Research Article

Post operative pain relief in lower abdominal and lower limb surgeries using fentanyl and tramadol – a comparative study

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Abstract

Introduction: This clinical study is being done to compare and evaluate the drugs, Bupivacaine 0.5% heavy, Tramadol with Bupivacaine 0.5% heavy and Fentanyl with Bupivacaine 0.5% heavy, for Postoperative Pain Relief in Lower Abdominal and Lower Limb surgeries. **Methodology:** 90 patients were given either of the three sets of intrathecal drugs randomly so that each group comprised 30 patients. Group A- 3ml (15mg) Bupivacaine 0.5% heavy, Group B-3ml (15mg)Bupivacaine 0.5% heavy and Tramadol hydrochloride 25mg (0.5 ml),Group C-3ml (15mg) Bupivacaine 0.5% heavy and Fentanyl citrate 25mg (0.5 ml). **Observation:** On intergroup comparison the difference is statistically highly significant for duration of sensory blockade. Though duration of sensory blockade is prolonged with both Tramadol and Fentanyl, it is more prolonged with Fentanyl. **Conclusion:** The mean duration of postoperative pain relief was significantly longer in the range of 6.15±1.02 hours with intrathecal Fentanyl when compared to 4.21±0.91 hours with intrathecal Tramadol. Intraoperative and postoperative vital parameters are not affected by the addition of Fentanyl or Tramadol to Bupivacaine for subarachnoid block. Fentanyl or Tramadol given intrathecally with Bupivacaine does not affect the characteristics subarachnoid block. Thus it can be concluded the Fentanyl in a dose of 25 µg intrathecally provides longer postoperative pain relief compared to intrathecal 25mg Tramadol with appreciable less incidence of side effects.

Keywords: Abdominal pain, Bupivacaine, Fentanyl, Tramadol

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INTRODUCTION

"Divine is the task to relieve pain"..... Hippocrates"

Pain has been defined by the International Association for study of Pain (IASP) as "*An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage*".[1] The relief of pain during surgery is the raison d'etre of Anaesthesiologist and any expertise acquired in this field should preferably be extended into the post-operative period. Bupivacaine is a potent, long-acting local anaesthetic agent whose drug profile overcomes the most of the side effects associated with the agents used previously. Tramadol a relatively new, centrally acting analgesic drug has a low but preferential activity at opioid receptors. The adverse effect profile of tramadol especially respiratory depression is that of weak opioid at effective analgesic doses with low abuse and addiction potential. Fentanyl is a potent, short acting synthetic opioid, a lipophilic opioid, has rapid onset of action following intrathecal administration[1] This clinical study is being done to compare and evaluate the drugs, 0.5%

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Bupivacaine, Tramadol with 0.5%, Bupivacaine and Fentanyl with 0.5% Bupivacaine, for Postoperative Pain Relief in Lower Abdominal and Lower Limb Surgeries.

METHODOLOGY

The present study has been carried out in Department of Anaesthesiology, S.S. Medical College and Associated Sanjay Gandhi Memorial Hospital and Gandhi Memorial Hospital, Rewa. This study comprised of 90 patients of ASA grade I and II, of both sexes and age ranging between 18 to 60 years posted for routine surgeries of lower abdomen and lower limb. 90 patients were given either of the three set of i.t. drugs randomly so that each group comprised 30 patients. **Group A:** 3 ml (15 mg) 0.5% Bupivacaine

Group B: 3 ml (15 mg) Bupivacaine 0.5% heavy + 25 mg (0.5 ml) Tramadol hydrochloride

Group C: 3 ml (15 mg) Bupivacaine 0.5% heavy +25 µg (0.5 ml) Fentanyl citrate

All patients were kept nil orally for 6 hours before the scheduled time of surgery. Xylocacine sensitivity was performed in all the patients. Patients were taken on operation table and vital parameters checked manually. Monitors were set up for pulse rate, blood pressure and SpO_2. A wide bore intravenous line was established and preloading done with 15 ml/kg body weight of Ringer's solution about 15 minutes before the intended time of intrathecal drug administration. Uniform premedication with i.v. glycopyrolate 0.2 mg was done about 5 min before subarachnoid block. The pulse rate, blood pressure, respiratory rate, SpO_2 reading were taken and recorded as basal parameters. Under all aseptic precautions, lumbar puncture was performed at L_3-4/L_2-3 intervertebral space using midline approach with 25 gauge quincke spinal needle. After ensuring a free flow of cerebrospinal fluid, the drugs according to the group allocated were injected. The patients were laid in supine position, to all the cases; oxygen was given by polymask (3-4 lit/min). The vital parameters like pulse rate, blood pressure (systolic and diastolic), respiratory rate and SpO_2 were recorded every 2 minutes for initial 10 min, then every 5 minutes till 30 minutes, then every 10 minutes till completion of surgery. During surgery, IV fluids (crystalloids, colloids and blood) were administered as required. A record was also made of blood loss, urine output and i.v. fluid input. Patients were observed for any discomfort, nausea, vomiting, shivering, pain, bradycardia, hypotension and any other side effect and the need for any additional medication was recorded.

Monitoring

During monitoring the parameters, pulse rate of less than 60/min was graded as bradycardia and of greater than 100/min as tachycardia. Atropine 0.6 mg was administered in cases of bradycardia. Whenever there was a fall of ≥20% of systolic blood pressure from the base the value or to less than 90 mmHg, it was treated with IV fluids and/or by mephentermine sulfate 3mg. A respiratory rate of less than 10/min or SpO_2 less than 90% was taken as respiratory depression. Onset of sensory analgesia was assessed by pin-prick method. Time from intrathecal drug administration to loss of sensation to Pin-prick was taken as time of onset of sensory analgesia. The highest level at which patient could not feel Pin-Prick sensation was taken as level of sensory analgesia. After completion of surgery, patients were shifted to postoperative wards and the time interval from onset of analgesia to first complain of pain by the patient was recorded as duration of analgesia. The time of onset of motor blockade was taken as the time elapsing from injection of drug to failure to raise the lower limbs on command. Degree of motor blockade was assessed by the ability to perform limb movements. This was classified into four grades according to criteria described by Bromage P.R. *et al*[1] in 1962. Duration of motor blockade was recorded as time taken from the onset of the motor block to the time when the patient was able to perform limb movements.

Bromage Score[2]

a. Grade I : Free movement of legs and feet
b. Grade II: Just able to flex knees with free movement of feet
c. Grade III: Unable to flex knee, but with free movement of feet
d. Grade IV: Unable to move legs or feet

Duration of surgery was taken as time period from skin incisions to skin closure after completion of surgical procedure. Patients were closely monitored in the intraoperative and postoperative periods for any complications and/or side effects.

The observed parameters recorded in all the three groups were tabulated and statistical analysis carried out by using chi-square and student "t" test (paired for intragroup and unpaired for intergroup comparison). P value <0.05 was taken to be statistically significant and <0.001 highly significant. Relevant literature was reviewed.

OBSERVATION

Table 1: Distribution of Patients according to the type of Surgery

Department	Groups A (n=30)	Group B (n=30)	Group C (n=30)	Total
General Surgery	8	10	9	27
Gynaecological Surgery	12	7	13	32
Orthopaedic Surgery	10	13	8	31
Total	**30**	**30**	**30**	**90**

Distribution of patients according to different type of surgeries is shown in above table.

Table 2: Mean Basal Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure and Respiratory Rate

Parameters	Groups A (n=30)	Group B (n=30)	Group C (n=30)
Heart Rate	84.80±11.10	85.56±13.06	86.13±14.47
SBP	126.98±13.5	127.73±13.2	125.12±10.83
DBP	81.23±6.51	79.28±8.69	82.81±9.54
RR	16.23±1.4	15.91±3.02	16.38±2.34
SpO_2	98.22±1.5	98.38±1.18	98.48±1.28

Above shows the base line hemodynamic values, respiratory rates and SpO_2 of all the three groups.

Table 3: Mean Duration of Sensory Blockade

Parameters	Groups A (n=30)	Group B (n=30)	Group C (n=30)
Time (Hrs)	3.41±0.42	4.21±0.91	6.154±1.02

Intergroup comparison

Group A Vs. B $p < 0.001$
Group A Vs. C $p < 0.0001$
Group B Vs. C $p < 0.0001$

Above table shows the mean duration motor blockade, which was found to be 3.41±0.42, 4.21±0.91 and 6.154±1.02 in Group A, B and C respectively. On intergroup comparison p value for Group A Vs. B is <0.001 which is statistically highly significant, <0.0001 for Group A Vs. Group C and Group B Vs. Group C which is statistically very highly significant.

Table 4: Effect on Pulse Rate and Mean Arterial Pressure (MAP) in different Groups

Interval	Pulse Rate			Mean Arterial Pressure (MAP)		
	Groups A	Group B	Group C	Groups A	Group B	Group C
Baseline	84.80±11.10	85.56±13.05	86.13±14.47	84.05±5.53	84.94±4.08	84.28±5.07
5 min	83.16±8.39	84.56±9.21	83.39±7.16	82.78±4.61*	80.30±4.84*	80.21±5.665*
15 min	88.40±7.67	86.08±9.97	83.07±11.74	82.65±5.41*	79.80±3.94*	79.68±4.22*
30 min	88.76±12.07	88.56±7.03	82.01±11.42	82.25±4.48*	79.59±4.38*	79.94±4.84*
60 min	87.36±11.59	86.40±6.52	82.28±8.49	83.75±4.69	81.23±5.6	81.54±4.96
90 min	86.44±9.74	82.40±6.42	80.76±9.08	83.64±3.58	81.73±4.12	81.86±5.14
120 min	84.96±11.01	79.28±5.94	80.98±7.30	84.12±5.63	82.21±7.4	83.31±4.8
150 min	80.12±10.73	79.12±5.94	81.04±6.76	83.51±5.53	82.93±6.97	83.11±3.71
180 min	80.60±9.99	78.0±5.57	81.58±7.94	83.25±5.22	82.71±7.24	83.19±4.39

*($p<0.05$)

Above table shows mean ± SD of pulse rate and mean arterial pressure (MAP) in different groups at different time intervals.

Table 5: Effect on Respiratory Rate and SpO_2 in Different Groups

Interval	Pulse Rate			Mean Arterial Pressure (MAP)		
	Groups A	Group B	Group C	Groups A	Group B	Group C
Baseline	16.23±1.4	15.91±3.02	16.39±2.34	98.22±1.5	98.38±1.18	98.48±1.28
5 min	16.28±1.5	16.12±2.8	16.32±2.23	98.20±1.19	98.54±1.07	98.38±1.19
15 min	16.26±1.4	16.24±3.01	16.61±2.81	98.54±1.07	98.38±1.19	98.20±1.12
30 min	17.01±1.5	16.14±2.9	16.48±2.62	98.36±1.12	98.10±1.09	98.38±1.18
60 min	16.98±1.4	16.28±2.7	16.22±2.01	98.40±1.16	98.42±0.97	97.22±1.15
90 min	16.29±1.6	16.29±2.8	16.00±1.86	97.44±1.28	98.20±1.19	98.01±1.28
120 min	16.59±1.6	16.21±2.6	16.09±1.97	98.21±1.6	98.00±1.94	98.08±1.48
150 min	16.71±1.6	16.16±2.9	16.81±2.46	97.64±1.02	98.86±0.99	98.61±1.89
180 min	16.90±1.4	16.12±2.8	16.97±2.32	98.18±0.90	98.54±1.07	98.38±1.19

Above table shows mean ± SD of respiratory rate and SpO_2 in different groups at different time interval.

Demographic Data

In the present study mean age in control group A was 40.35±2.23 years, 41.90±2.55 in Group B and 41.21±2.35 in group C. The mean weight of patients in this study was 58.83±5.83 kg in group A, 57.60±6.70 in group B and 58.70±5.72 in group C. The mean height of patients was 161.18±3.34 in group A, 162.80±3.89 in group B and 162.94±3.94 in group C. All three groups were similar in terms of weight and height (Table No. 2). Similar age, weight and height distribution was also seen in the study of Torres *et al* (1993), Harbhej Singh *et al* [3] (1995), Khusniemi K. S. *et al* (2000), Susmita Chakraborty *et al*[4] (2008), S. Goel *et al*[9] (2001) and B.N. Biswas *et al*[6] (2002).

Sensory Blockade

In the present study the onset of sensory blockade was tested by pin-prick method, this has been the commonest method of testing the onset of sensory blockade. The mean time of onset of blockade sensory blockade seen in different groups. It is found to be 111.00±11.54 sec. in group A, 110.94±13.57 sec in group B and 107.86±13.98 sec in group C (Table-6). On intergroup comparison p>0.05 for all the group which is statistically not significant. This shows that there is no direct effect of Tramadol or Fentanyl on nerve conduction, suggesting local anaesthetic action is unlikely.

Motor Blockade

In the present study mean time of onset of motor blockade was 253.98±28.2, 268±53.4, 255.96±47.4 second in Group A, B and C respectively (Table -7). On intergroup comparison p>0.05 for all the group which is statistically not significant. The mean duration of motor blockade in the present study was found to be 3.01±1.3, 3.34±0.69 and 3.45±0.82 hours in Group A, B and C respectively (Table-8). However, the duration of motor blockade is slightly prolonged in Group B and Group C as compared to the control Group A, statistically it was found to be insignificant on intergroup comparison. (Group A with Group B, p>0.05, Group A with Group C, p>0.05, Group B with Group C, p>0.05). The result was got were comparable with the results obtained by Torres *et al* (1993). They compared the analgesic efficacy of intrathecal tramadol and bupivacaine with fentanyl and bupivacaine in moderate to severe post operative pain. There was no effect on the time of onset and duration motor blockade in any of the group. Harbhej Singh *et al*[3] (1995) found that there was no significant effect on the onset and duration of motor blockade by the addition of fentanyl to hyperbaric bupivacaine. J.A. Alhashemi *et al*[4] (2003) and Susmita Chakraborty *et al*[5] (2008) found no significant change in the onset and duration of motor block by addition of tramadol to hyperbaric bupivacaine. Roussel JR and Heindel L[6] (1999) studied the effect of intrathecal fentanyl on duration of bupivacaine spinal blockade. They concluded that fentanyl does not enhance the onset and duration of motor blockade. Thus it is quite clear that addition of Tramadol or Fentanyl to Bupivacaine 0.5% heavy does not cause any significant change in its time of onset of motor blockade.

Duration of Sensory Blockade

In the present study duration of analgesia was estimated from the time of completion of intrathecal injection to the time when the VAS score was greater than 40mm and medication for pain was administered. The mean duration of sensory blockade was 3.41±0.42, 4.2±0.91 and 6.154±1.02 in Group A, B and C respectively (Table-9). On intergroup comparison the difference are statistically highly significant for group A with Group B (p<0.001) and very highly significant for Group A with Group C and Group B with Group C (P<0.0001). Though duration of sensory blockade is prolonged with both Tramadol and Fentanyl, it is more prolonged with fentanyl. This explains synergism between bupivacaine and fentanyl. Torres *et al* (1993) compared the analgesic efficacy of intrathecal tramadol and bupivacaine with fentanyl and bupivacaine in moderate to severe postoperative pain. They concluded that intrathecal administration of bupivacaine with tramadol or fentanyl prolongs the duration of sensory blockade. They further reported that duration of sensory blockade was more prolonged with fentanyl as compared to the group containing tramadol. Harbhej Singh *et al*[3] (1995) studied the effect of intrathecal fentanyl on the onset and duration of hyperbaric bupivacaine induced spinal block. They concluded that fentanyl 25 µg intrathecally prolonged the duration of bupivacaine induced sensory block. Roussel J. R. and Hindel L[6] (1999) in their study concluded that fentanyl prolongs post operative analgesia. B.N. Biswas *et al*[7] (2002) studied the effect of addition of Fentanyl to bupivacaine to improve the quality of spinal anaesthesia. They concluded that the duration of effective analgesia (time from intrathecal injection to first parenteral analgesic) was increased with addition of fentanyl. M. Ravishankar *et al*[8] (2002), A. M. Kaki *et al*[9] (2003) and Chakraborty *et al*[5] (2008), in their respective studies concluded that when tramadol is added to bupivacaine, increases the analgesic effect of the spinal blockade.

Vital Parameters

a) Hemodynamic

The mean pulse rate before intrathecal injection were 84.80±11.10, 85.56±13.05, 86.13±14.47 in group A, group B and group respectively. The difference was statistically insignificant (p>0.05) (Table - 10).The mean arterial pressure (MAP) in before, intrathecal injection in the present study were 84.05±5.53, 84.94±4.08, 84.28±5.07 mmHg in Group A, Group B and Group C

respectively. The differences were statistically insignificant (p>0.05) slight fall in the MAP in all the group was observed when the difference between the pre-injection value and after giving injection at 5th, 15th and 30th minute was compared. This difference was statistically significant (p<0.05). After that there was no significant change in mean arterial pressure in any of the group. Hypotension is an anticipated sequel after neuraxial blockade and it is quite clear that addition of either tramadol and fentanyl has not increased the severity of hypotension. In all the patients the systolic blood pressure did not fall more than 20mmHg from the baseline value, as all the patients in the present study were of ASA grade I and II and were properly preloaded with 10ml/kg of Ringer's Lactate, no episode of moderate or severe hypotension was encountered. Majority of workers who evaluated the hemodynamic effects of intrathecal/epidural tramadol or fentanyl have found them safe. Torres *et al* (1993), Harbhej Singh *et al*[3] (1995), M. Ravishankar *et al*[8] (2002), Sushmita Chakraborty *et al*[5] (2008) found no significant change in pulse rate and blood pressure in there respective studies. S. Goel *et al*[10] (2001) studies the effect of fentanyl with bupivacaine when given intrathecally for day care surgery found that fentanyl increased reliability of block with haemodynamic stability. Arora N. *et al*[12] (2005) reported that there was no episodes of bradycardia or hypotension in patients given intrathecal fentanyl. A. M. Kaki *et al*[9] (2003) in his study found that there was good hemodynamic stability with intrathecal tramadol added to bupivacaine. These observations were similar to the present study.

b) Respiratory Rate

The mean respiratory rate/min before intrathecal injection in this study were 16.23±1.4, 15.91±3.02, 16.38±2.34 in Group A, Group B and Group C respectively (Table-12). The difference between pre injection value and after giving intrathecal injection at different time interval in all the three group were statistically insignificant (p>0.05). These observations were supported by various studies. Torres *et al* (1993) in their study compared the analgesic efficacy of intrathecal tramadol and bupivacaine with fentanyl and bupivacaine in moderate to severe postoperative pain. They found that respiratory rate was lower in fentanyl group, but there was no respiratory depression (RR<10) intraoperatively as well as postoperatively. B. N. Biswas *et al*[7] (2002) in their study reported that none of the patient in either group experienced respiratory depression (RR<10/min or SpO_2 <90%). Hiral Chavda and Purvi J Mehta[11] (2009) in their study concluded that fentanyl (25 μg) does not cause respiratory depression when administered intrathecaly. M. Ravishankar *et al*[8] (2002), A. M. Kaki *et al*[9] (2003) and Susmita Chakraborty *et al*[5] (2008) found that intrathecal tramadol in their respective study doses, with hyperbaric bupivacaine does not cause respiratory depression.

Side Effects

In present study incidence and frequency of side effects and complications were closely monitored in intraoperative as well as postoperative period (Table-13). There was 1 patient in control group A, 2 patients each in group B and C; who had suffered bradycardia, which was effectively treated by i.e. Atropine 0.6 mg. There were 2, 3, 5 patients in group A, B and C respectively, who suffered hypotension, it was transient and treated by i.v. fluids and i.v Mephentermine sulphate 3 mg. Although incidences of hypotension were more with Tramadol and Fentanyl group, none of the patient suffered moderate to severe hypotension. Nausea and Vomiting was most common in group B (5 patients), followed by group C (2 patients) and group A (1 patient). It was treated with i.v. Pantoprazol 40 mg and i.v. Metoclopramide 10 mg. Shivering was found in 3 patients in group A, there was no incidence of Shivering in Group B and Group C. This may be due to the anti shivering effect of Tramadol and Fentanyl. Incidence of sedation was equal in all three groups, 3 patients in every group. There were no incidence of respiratory depression and headache intra operatively and postoperatively. No incidence of urinary retention could be identified as all patients were catheterized intraoperatively till postoperative period.

CONCLUSION

On the basis of present study following conclusion were drawn:

The mean duration of postoperative pain relief was significantly longer in the range of 6.15±1.02 hours with intrathecal Fentanyl when compared to 4.21±0.91 hours with intrathecal Tramadol. Intraoperative and postoperative vital parameters are not affected by the addition of fentanyl or Tramadol to Bupivacaine for subarachnoid block. Fentanyl or Tramadol given intrathecally with Bupivacaine does not affect the characteristics subarachnoid block. Thus it can be concluded the Fentanyl in a dose of 25 μg intrathecally provides longer postoperative pain relief compared to intrathecal 25mg Tramadol with appreciable less incidence of side effects.

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