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Original Research Article

A COMPARISON OF BUPIVACAINE WITH BUPRENORPHINE VERSUS BUPIVACAINE WITH FENTANYL IN SPINAL ANAESTHESIA

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Abstract

Introduction: Neuraxial block for lower abdominal and lower limb surgeries are popular as it has many advantages over general anaesthesia. In current day practice various additives are used intrathecally to have good post-operative analgesia and optimal operating conditions.

Materials and Methods: In this Cross sectional study 60 patients were enrolled .After approval of the study protocol by our institutional committee, written informed consent was taken from each patient. In this Cross sectional study 60 patients of ASA status I and II patients of either sex, aged between 18-60 years, weighing 50- 70kgs, undergoing lower abdominal or lower limb surgeries under spinal anaesthesia were enrolled in this study and divided into 2 groups. Group B were given Buprenorphine 60mcg with 0.5% Hyperbaric Bupivacaine, whereas Group F were given Fentanyl 25mcg (0.5 ml taken in 2 ml syringe) with 0.5% Hyperbaric Bupivacaine. Sensory and motor block were assessed every 30mins in the Intraop period and every 2hrs for the first 8hrs. VAS score was analysed post operatively.

Result: The onset of sensory and motor blockade was faster in group B when compared to Group F. The duration of Post-operative analgesia was longer in Group B when compared to Group F ($p<0.001$)

Conclusion: We conclude that addition of 60mcg Buprenorphine as an adjuvant to 0.5%Hyperbaric Bupivacaine for Spinal anaesthesia increases the duration of Analgesia and facilitates fast onset of sensory and motor blockade.

Keywords: Bupivacaine, Buprenorphine, Fentanyl, Spinal Anaesthesia

Introduction

Pain is a complex, multidimensional perception .It has been defined as an unpleasant feeling that is conveyed to the brain by sensory neuron .It is a dynamic process. It involves actions at multiple sites starting from peripheral tissue injury provoking peripheral sensitization leading to central sensitization. Ultimately the inflammatory response leads to release of chemical mediators that act synergistically to convert high thresh-hold nociceptors to low thresh-hold nociceptors[1].

Prevention and treatment of postoperative pain plays an important role in reducing patient morbidity. It enables early ambulation, reduces morbidity, duration of hospital stay and improves the surgical outcome. The adequacy of postoperative pain control is one of the most

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important factors in determining safe discharge from Day care surgery[2]. Systemic analgesia by nature is associated with numerous side effects like drowsiness, dizziness, respiratory depression and disorientation. This may not allow the patient to ambulate early. Some drugs may cause nausea, vomiting and itching.

Spinal anaesthesia is the technique usually performed for urological, perineal, lower abdominal and lower limb surgeries. It is technically easier, has rapid onset of action and decreased failure rates. It is safe and economical.[3,4] Patient is awake and conscious, so is able to describe and relate timely indicators of complications. Spinal anaesthesia is straightforward and rapid to learn and teach. It requires less experience and provides relief from pain of surgery for several hours as compared to general anaesthesia[5].

Spinal anaesthesia using traditional local anaesthetics only, without adjuvants have a shorter duration of action and so leads to an early analgesic requirement in the postoperative period. In the context of augmentation strategies for neuraxial blockade, a number of intrathecal adjuvants have been used .This includes Opioids like Morphine, Fentanyl and Buprenorphine and Non-opioids like Midazolam, Ketamine, Neostigmine, Tramadol and Clonidine. Amongst them Opioids have been the most studied and commonly used drugs.

Highly specific opioid receptors were discovered in 1971. Later they were found to be localized in mammalian brain and primate spinal cord. Yaksh and Rudy first demonstrated the effectiveness of intrathecal opioids in abolishing experimental pain in an animal model. There is profound antinociception obtained and despite the side effects, opioids still remain effective and popular. Unlike the response to local anaesthetics, there is no motor or autonomic blockade. Paralysis and hypotension therefore, are absent. Morphine was amongst the first opioid to be used intrathecally. Buprenorphine, Fentanyl, Sufentanyl as intrathecal adjuvants have also been used. Another critical advantage of opioids over intrathecal local anaesthetics is the availability of a specific opioid receptor antagonist, Naloxone. Opioids can be classified on the basis of their solubility in fat. The lipophilic or fat soluble opioids are shorter acting compared to hydrophilic opioids. Hydrophilic opioid is mainly morphine, while lipophilic opioids are Buprenorphine, Fentanyl, Sufentanyl, Butorphanol and Pethidine. Intrathecal narcotics potentiate the sensory blockade of local anaesthetics without affecting the sympathetic activity [6]. They provide prolonged post-operative analgesia but are associated with increased risk of nausea, vomiting, itching and respiratory depression.[7]

MATERIALS AND METHODS

Patients undergoing lower abdominal and lower limb surgeries under Spinal anaesthesia in the Department of Anaesthesia ,ESIC PGIMSR,Kalaburagi

RESULTS

This was a prospective randomized, comparative double blind clinical study to evaluate he combination technique under spinal anaesthesia to assess the sensory motor effects, post-operative pain relief and side effects if any in patients undergoing lower abdominal and lowerlimb surgeries. A total of 60 patients belonging to ASA class 1 and 2 were enrolled in the study .These patients were randomly allocated to one of the two groups by consecutive numbers.

We assessed efficacy of 2 drugs Buprenorphine and Fentanyl as intrathecal adjuvants to Hyperbaric Bupivacaine for the sensory motor, post-operative analgesic effects. Hemodynamic parameters were recorded in the Intraoperative and Post- operative period using standard monitors. Post-operative pain was assessed using VAS score. Side effects such as nausea, vomiting, hypotension, bradycardia, pruritis were also noted.

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Following observations were made in the study

All demographic data are comparable in all the 2 groups. The following table shows the age, height, weight, sex distribution, ASA physical status and duration of study from all the two groups.

Statistical analysis: The data was expressed in number, mean and standard deviation. Statistical Package for Social Sciences (SPSS 16.0) version used for analysis. Unpaired t test applied to find the statistical significant between the groups. p value less than 0.05 considered statistically significant at 95% confidence interval.

Table 1: Distribution of patients based on the age

Age (Years)	Group-B		Group-F	
	Number	Percentage (%)	Number	rcentage (%)
Less than 20 years	2	6.67	0	0.00
20-40 years	13	43.33	17	56.66
41-60 years	15	50.00	13	43.34

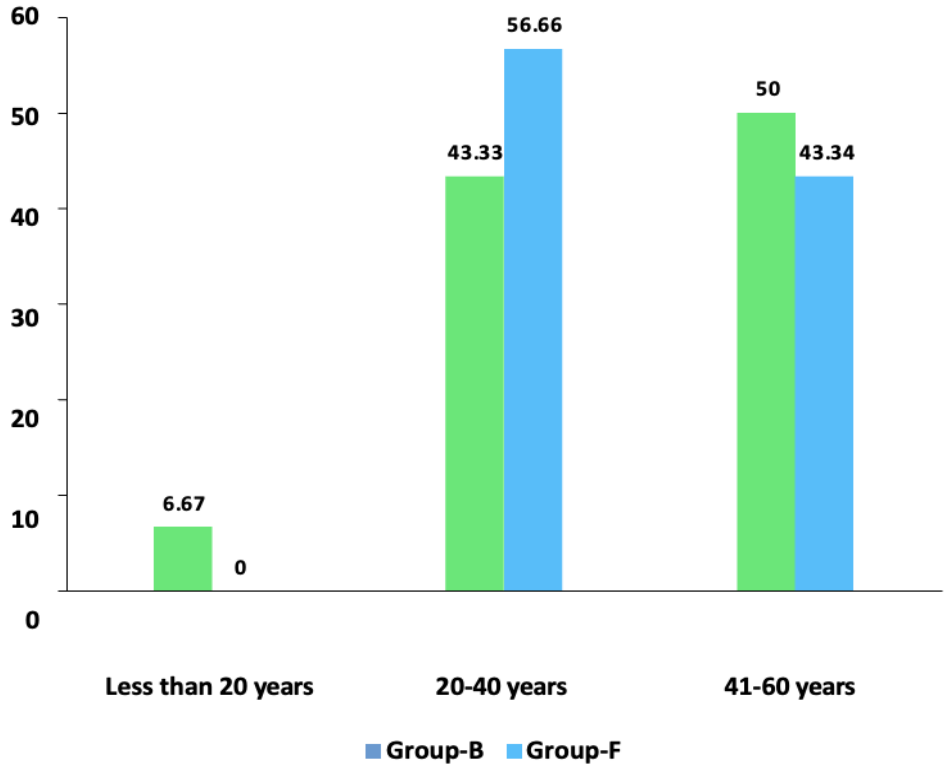

Fig 1: Distribution of patients based on the age

Table 2: Distribution of patients based on gender

Gender	Group-B		Group-F	
	Number	Percentage (%)	Number	Percentage (%)
Male	23	76.67	23	76.67
Female	7	23.33	7	23.33

(p>0.05 no significant compared group-B with group-F)

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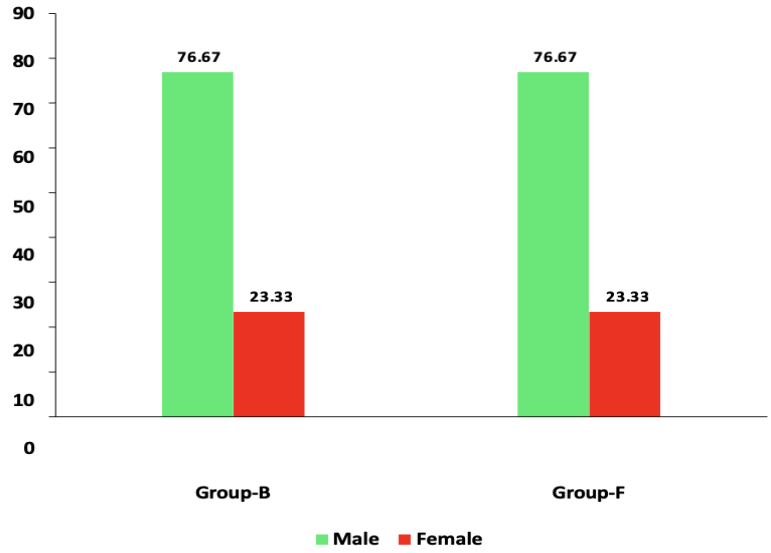

Fig 2: Distribution of patients based on gender

Table 3: Distribution of patients based on ASA

ASA score	Group-B		Group-F	
	Number	Percentage (%)	Number	Percentage (%)
Score-I	21	70.00	17	56.67
Score-II	9	30.00	13	43.33

(p>0.05 no significant compared group-B with group-F)

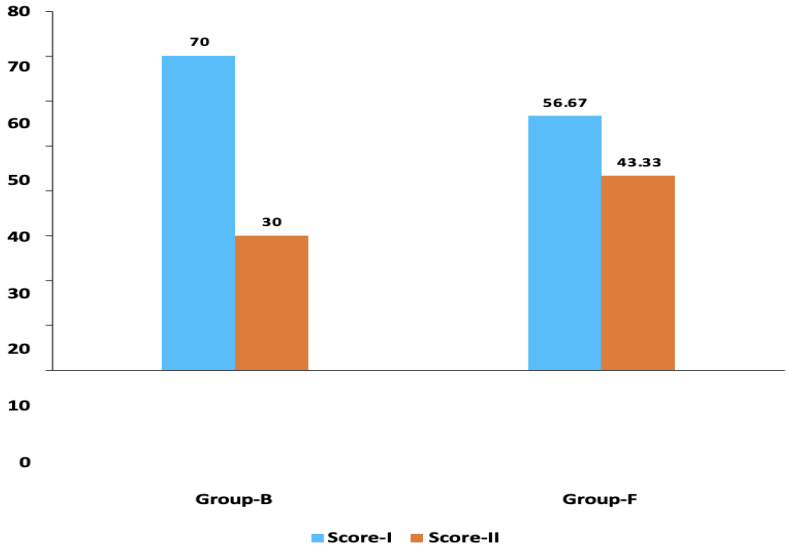

Fig3: Distribution of patients based on ASA

Table 4: Comparison of mean weight between the groups

Groups	Weight (Kg) (MEAN±SD)	p value
Group-B	66.56±1.19	0.78
Group-F	63.45±1.89	

(p>0.05 no significant compared group-B with group-F)

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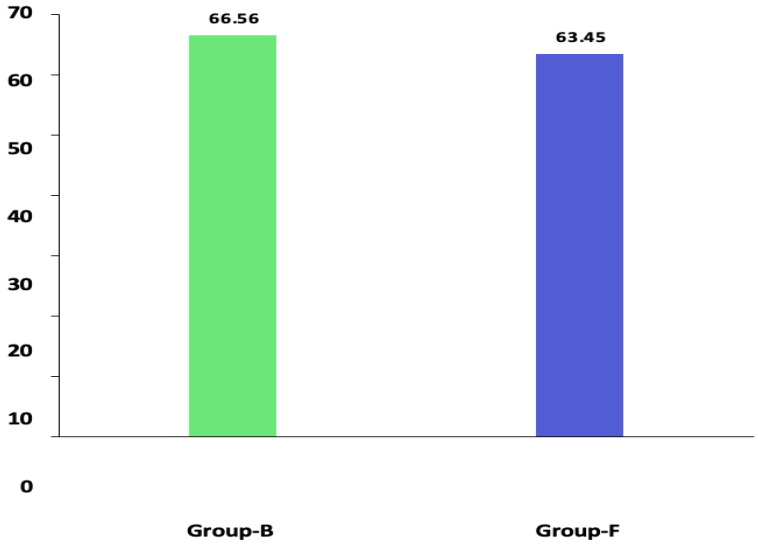

Fig 4: Comparison of mean weight between the groups

Table 5: Comparison of mean height between the groups

Groups	Height (cm) (MEAN±SD)	p value
Group-B	165.70±7.68	
Group-F	164.90±9.7	**0.89**

(p>0.05 no significant compared group-B with group-F)

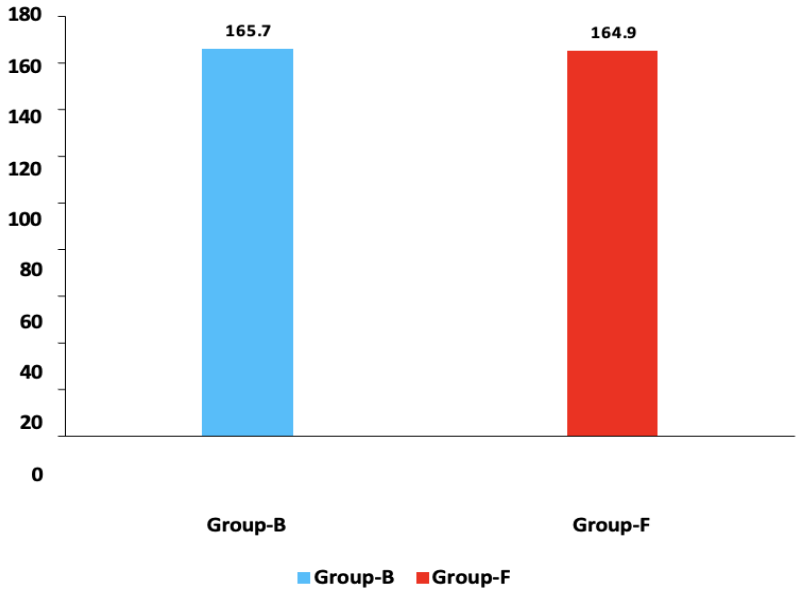

Fig 5: Comparison of mean height between the groups

Table 6: Comparison of mean duration of surgery time between the groups

Groups	Mean duration of surgery (MEAN±SD)	p value
Group-B	63.00±31.08	
Group-F	67.00±34.90	**0.12**

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(p>0.05 no significant compared group-B with group-F)

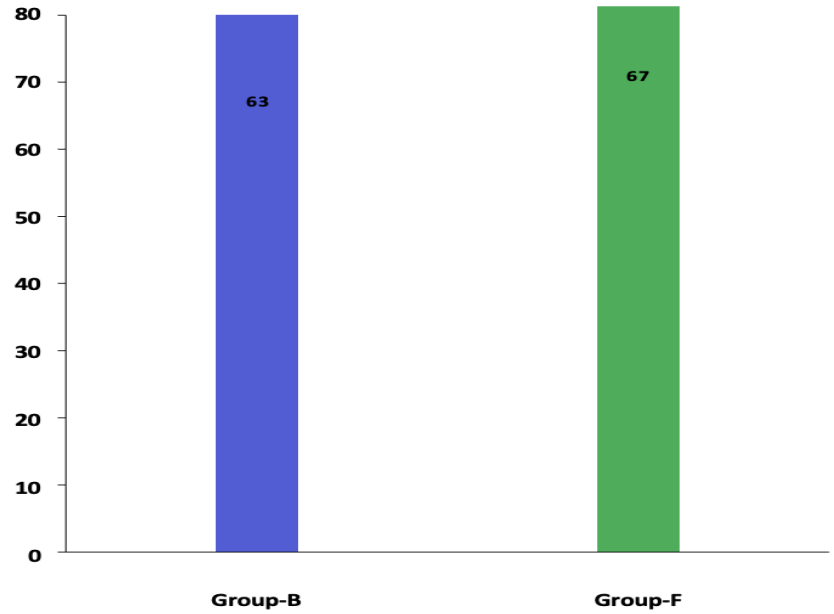

Fig 6: Comparison of mean duration of surgery time between the groups

Table 7: Comparison of mean heart rate between the groups at same time period

Time (min)	Heart rate (min) (MEAN±SD)		p value
	Group-B	Group-F	
0 min	81.63±1.04	74.26±7.30*	**0.03**
5 mins	89.73±15.02	75.96±10.60*	**0.03**
10 mins	88.10±14.39	72.96±11.11*	**0.03**
15 mins	85.20±15.13	71.13±10.68*	**0.03**
20 mins	83.30±16.22	71.76±10.26*	**0.03**
25 min	80.13±15.04	71.63±10.67*	**0.03**
30 mins	80.00±14.99	70.56±9.98*	**0.04**
40 mins	75.43±13.81	72.66±3.45*	**0.04**
50 mins	71.70±10.79	70.64±10.67	**0.56**
60 mins	70.87±11.27	70.85±10.78	**0.45**
70 mins	73.50±14.10	70.50±9.67	**0.67**
80 mins	73.11±12.90	70.45±9.45	**0.54**
90 mins	73.11±12.89	70.11±10.67	**0.34**
100 mins	73.11±14.82	68.7±10.63*	**0.04**
110 mins	73.11±13.90	68.45±10.56*	**0.04**
120 mins	72.90±12.05	68.12±10.76*	**0.04**

(*p<0.05 significant compared group-B with group-F)

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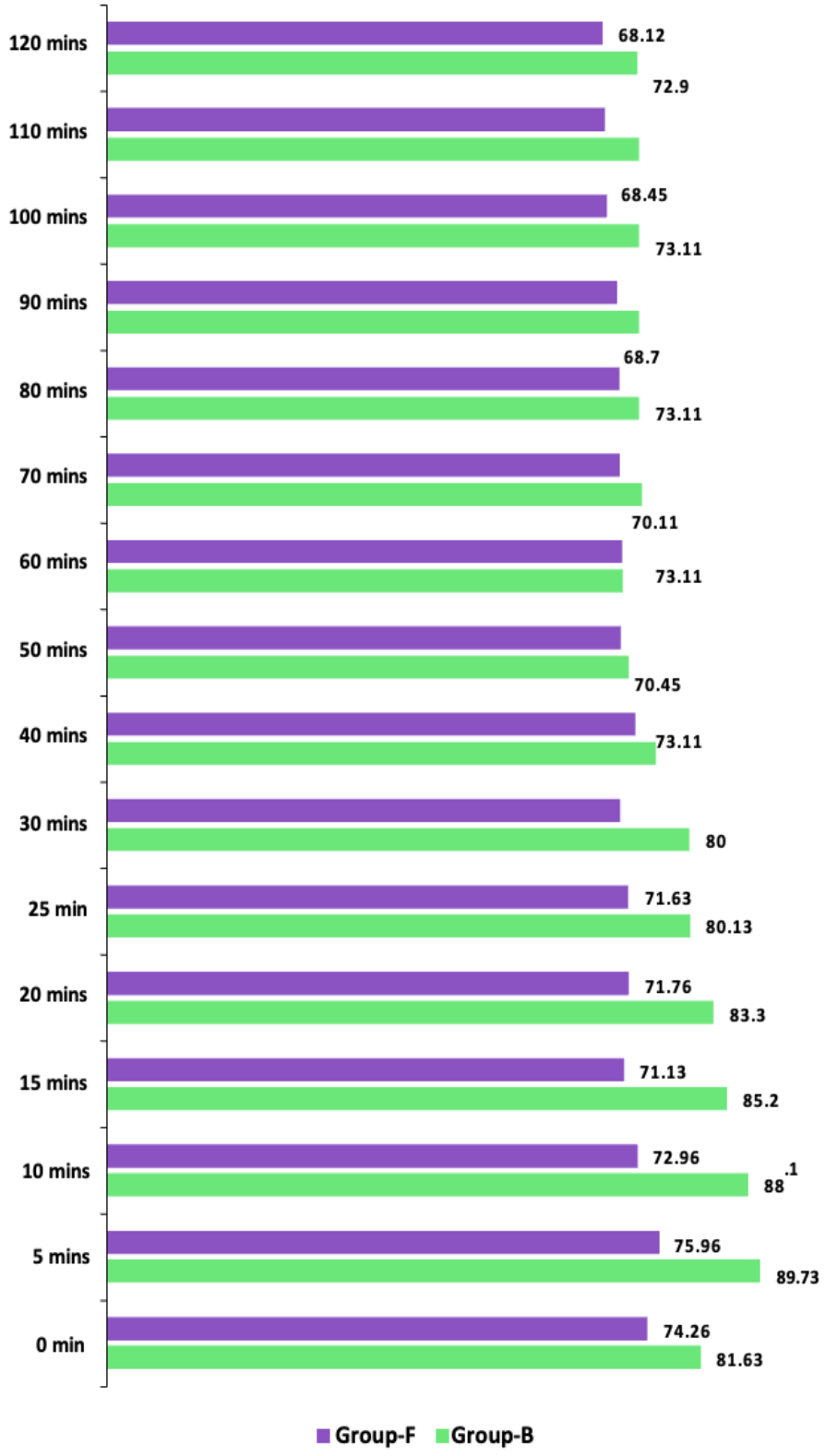

Fig 7: Comparison of mean heart rate between the groups at same time period

Table 8: Comparison of mean systolic blood pressure between the groups at same time period

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Time (min)	Systolic blood pressure (mmHg) (MEAN±SD)		p value
	Group-B	Group-F	
0 min	134.10±13.67	138.73±12.67	**0.78**
5 mins	135.73±14.09	140.60±10.56*	**0.03**
10 mins	130.83±15.11	132.50±10.12	**0.03**
15 mins	123.33±16.58	124.83±19.45	**0.03**
20 mins	117.66±20.38	125.60±12.89*	**0.03**
25 mins	114.56±18.18	127.90±13.78*	**0.04**
30 mins	110.48±25.93	125.86±12.10*	**0.05**
40 mins	114.39±14.62	125.40±10.32*	**0.05**
50 mins	110.94±13.74	128.90±10.32*	**0.03**
60 mins	110.37±13.36	128.00±9.56*	**0.03**
70 mins	110.83±11.38	129.89±10.10*	**0.04**
80 mins	110.11±13.28	127.13±10.23*	**0.03**
90 mins	110.22±13.29	121.93±10.89*	**0.04**
100 mins	110.56±12.04	119.89±9.21*	**0.03**
110 mins	110.89±11.90	116.78±9.67*	**0.03**
120 mins	119.34±12.96	114.90±9.34*	**0.03**

(*p<0.05 significant compared group-B with group-F)

Table 9: Comparison of mean diastolic blood pressure between the groups at same time period

Time (min)	Diastolic blood pressure (mmHg) (MEAN±SD)		p value
	Group-B	Group-F	
0 min	83.43±10.10	83.13±12.98	**0.45**
5 mins	82.30±10.53	82.13±10.56	**0.13**
10 mins	75.06±17.01	77.33±11.67	**0.89**
15 mins	73.00±11.45	74.63±10.45	**0.14**
20 mins	69.96±14.15	67.46±10.34*	**0.04**
25 min	68.63±11.67	73.50±12.56*	**0.04**
30 mins	68.93±11.14	72.78±10.12	**0.83**
40 mins	69.54±11.70	75.64±10.11*	**0.03**
50 mins	69.64±9.63	76.89±10.45*	**0.03**
60 mins	67.62±8.61	74.89±12.67	**0.94**
70 mins	68.25±6.74	74.34±13.12	**0.19**
80 mins	68.00±7.92	72.10±11.34	**0.27**
90 mins	68.00±9.79	72.12±11.78	**0.34**
100 mins	67.34±7.34	71.89±12.94	**0.67**
110 mins	67.12±7.02	70.45±11.54	**0.23**
120 mins	67.34±7.19	70.34±11.45	**0.56**

(*p<0.05 significant compared group-B with group-F)

DISCUSSION

Spinal anaesthesia is a commonly used technique for urological, perineal and lower limb surgeries requiring a block from T10-S4. [9] Spinal anaesthesia is the technique of choice

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for these procedures as patients remain conscious; making it possible for early recognition of complications if any due to intrathecal procedure or surgery per se. Local anaesthetics were administered alone for providing anaesthesia for this procedure for several years. However, this contributed to considerable hemodynamic adverse effects in many patients. Also the need to prolong post- operative analgesia lead to addition of various adjuvants to intrathecal local anaesthetics.

After lower abdominal and lower limb procedures patients often suffer from pain. It is therefore important to ensure adequate postoperative analgesia. In order to achieve this, addition of adjuvants to intrathecal local anaesthetics came into practice. An ideal combination should provide adequate intraoperative anaesthesia, good extended postoperative analgesia without prolonging the motor blockade or producing adverse haemodynamic or respiratory consequences.

Since the first clinical use of intrathecal morphine in 1979, numerous studies have confirmed the efficacy of spinally-administered opioids for postoperative pain relief [10]. However, opioids do not remain localised to the site of intrathecal injection. After spinal administration, opioids undergo redistribution by rostral spread, which explains the occurrence of nausea, vomiting and respiratory depression [11].

Sensory Block

Onset of Analgesia is taken as the time period from Drug administration to onset of Pain relief .In this study the mean highest level of Sensory block in Group B was 6.50±1.96 and in Group F was 7.26±2.18.The comparison was statistically significant. The Time to highest sensory level block in Group B was 9.72±2.91mins compared to Group F which was 8.43±2.56mins. The p value is 0.04 which is statistically significant.

Motor Block

The Degree of Motor blockade, degree and time taken for complete blockade was recorded In this study the comparison of mean highest motor block between the groups at same time period in Group F was 5.46±1.64 compared to Group B which was 4.06±1.10. The p value was 0.043 which statistically significant.

Post-operative Analgesia

The need for rescue analgesia was taken when the patient first complained of pain. The duration of analgesia was measured from the time of Subarachanoid injection to the time of first rescue analgesia. Time at which patients complained of pain more than 5 cms on the scale was noted. That point was taken as the end of fair analgesia and at that point rescue analgesics were given**.** The comparison of mean time to post analgesia between the groups at same time period was 457.29±2.28mins in Group B when compared to Group F was 361.88±3.26mins. The p value is 0.001 ($p<0.05$) which is highly significant.

Side effects

The commonly seen adverse effects with opioid administration include nausea, vomiting, retention of urine and pruritus, Respiratory depression and hypotension. Opioids produce nausea and vomiting by direct stimulation of CTZ in the area of postrema of the medulla. The effect is dose related and tolerance to it develops rapidly. The emetic effect can be treated by anticholinergics and phenothiazines, especially those which are antagonists at dopamine

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receptors. Retention of urine is due to opioid analgesics causing increase in urinary sphincter tone and a decrease in detrusor muscle tone. Nalaxone antagonizes these effects, promoting an increase in detrusor contractility, with a reduction in functional bladder capacity.Pruritus, particularly facial pruritus following extradural injection of opioids is attributed variously to histamine release, an effect of opioid spreading to medulla or fourth ventricle.

The patients were observed for side effects like nausea, vomiting, Tachycardia, pruritus and hypotension in both the groups.

In our study 1 patient from Group B developed Tachycardia. 2 patients developed nausea and 3 patients had vomiting .3 patients of Group F developed Pruritis compared to none in Group B. None of the patients in our study had significant hypotension in either of the groups

Lanz et al demonstrated that buprenorphine is compatible with CSF and produces no adverse reactions when administered intrathecally. Buprenorphine has high molecular weight, is highly lipophilic and has high affinity for opiate receptors. The study was on Epidural buprenorphine for postoperative analgesia and side effects [14].

Pal et al study on Intrathecal Buprenorphine, Clonidine and Fentanyl as Adjuvants to 0.5% Hyperbaric Bupivacaine in Lower Abdominal and Lower Limb Surgeries showed that Buprenorphine is another opioid which increases sensory block without affecting motor block and haemodynamics[12].

Saxena et al in his study of Current concepts in neuraxial administration of opioids and non-opioids showed that Fentanyl is a lipophilic μ receptor agonist opioid when given intrathecally it exerts its effect by combining with opioid receptor in the dorsal horn of spinal cord and may have a supraspinal spread and action. The effectiveness of Intrathecal opioids depends on their bioavailability, so opioids can provide good perioperative analgesia [13].

Chavan et al studies showed that two segment regression and the duration of analgesia was i.e.134.12±10.81 and 207±17.57 minutes respectively In the context of 'Augmentation strategies' for epidural and intrathecal analgesia, the discovery of opioid receptors and subsequent development of the technique of epidural and intrathecal opioid administration is undoubtedly one of the most significant advances in pain management of last four decades In this study with fentanyl 25 mcg as additive to bupivacaine, showed that quality of analgesia was good with minimal side effects[8].

Conclusions

This study shows that the addition of Fentanyl or Buprenorphine to Intrathecal Hyperbaric Bupivacaine is safe as both maintain hemodynamic stability without producing excessive sedation or respiratory depression but Buprenorphine as adjuvant prolongs the duration of postoperative analgesia and the request for first analgesics. The patient's well-being was satisfactory in both the groups. Further studies to validate our findings recruiting larger patient population is considered essential.

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