

Comparison between Intrathecal Fentanyl and Ketamine as an Add-On to Heavy Bupivacaine for Cesarean Section

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Abstract: Background: Obstetric anesthesia is demanding but gratifying subspecialty of anesthesiologist. Anesthetic care of pregnant patient is unique in that two patients are cared for simultaneously; the parturient and the fetus. Aim of Study: The aim of our study was to compare between the two preparations and also to know if one preparation has advantage over the other regarding the onset, duration and recovery of sensory and motor blocked, duration of analgesia, hemodynamics changes, respiratory changes, and incidence of side effects Patients and Methods: A randomized double blinded controlled clinical trial conducted in the department of obstetrics & gynecology of Maternity teaching hospital in Erbil city over a period of 5 months from (1st of Sept .2012 to 1st Feb.2013). This study was conducted on 40 parturient of ASA physical status I and ASA II, in the age group of 17 to 46 years, planned for caesarean section under subarachnoid block were included in the study. Patients with any contraindication to spinal anesthesia, or patients with history of allergy to opioids/local anesthetics/Ketamine excluded.They were randomly divided into two groups of 20 patients each: Group-F (12.5 mg hyperbaric bupivacaine 0.5% + 25µg Fentanyl) and Group-K (12.5 mg hyperbaric bupivacaine 0.5% + 50 mg ketamine) by the sealed envelope technique after taking informed consent. Results : Intrathecal ketamine with bupivacaine as compared to fentanyl with bupivacaine produced faster onset of sensory block (63.1sec vs 69sec), longer Time for first analgesic (176.1 min vs 141.3 min) with better hemodynamic stability. The incidence of nystagmus is more with intrathecal ketamine (20% vs 0%) and pruritis is more with intrathecal fentanyl (0% vs 30%).Conclusions: Intrathecal ketamine is a better adjuvant to Bupivacaine than intrathecal fentanyl in patients undergoing CS under subarachnoid block. Thus it is safe modality for the parturient undergoing caesarean section, but central side effects like, nystagmus can occur in some patients.

Keywords: Caesarean Section, Bupivacaine, Ketamine, fentanyl, subarachnoid block.

INTRODUCTION

In an analysis of obstetric anesthesia trends in the United States between 1981 and 2001, a progressive increase was noted in the use of neuraxial anesthesia, especially spinal anesthesia, for both elective and emergency cesarean deliveries (Bucklin, B. A. *et al.*, 2005).

Neuraxial anesthesia has been used for more than 80% of cesarean deliveries since 1992. Similar increases have occurred in the United Kingdom and in other developed as well as developing countries.

Small doses of opioids administered directly into the cerebrospinal fluid (CSF) have been found to be very effective in controlling symptoms of pain in patients (Cousins, mj and mather, le. 1998).

Fentanyl, a short acting lipophilic opioid, is known to augment the quality of subarachnoid block. The addition of fentanyl to local anesthetics increased the intraoperative and early postoperative quality of subarachnoid block for Cesarean section (Hunt, C. O. *et al.*, 1989).

This technique has also been used to increase post-operative analgesia and maternal satisfaction after Cesarean section (Kelly, M. C. *et al.*, 1998).

The addition of ketamine to a local anesthetic or other analgesics in peripheral or neuraxial

anesthesia and analgesia improves or prolongs pain relief (Panjabi, N. *et al.*, 2004).

A decrease in drug-related side effects (sedation, pruritus, or adverse psychological reactions) has also been found (Togal, T. *et al.*, 2004).

The principal objective of the present study was to evaluate the characteristics of subarachnoid block of fentanyl and Ketamine when added to Bupivacaine for Cesarean delivery.

PATIENTS AND METHODS

A randomized double blinded controlled clinical trial conducted in the department of obstetrics & gynecology of Maternity teaching hospital in Erbil city over a period of 5 months from (1st of Sept .2012 to 1st Feb.2013).

This study was conducted on 40 parturient of ASA physical status II, in the age group of 17 to 46 years, planned for caesarean section under subarachnoid block were included in the study. Patients with any contraindication to spinal anesthesia, or patients with history of allergy to opioids/local anesthetics/Ketamine excluded.

They were randomly divided into two groups of 20 patients each: Group-F (12.5 mg hyperbaric bupivacaine 0.5% + 25µg Fentanyl) and Group-K (12.5 mg hyperbaric bupivacaine 0.5% + 50 mg

ketamine) by the sealed envelope technique after taking informed consent.

The study drug was administered in a double blind manner. After taking history, physical examination and all routine investigation were done. After placement of routine noninvasive monitors, IV access was established and all patients were preloaded with 1000ml of lactated ringer's solution. A baseline recording of Heart rate, NIBP, RR, SPO2 was recorded.

After infiltrating the skin and inter-spinal ligament over the L3/4 interspace with 1% lidocaine 2 ml, the subarachnoid space was entered using a 24-gauge pencil-point spinal needle.

Once free flow of CSF had been recognized, the intrathecal anesthetic solution was injected over 20 s, aspirating CSF at the end of the injection to confirm needle position .

Following injection of the anesthetic mixture patients were placed supine immediately with a 20 degree left lateral tilt and 100% O₂ was delivered by face mask.

Blood pressure, heart rate, respiratory rate and oxygen saturation were recorded at 2, 5, 10, 15, 20, 30, 60, 90,120 min interval till the end of surgery.

Parameters Studied Are:-

- Onset of sensory level defined as the loss of sharp sensation (checked at 30sec interval at T12 dermatome by using a pinprick test was recorded bilaterally at the mid-clavicular line.
- Duration of Analgesia (was measured as the time from induction of block to first patient request for supplemental analgesia.
- Onset and duration of motor block was assessed by using Bromage Score:
 1. No impairment of movement of legs and feet

2. Barely able to flex knees, no impairment in movement of feet
3. Unable to flex knees, barely able to move feet
4. Unable to move knee or feet.

- Onset motor blockade (The time taken to reach Bromage Score 3)
- Duration of motor blockade (time taken to reach Bromage Score 0)
- Hemodynamic changes (SBP, DBP, Mean BP and Heart rate)
- Respiratory changes (Respiration rate and Saturation)
- Incidence of side effects, sedation, nausea & Vomiting, pruritis, shivering, and nystagmus.

SPSS v.16 US. software for windows and Epi. calc.2000 software WHO,CDC , package were used in statistical analysis. All data were entered in these programs and appropriate statistical tests and procedures were performed; Chi. Square (X²) was used to compare in between both groups at each time category, also it used to compare frequencies of doses needed per patient in each group . Pearson's correlation bivariate test was used to find any association between parity and the number of doses needed per patient in both groups. Student's (t) test was used to compare age and weight of patient in between groups. Epi. Calc.2000 software was used to compare percentages and proportions.

Level of significance in all statistical tests and comparisons was set at p-value ≤ 0.05 to be considered as significant difference. All data and information were presented as tables, graphs or paragraphs.

RESULTS:

As it had been shown by table (1) there was no significant differences in Parity, Age or weight in between groups.

Table 1: Preoperative patient's characteristics.

Characteristic		Group K	Group F	p.value
Number (patient)		20	20	-
Parity	Mean ± SD *	2.7 ± 1.1	2.68 ± 1.3	0.95
	Range	1 - 5	1 - 6	-
Age (year)	Mean ± SD	41.1 ± 11.2	39.1 ± 9.2	0.34
	Range	17 - 41	18 - 46	-
Weight kg	Mean ± SD	70.5 ± 13.6	72.96 ± 9.7	0.45
	Range	59 - 91	52 - 86	-

Table 2: Data of Sensory block

Parameter	Group K	Group F
Onset (Sec)	63.1 ± 2.5	69.0 ± 3.6
Sensory level	T4 (T3-T5)	T4 (T3-T5)
Time for first analgesic (min)	176.1 ± 13.4	141.3 ± 6.8

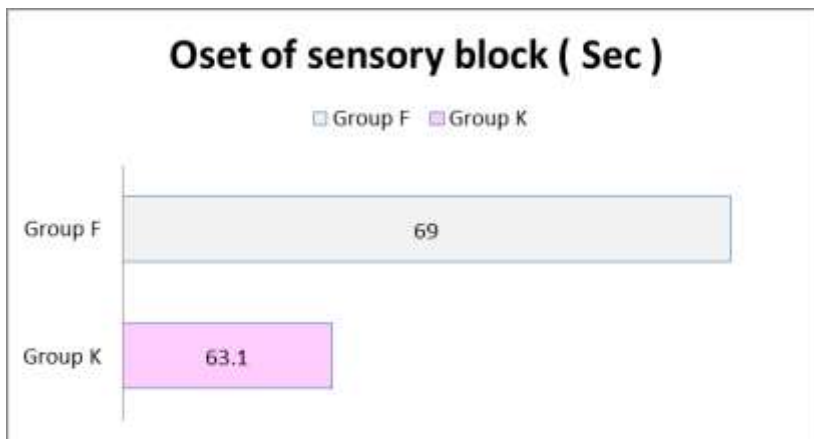


Figure 1: Onset of sensory block (seconds)

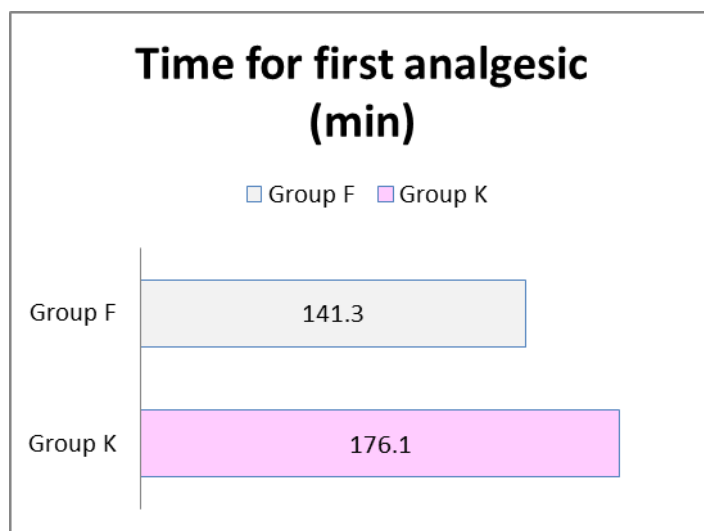


Figure 2: Time for first analgesic (min)

Table 3: Motor Blockade

Parameter	Group K	Group F	P Value
Time to achieve Bromage scale 3 (min)	11.8 ± 1.68	12.76 ± 1.70	NS
Time to achieve Bromage scale 0 (Hours)	2.45 ± 0.19	2.41 ± 0.091	NS

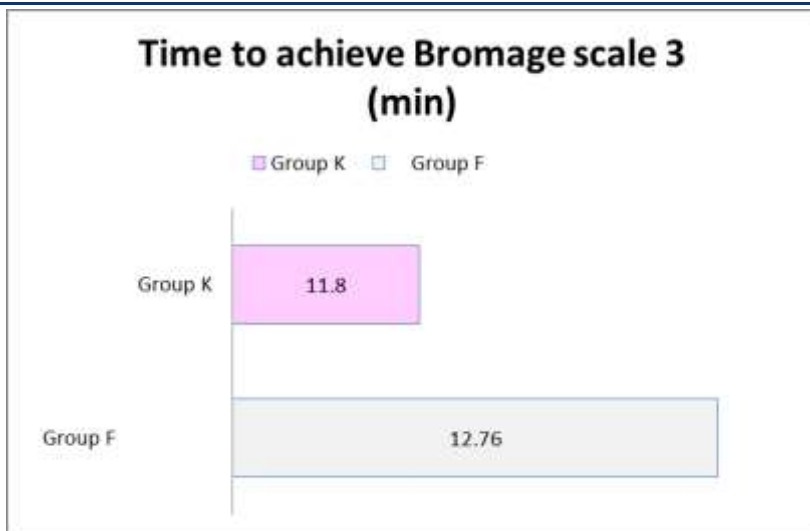


Figure 3: Onset of motor block (min).



Figure 4: Offset of motor block (hrs).

Table 4: Changes in Pulse Rate.

Time	Group K (Mean ± SD)	Group F (Mean ± SD)	P value
Basic	104.90 ± 5.86	107.4 ± 2.15	NS
2 Min	109.3 ± 3.16	110.5 ± 4.16	NS
5 Min	105.16 ± 3.31	101.44 ± 4.52	NS
10 Min	93.08 ± 4.11	85.96 ± 1.71	P<0.05
20 Min	90.21 ± 3.16	83.12 ± 2.10	P<0.05
30 Min	86.04 ± 4.21	80.60 ± 1.97	P<0.05
60 Min	76 ± 4.63	68.64 ± 3.05	P<0.05
90 Min	75.33 ± 4.70	68.20 ± 3.50	P<0.05
120 Min	75 ± 5.96	68.12 ± 5.15	P<0.05

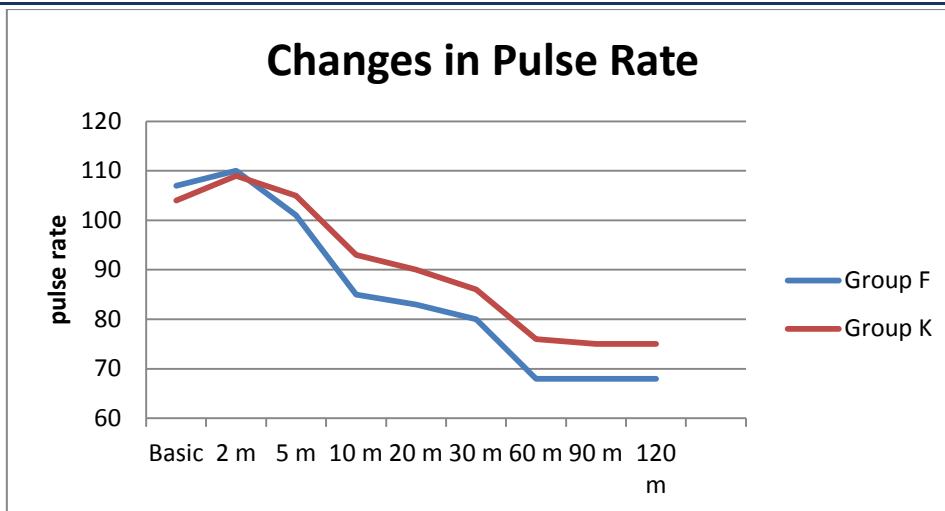


Figure 5: Changes in Pulse Rate

Table: Changes in Pulse Rate.

Time	Group K (Mean ± SD)	Group F (Mean ± SD)	P Value
Basic	111 ± 5.74	110.44 ± 6.01	NS
2 Min	110 ± 4.10	108.54 ± 4.03	NS
5 Min	98.24 ± 4.74	96.16 ± 4.97	NS
10 Min	94 ± 5.88	80.96 ± 5.1	NS
20 Min	94.08 ± 5.80	92.08 ± 4.30	NS
30 Min	100.24 ± 4.37	98.16 ± 2.88	NS
60 Min	114 ± 4.26	110 ± 4.16	NS
90 Min	105.33 ± 4.42	104.24 ± 4.33	NS
120 Min	106.56 ± 3.80	106.56 ± 3.96	NS

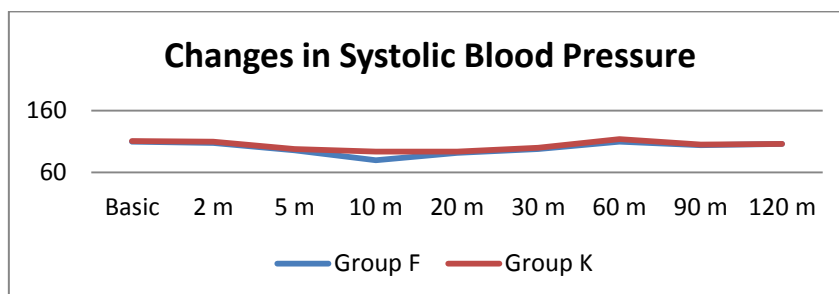


Figure 6: Changes in Systolic Blood Pressure

Table 6: Changes in Diastolic Blood Pressure

Time	Group K (Mean ± SD)	Group F (Mean ± SD)	P Value
Basic	74.56 ± 6.12	73.68 ± 5.90	NS
2 Min	72.4 ± 3.1	71 ± 3.25	NS
5 Min	68.8 ± 5.80	66.56 ± 5.60	NS
10 Min	65.36 ± 4.92	58.96 ± 3.37	P < 0.05
20 Min	66.4 ± 3.5	64.64 ± 3.45	NS
30 Min	66.56 ± 3	67.68 ± 3.21	NS
60 Min	70 ± 4.86	66 ± 5.16	NS
90 Min	71.36 ± 3.72	70.16 ± 3.43	NS
120 Min	72.8 ± 4.35	71.6 ± 3.55	NS

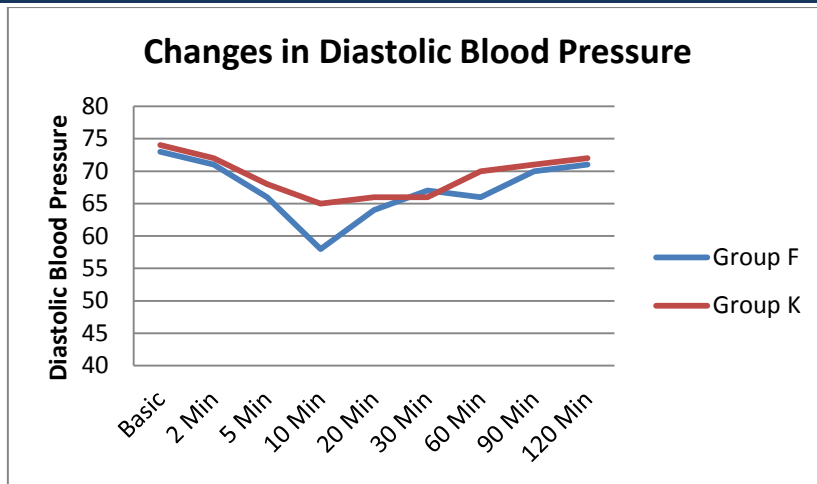


Figure 7: Changes in Diastolic Blood Pressure

Table 7: Changes in Mean Blood Pressure

Time	Group K (Mean ± SD)	Group F (Mean ± SD)	P Value
Basic	87.36 ± 6.12	86.68 ± 5.90	NS
2 Min	88.4 ± 3.1	83 ± 3.25	NS
5 Min	88.8 ± 5.80	75.56 ± 5.60	P < 0.05
10 Min	75.36 ± 4.92	67.96 ± 3.37	P < 0.05
20 Min	75.4 ± 3.5	77.64 ± 3.45	NS
30 Min	76.56 ± 3	76.68 ± 3.21	NS
60 Min	85 ± 4.86	80 ± 5.16	NS
90 Min	82 .36 ± 3.72	82.16 ± 3.43	NS
120 Min	83.8 ± 4.35	82.6 ± 3.55	NS

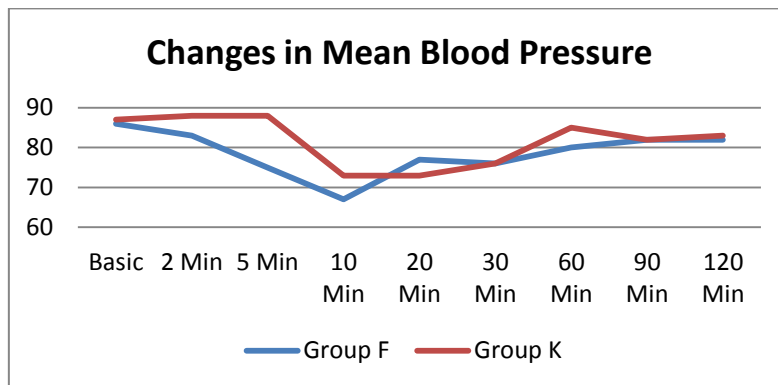


Figure 8: Changes in Mean Blood Pressure

Table 8: Changes in SpO₂.

Time	Group K (Mean ± SD)	Group F (Mean ± SD)	P Value
Basic	98.8 ± 1.4	98 ± 1.73	NS
2 Min	99 ± 1.73	97.2 ± 2.44	NS
5 Min	98 ± 1.73	97 ± 1.4	NS
10 Min	98.8 ± 1.4	96 ± 2.23	NS
20 Min	98 ± 2.23	96.8 ± 1.4	NS
30 Min	99.6 ± 2.44	96 ± 1.7	NS
60 Min	98.6 ± 2.23	96.8 ± 2.44	NS
90 Min	99 ± 1.7	96 ± 3.43	NS
120 Min	99 ± 2.44	97.2 ± 3.55	NS

Table 9: Changes in respiratory rate.

Time	Group K (Mean ± SD)	Group F (Mean ± SD)	P Value
Basic	15.4 ± 3.1	16.3 ± 2.6	NS
2 Min	16.2 ± 1.70	15.8 ± 3.43	NS
5 Min	15.8 ± 3.43	15.2 ± 1.7	NS
10 Min	15.4 ± 3.1	16.4 ± 1.4	NS
20 Min	16.3 ± 2.6	15.6 ± 1.68	NS
30 Min	15.2 ± 1.7	13.4 ± 1.70	NS
60 Min	15.4 ± 2.6	12.4 ± 1.70	NS
90 Min	16.3 ± 3.1	11.6 ± 2.6	P < 0.05
120 Min	15.8 ± 3.43	12.2 ± 3.1	NS

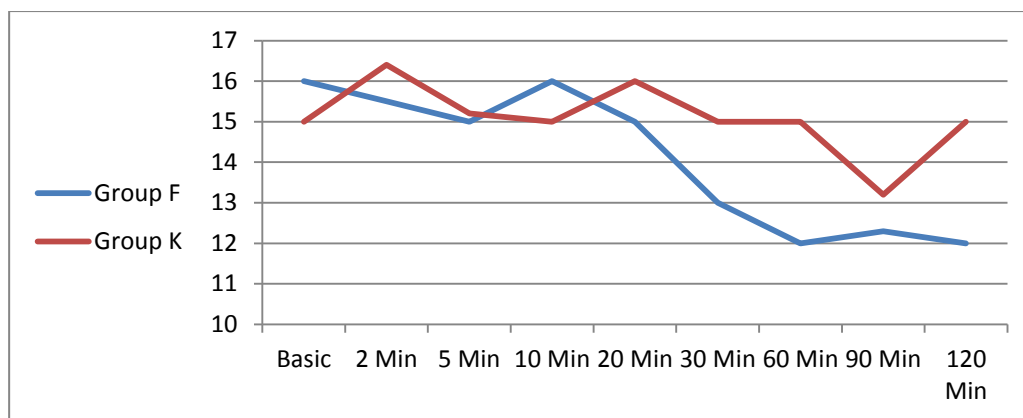


Figure 9: Changes in respiratory rate.

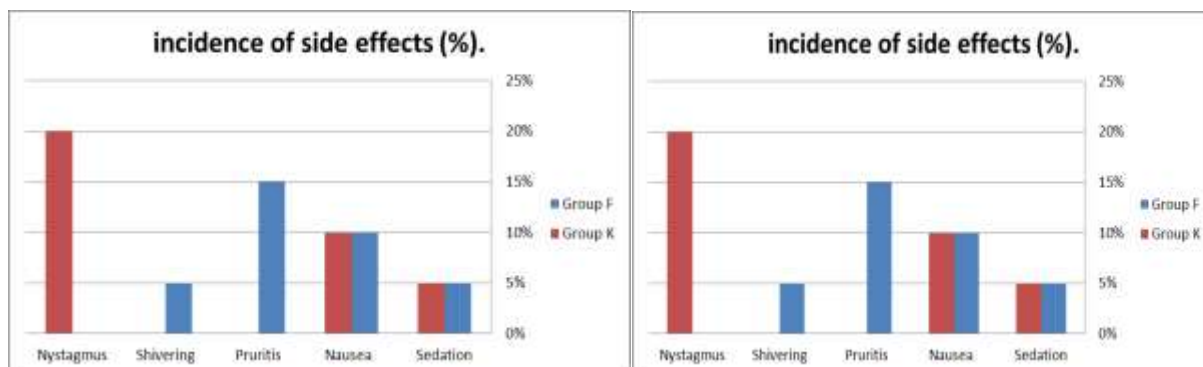


Figure 10: Incidence of side effects (%).

DISCUSSION

This study compares the effectiveness of Ketamine versus Fentanyl when added to Bupivacaine as adjunctive agents for spinal anesthesia in C.S.

The physical characteristics were comparable between the groups, and the results obtained declared that there was no significant difference in ASA, Parity, Age or weight in between groups.

The onset of sensory block was earlier in group K (63.1 sec), when compared to group F (69.0 sec, P<0.05).The duration of post operative analgesia were longer in group K (176.1min),when compared to group F (141.3min), P<0.05. Bansal et al., (1994) also reported similar onset of action.

The Bromage score was similar in both the groups. These observations are similar to other studies Kathirvel S, Sadhashivam S, Saxena A, et al (2000).

There is a statistically significant fall in the heart rate in both groups. Similar observations are recorded by Bhattacharya D, Banerjee A, et al., (2004).

There was hypotension with group-F at 10 minutes. There was no such hypotension with group-K during the intraoperative period. Kathirvel S, Sadhashivam S, Saxena A, et al., (2000) found that requirement for intravenous

fluids in the perioperative period were less in the ketamine group.

Fentanyl group showed a slight reduction in respiratory rate throughout the study period as compared to ketamine group which was not clinically significant, but change in respiratory rate was statistically significant at the 90th min, $P < 0.05$. There was no episode of desaturation during the study period. Bion *et al.*, (1994) also stated that intrathecal ketamine does not change the respiratory rate significantly.

The incidence of pruritis in group F (15%) when compared to group K (0%, $P < 0.05$). The incidence of nausea was similar in both the groups (10%) whereas the incidence of shivering more in the fentanyl group (5%) than the ketamine group (0%), these were found to be not statistically significant.

The incidence of nystagmus was 20% in the ketamine group (which is quite low as compared to the study of Bansal *et al.*, (1994) $> 80\%$) as compared to group F (0%, $P < 0.05$).

CONCLUSION

We have concluded that Onset of sensory block is more rapid by adding ketamine to intrathecal bupivacaine. There was no change in highest level of sensory block by adding ketamine to intrathecal bupivacaine. Duration of analgesia is longer with intrathecal bupivacaine + intrathecal ketamine than bupivacaine + intrathecal Fentanyl.

Incidence of hypotension is much less after adding ketamine to intrathecal bupivacaine. Hemodynamic stability is better maintained with intrathecal bupivacaine + intrathecal ketamine.

RECOMMENDATIONS

It is better to add ketamine to Bupivacaine than adding Fentanyl while performing a spinal anesthesia in CS.

REFERENCES

1. Bucklin, B. A., Hawkins, J. L., Anderson, J. R., & Ullrich, F. A. "Obstetric anesthesia workforce survey: twenty-year update." *The Journal of the American Society of Anesthesiologists* 103.3 (2005): 645-653.
2. Cousins, mj and mather, le. "Intrathecal and epidural administration of opioids." *Anesthesiology* 61 (1998): 276-310.
3. Hunt, C. O., Naulty, J. S., Bader, A. M., Hauch, M. A., Vartikar, J. V., Datta, S., ... & Ostheimer, G. W. "Perioperative analgesia with subarachnoid fentanyl-bupivacaine for cesarean delivery." *Anesthesiology* 71.4 (1989): 535-540.
4. Kelly, M. C., Carabine, U. A., & Mirakhur, R. "Intrathecal diamorphine for analgesia after Caesarean section A dose finding study and assessment of side-effects." *Anaesthesia* 53.3 (1998): 231-237.
5. Panjabi, N., Prakash, S., Gupta, P., & Gogia, A. R. "Efficacy of three doses of ketamine with bupivacaine for caudal analgesia in pediatric inguinal herniotomy." *Regional Anesthesia & Pain Medicine* 29.1 (2004): 28-31.
6. Togonal, T., Demirbilek, S., Koroglu, A., Yapici, E., & Ersoy, O. "Effects of S (+) ketamine added to bupivacaine for spinal anaesthesia for prostate surgery in elderly patients." *European journal of anaesthesiology* 21.3 (2004): 193-197.
7. Azeez, S. A. S., Hashim, A. S., Janabi, A. H. A., and Almashhadani, M.M. "The Effect of height and weight adjusted dose of intrathecal hyperbaric bupivacaine for elective caesarean section", *World Journal Of Advance Healthcare Research*, 7.11 (2023):123–129.
8. Bansal, S. K., Bhatia, V. K., Bhatnagar, N. S., Bhushan, S., & Pant, K. K. "Evaluation of intrathecal ketamine in emergency surgery." *Ind J Anaesth* 42 (1994): 32-36.
9. Kathirvel, S., Sadhasivam, S., Saxena, A., Kannan, T. R., & Ganjoo, P. "Effects of intrathecal ketamine added to bupivacaine for spinal anaesthesia." *Anaesthesia* 55.9 (2000): 899-904.
10. Bhattacharya, D., & Banerjee, A. "A comparative study of clinical effects of intrathecal hyperbaric bupivacaine and ketamine in hyperbaric solution." *Indian J. Anaesth* 48.2 (2004): 116-120.
11. Bion, J. F. "Intrathecal ketamine for war surgery. A preliminary study under field conditions." *Anaesthesia* 39.10 (1984): 1023-1028.

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