7]. It possess some definite advantages over the conventional local anesthetic agents as it stimulates the respiratory system[8]and cardiovascular system[9,10], furthermore, it has good intra and post operative analgesic properties when given by intravenous, intramuscular, epidural or intrathecal route [1].

The objective of this study is to compare ketamine local anesthetic action with that of bupivacaine in neuraxial blockage (spinal anesthesia), in onset, duration of analgesia and sedation.

PATIENTS AND METHODS:

The study was approved by institutional ethics committee, the University of Mustansiriyah, Medical College, Surgical Department. Done at Al-Yarmook Teaching Hospital, Baghdad, Iraq. June 1, 2010 to February 1, 2012.

In double blind clinical trial hundred patients, from both sexes, belong to ASA physical status classification I and II were scheduled for elective inguinal hernia surgery under spinal anesthesia, divided into two equal groups(I, II). Group I received 2ml (5%) hyperbaric bupivacaine (PKa which is the negative Log_{10} of ionization constant=8.1). Group II received 1.5ml (75mg, PKa=7.5) of preservative free ketamine mixed with 0.5ml 30% dextrose. The patients were allocated in each group through a simple random technique.

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Patient refusal, allergy to any of used drugs, contraindication to regional blockade, opioid addiction, intestinal obstruction, recurrent hernia, bilateral inguinal hernia and psychological disorder were excluded from the study.

Age range for group I were (19-52) years with Mean±SD: 32.48±8.06, while for group II were (18-50) years with Mean±SD: 35.68±8.62 (Table 1).

Complete physical examination and the necessary investigations were done. Written informed consents were signed by all patients.

All patients receive 0.5µg/kg fentanyl IV, and preloaded with 800 - 1000 ml of Ringer's lactate solution and spinal anesthesia was administered by standard technique, strict aseptic conditions, using 22-gauge spinal needle through L3-4 inter vertebral space in setting position, lay supine immediately after spinal anaesthesia with approximately15 degree head up tilt.

Oxygen administered via nasal cannula (3-5 litters/min.), IV fluid maintenance, pulse oximetry and automated blood pressure (every 5 minutes) monitoring were applied.

The following parameters were studied:

1-Onset of sensory block, assessed by pin prick test.

2-Sedation as awake or sedated (state of reduced consciousness in which verbal contact with the patient can be maintained).

3-Duration of analgesia (from the time of administering the drug to the time of first request for systemic analgesia).

Statistical analysis

Analysis of data was carried out using the available statistical package of SPSS-20 (Statistical Packages for Social Sciences- version 20 "PASW" Statistics).

Data were presented in simple measures of percentage, mean and standard deviation. The significance of difference of different means (quantitative data) was tested using independent student-t-test for difference between two means, while different percentages (qualitative data) were tested using Pearson Chi-square test. Statistical significance was considered whenever the P value was less than 0.05.

REULTS:

The number of male and female patients in both groups was: Group I (42 males i.e. 84%, 8 female i.e. 16%), Group II (37 males i.e. 74%, 13 females i.e. 26%) as in (table 1).

Table 1:Distribution of patients according to their age and gender.

	Group I		Group II		P value
	No	%	No	%	
Age (years) <25	9	18.0	5	10.0	0.508
25---	6	12.0	5	10.0	
30---	15	30.0	12	24.0	
35---	7	14.0	6	12.0	
40---	9	18.0	13	26.0	
=>45	4	8.0	9	18.0	
Mean±SD(Range)	32.48±8.06 (19-52)		35.68±8.62 (18-50)		
Gender Male	42	84.0	37	74.0	0.220
Female	8	16.0	13	26.0	

Regarding body weight, there is no significance difference between the two groups as in (table 2).

Table 2: Distribution of patients according to their weight.

	Group I		Group II		P value
	No	%	No	%	
Body weight (Kg) 50---	6	12.0	5	10.0	0.112
60---	15	30.0	11	22.0	
70---	17	34.0	10	20.0	
80---	10	20.0	16	32.0	
90---	2	4.0	8	16.0	
Mean Wt±SD (Range)	68.62±10.47 (50-90)		75.32±11.81 (50-95)		

About the onset, in group I was (5-8) min. with mean ± SD = 6.29 ± 0.83 while in group II was (3.5-5.5) min. with mean ± SD = 4.28± 0.56, the difference was significant as in (table 3).

Table 3: Distribution of patients according to onset of action in both groups.

Onset (minutes)	Group I		Group II		P value
	No	%	No	%	
<4	-	-	10	20.0	0.0001*
4---	-	-	27	54.0	
5---	13	26.0	13	26.0	
6---	19	38.0	-	-	
=>7	18	36.0	-	-	
Mean±SD (Range)	6.29 ± 0.83 (5-8)		4.28± 0.56 (3.5-5.5)		0.0001*

*Significant difference at 0.05 levels.

About sedation, in group I: 6 patients were sedated while in group II: 15 patients were sedated; the difference was significant, as in table 4.

Table 4: Distribution of patients according to sedation.

	Group I		Group II		P value
	No	%	No	%	
Sedation Sedated	6	12.0	15	30.0	0.027*
Awake	44	88.0	35	70.0	

*Significant difference at 0.05 levels.

Duration of analgesia, in group I: ranged between 120-150 min. with mean±SD = 135.20±9.90 while in group II ranged between 140-175 min. with mean±SD = 156.50±10.51, the difference was significant, as in table 5.

Table 5: Distribution of patients according to duration of analgesia.

Duration of analgesia (minutes)	Group I		Group II		P value
	No	%	No	%	
<130	7	14.0	-	-	0.0001*
130---	22	44.0	-	-	
140---	15	30.0	9	18.0	
150---	6	12.0	16	32.0	
160---	-	-	15	30.0	
=>170	-	-	10	20.0	
Mean±SD (Range)	135.20±9.09 (120-150)		156.50±10.51 (140-175)		0.0001*

*Significant difference at 0.05 levels.

No side effects were reported in both groups except one patient belongs to group II who showed nystagmus following administration of intrathecal ketamine by 30 min.

DISCUSSION:

The faster onset (4-6 min.) for group II as compared with (5-8 min.) for group I come in agree with study of Dipasri Bhattacharya and Arnab Banerjee [11] who made a comparative study between the same two drugs in spinal anesthesia, this may be due to lower PKa of ketamine i.e. at physiological PH, the non ionized and ionized portion are nearly equal.

Thirty percent of patients received ketamine intrathecally were sedated, statistically significant; due to systemic effect resulting from intravascular absorption [12, 13].

No side effects were reported in both groups except one patient belongs to group II who showed nystagmus 30 min after administration of intrathecal ketamine, resolved spontaneously in 5 minutes. But in a study done by Kaliyani Govindan[14] etal on 60 patients scheduled for lower abdominal and lower extremities surgeries, under spinal anesthesia, divided in to four groups given spinal anesthesia by different doses (75mg or 100mg) ketamine alone or in combination with epinephrine, 86% of the patients had nystagmus which is much more than our study (just one patient), 2 had vomiting (not reported in our study) and one patient had delirium (not reported in our study) that needed to be treated with IV diazepam. They claim that these side effects may be due to systemic absorption of the drug or migration of ketamine via the CSF (cerebrospinal fluid) to the lateral ventricles, but if this is the cause it must also appeared in our study, we think that these side effect may be due to the surgical pathology or manipulation of abdominal viscera which maybe the cause of nausea and vomiting. The cause of higher percentage of nystagmus and appearance of delirium in one patient may be the use of higher doses of ketamine. Unfortunately the authors not study the relation between these side effects and the type of surgery or ketamine dose. They found that increasing the dose of ketamine prolonged the duration of surgical analgesia and produce a higher level of analgesia, our study designed for inguinal hernia surgery which usually with a moderate duration and there is no need for high spinal anesthesia, so we use 75 mg ketamine, giving us fair enough duration of surgical analgesia, adequate level of analgesia and avoid any of these side effects.

Kaliyani Govindan et al[14] study the hemodynamic parameters and found that patients given ketamine intrathecally were hemodynamically more stable, we also noticed that but our patient usually not complained of significant hemodynamic instability. Analgesia obtained by ketamine was more prolonged, this can be explained by the other shared mechanisms of the drug other than blocking Na^+ channels such as NMDA receptor antagonism[9]and μ-opioids receptor agonism[15, 16]. Hawksworth et al [17]studied intrathecal ketamine by administering 0.7 mg/kg in patients undergoing transurethral resection of prostate, of the ten patients studied, five of them required general anesthesia because of insufficient pain relief, and his results might be due to low dose used in face of long surgery.

CONCLUSION AND RECOMMENDATION:

As a new look to an old drug; ketamine can be used as a pure local anesthetic for spinal anesthesia with the advantage of longer period of analgesia and faster onset as compared with that of bupivacaine. Ketamine group appeared more hemodynamically stable.

We recommend a future study to be done on hemodynamic parameters during ketamine spinal anesthesia.

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