International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 19-10-2019; Accepted: 21-11-2019
www.medicalsciencejournal.com
Volume 5; Issue 12; December 2019; Page No. 86-93

Comparative clinical study of analgesic efficacy of intrathecal hyperbaric bupivacaine with nalbuphine and hyperbaric bupivacaine with Pentazocine in lower abdominal and lower limb surgeries

Abhijit Tarat[1*], Rupali Brahma[2], Debo Gopal Pathak[3]
[1] Associate Professor, SMCH, Assam, India
[2] Post Graduate Trainee, SMCH, Assam, India
[3] Professor, Head of Department, SMCH, Assam, India

Abstract
Background: Nalbuphine, a relatively newer mixed agonist–antagonist opioid, has a potential to attenuate the μ- opioid effects and to enhance the κ-opioid effects. Pentazocine is also a mixed agonist-antagonist analgesic with agonistic action at κ and σ recptors and a weak antagonistic action at μ receptor. Aim: This study is designed to quantitatively examine the effects of adding Nalbuphine and Pentazocine to hyperbaric Bupivacaine chloride in spinal anaesthesia, to evaluate the efficacy, to know the duration of pain relief and to know the incidence of adverse effects and complications if any. Methods: 100 patients were selected by randomization and divided into two groups Group A (n=50) = received 0.8 mg (0.5ml) nalbuphine with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally. Group B (n=50) = received 3 mg (0.5ml) of pentazocine with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally. All durations were calculated considering the time of spinal injection as time zero. Assessment of pain intra operatively was done by noting Visual Analogue Scale score hourly. Post-operative pain score (VAS) and sedation score were recorded at 1 hr,2 hr, 3 hr, 4 hr, 5 hr, 6 hrs, 12 hrs, 24 hrs. Conclusion: It was observed that nalbuphine hydrochloride (0.8 mg) when added to intrathecal 0.5 % hyperbaric bupivacaine provided longer duration of sensory blockade, excellent quality, and longer duration of postoperative analgesia with good sedation and minimal side effects.

Keywords: comparative, hyperbaric, Pentazocine, abdominal, Nalbuphine

Introduction
One primary responsibility of the anaesthesiologist is to render the patient pain free during surgical procedures. Pain is a consistent and predominant complaint of most individuals following most surgical interventions. Failure to relieve pain is morally and ethically unacceptable. Subarachnoid block or spinal anaesthesia is a popular and a commonly used worldwide technique. Spinal anaesthesia is advantageous in that it uses a small dose of anaesthetic, is technically easier to perform and offers a rapid onset of action, reliable surgical analgesia and good muscle relaxation. Currently, subarachnoid block has become very popular because of addition of opioids to the local anaesthetic for central neuraxial blockade which will provide better intra operative as well as the advantage of post-operative analgesia in a single injection. The adverse effects of parenteral analgesics (opioids, NSAIDs etc.) can also be avoided. This study is designed to quantitatively examine the effects of adding Nalbuphine and Pentazocine to hyperbaric Bupivacaine chloride in spinal anaesthesia, to evaluate the efficacy, to know the duration of pain relief and to know the incidence of adverse effects and complications if any.

Aims and Ojectives
1. To compare the intra operative effects of a single dose of intrathecal Nalbuphine and intrathecal Pentazocine with hyperbaric Bupivacaine 0.5%
2. To compare the duration of post-operative analgesia between patients who received intrathecal Nalbuphine and intrathecal Pentazocine with hyperbaric Bupivacaine 0.5%
3. To compare the hemodynamic response following subarachnoid block between Nalbuphine and Pentazocine as adjuvant with intrathecal Bupivacaine.
4. To compare the adverse effects between Nalbuphine and Pentazocine as adjuvant with intrathecal Bupivacaine.

Materials and Methods
After approval of the institutional ethical committee and after obtaining informed written consent from the patient, a prospective randomized double blind study was conducted in Silchar Medical College & Hospital, Silchar on 100 patients undergoing elective lower abdominal, perineal and lower limb surgeries. 100 patients were randomly divided into two groups. Group A (n=50) = received 0.8 mg (0.5ml) nalbuphine with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally. Group B (n=50) = received 3 mg (0.5ml) of pentazocine with 15 milligrams (3ml) of 0.5% hyperbaric bupivacaine intrathecally.

Inclusion criteria
- Patients in the age group 20 - 60 years.
- ASA grade I and II physical status patients.
- Elective lower abdominal, perineal and lower limb surgeries.
- Patient acceptance.

Exclusion criteria

- Patients belonging to ASA III and IV physical status.
- Patients with uncontrolled or labile hypertension.
- Known diabetes mellitus patients.
- Patients with psychiatric diseases.
- Patients with chronic low back pain.
- Patients with hepatic and renal impairment. Anticipated difficult tracheal intubation.
- Patients on alpha and beta blockers treatment.
- Patients with known allergy to any local anaesthetic or opioid
- Patients where subarachnoid block was contraindicated like bleeding tendencies, local infection and patient refusal.

Anaesthesia method

- 100 patients were selected by randomization. The randomization was done by computer generated method using nQuery Advisor® software.
- The pre anaesthetic check-up of the patients was done before the day of operation.
- The patients were given: Tab Alprazolam 0.5 mg night before surgery.
- Boyle's machine and suctioning equipments were checked on the day of operation, difficult airway cart was kept ready; which might be required in case of any failed spinal block.
- Standard monitoring devices were connected before starting the procedure and a IV cannula 18 Gauge were inserted.
- Pre medication: Inj. Ranitidine 1 mg / kg body wt IV
- Inj. Ondansetron 0.1 mg / kg body wt IV
- Patients were instructed about Visual Analogue Scale (VAS) and also a scale of 10 cm length with 0 on the scale corresponding to "NO PAIN " and 10 "MAXIMUM INTOLERABLE PAIN EXPERIENCED"

1 2	No pain to slight pain (excellent analgesia)
3 4 5	Mild pain (good analgesia)
6 7	Moderate pain (fair analgesia)
8 9 10	Severe pain (poor analgesia)

- Based on the above table we took the scale as >4 as an end point for need of analgesic medication in the post-operative period.
- Before the start of the procedure patients pulse rate, blood pressure, respiratory rate and saturation of oxygen were recorded. All the patients were preloaded with 500ml of Ringer's Lactate prior to spinal anaesthesia. The patients were kept nil per orally for 6 hours before surgery.
- Injection Pentazocine is available as 30 mg in an ampoule containing 1 ml of the drug. It is diluted to 5 ml with normal saline which becomes 6 mg/ml. So, 0.5ml of this solution contains 3 mg of pentazocine which is added to 3 ml of heavy bupivacaine for accuracy.
- Injection Nalbuphine is available as an ampoule of 1 ml containing 10 mg. 0.5 ml of the drug (5 mg) is diluted to 2.5 ml which becomes 1 mg/0.5ml. Hence 0.8 mg of nalbuphine is calculated as 0.8 mg/0.4ml of the solution which is diluted to 0.5 ml with normal saline and added to 3 ml of hyperbaric bupivacaine for accuracy.
- The drugs were prepared by an anaesthesiologist who did not take part in the study. Spinal injections were done by anaesthesiologists who did not participate in recording patient's data. The patients and the anaesthesia provider were blinded to the drugs given.
- Under all aseptic precaution lumbar puncture were performed with 25 Gauge Quincke's needle in the L3-4 space through midline approach. Group A received hyperbaric bupivacaine (0.5%) 15mg (3ml) and 0.8 mg nalbuphine in 3.5ml. Group B received hyperbaric bupivacaine (0.5%) 15mg (3ml) and 3 mg pentazocine in 3.5ml. Immediately after intrathecal injection the patients were made supine.
- All patients were given oxygen by facemask at 5 L/min.
- All patients were assessed for -

-Time for onset of sensory analgesia at T_{10} level.
-Highest level of sensory analgesia.
-Duration of grade 3 motor block according to Bromage scale.
-Duration of analgesia (time from sensory blockade to first rescue parenteral analgesic).
-Regression time for sensory and motor block in Post Anaesthetic Care Unit (PACU)/ Post-Operative Care Unit (POCU).
-Heart rate, systolic and diastolic pressure were recorded at 10 minutes interval intra operatively.
-In the Post Anaesthetic Care Unit (PACU)/ Post-Operative Care Unit (POCU) vitals signs were recorded every 15 minutes for the first 1 hour then at 30 min interval till 6^{th} post-operative hour and then at 12^{th} post-operative hour.
-The sensory block level was assessed by pin prick along mid clavicular line bilaterally. The motor block was assessed according to the modified Bromage scale.
-Any complication or side effects like shivering, nausea-vomiting, hypotension, bradycardia, pruritus, respiratory depression and urinary retention were recorded.

- All durations were calculated considering the time of spinal injection as time zero.
- Assessment of pain intra operatively was done by noting Visual Analogue Scale score hourly advocated by Revill and Robinson in 1976.
- Post-operative pain score (VAS) and sedation score (according to Filo's numerical scale) were recorded at 1 hr, 2 hr, 3 hr, 4 hr, 5 hr, 6 hrs, 12 hrs, 24 hrs.
- Rescue analgesia was given with i.v. tramadol on demand when VAS score > 4. Dose of 50 mg as needed with maximum dose of 600 mg/day.

Onset of analgesia

This was the time taken to achieve the analgesia at T10 dermatome assessed by pin prick method in the mid clavicular line using 24 G needle.

Maximum level of analgesia

This was taken from intrathecal injection to the highest level of sensory block as assessed by pin prick method. The time taken to achieve maximum level was noted.

Quality of motor blockade

The motor blockade was assessed using Bromage scale.
0 – No paralysis.
1 – Inability to raise extended leg against gravity but able to flex knee.
2 – Inability to flex knee but able to flex ankle.

3 – Unable to flex ankle but able to wriggle toes.

Filo's numerical scale

- Scale 1 = awake and nervous
- Scale 2 = awake and relaxed
- Scale 3 = sleepy but easy to awake
- Scale 4 = sleepy but hard to awake

Statistical Analysis

The data compiled were analyzed with Graphpad Instat® 3 statistical software. For qualitative data, Chi-square test was used. Quantitative data were analyzed using student t-test. P value < 0.05 was considered to be significant and P value < 0.001 was considered highly significant.

Results and Observations

Table 1: Distribution of type of operation among two groups

Proposed Surgery	Group A		Group B	
	No of patients	Percentage	No of patients	Percentage
Hysterectomy	12	24.00%	8	16.00%
ILN tibia	6	12.00%	9	18.00%
ILN femur	7	14.00%	8	16.00%
Herniorrhaphy	5	10.00%	4	8.00%
Fistulectomy	3	6.00%	3	6.00%
TBW	5	10.00%	5	10.00%
Haemorrhoidectomy	2	4.00%	3	6.00%
Prostatectomy	2	4.00%	3	6.00%
Others	8	16.00%	7	14.00%
Total	50	100.00%	50	100.00%

P value => 0.9999

There is no significant difference in distribution of type of operation among the two groups

Table 2: Comparison of subarachnoid block characteristics between two groups

Variables	Group A	Group B	P value
Time to reach T10 sensory block level	3.726 ± 0.6445 min	4.202 ± 0.6754 min	0.0005
Time to reach highest level of sensory block	18.644 ± 1.030 min	18.748 ± 0.9848 min	0.5236
Time to reach Bromage-3 motor block	5.45 ± 0.4362 min	5.334 ± 0.4138 min	0.1757
Regression time to S1 dermatome level	139.84 ± 8.115 min	125.68 ± 6.232 min	<0.0001
Regression time to reach Bromage-0	234.00 ± 9.846 min	143.62 ± 15.878 min	<0.0001

On comparing the spinal block characteristics among the two groups it was noticed that after applying unpaired t test (Welch corrected), there was significant difference in the onset of sensory block (p<0.001); the highest sensory level attained in both the groups was T4 and T10 level was achieved by all the patients: on comparing both the groups using unpaired t test the time to reach the highest level of sensory block was found to be comparable (p=0.5236). Time to reach Bromage – 3 motor block using unpaired t test was found to be comparable in both the groups (p=0.1757). The regression time of both sensory and motor block were extremely significantly prolonged in Group A (p<0.0001). The mean regression time to S1 dermatome level was significantly longer in Group A than in Group B; Pvalue = < 0.0001, also the mean regression time to reach Bromage 0 in Group A was extremely prolonged than that of Group B; P value =< 0.0001.

Table 3: Comparison of Intraoperative Analgesia

VAS Score	Groups	Mean	SD	P Value
1st hour	Group A	0.00	0.00	
	Group B	0.00	0.00	
2nd hour	Group A	0.0800	0.2740	0.0755
	Group B	0.2800	0.4536	
3rd hour	Group A	0.00	0.00	
	Group B	0.00	0.00	

No patients required additional analgesics intraoperatively and the mean intraoperative VAS score was comparable in the two groups

Table 4: Comparison of intraoperative sedation

Filo's sedation scale score	Groups	Mean	SD	P value
1st hour	Group A	2.800	0.4041	0.8609
	Group B	2.820	0.3881	
2nd hour	Group A	2.720	0.4536	0.2198
	Group B	2.580	0.4986	
3rd hour	Group A	0.5000	0.9742	0.3375
	Group B	0.2400	0.6565	

In both the groups the sedation scores were comparable.

Table 5: Comparison of post-operative analgesia

VAS Score	Groups	Mean	SD	P value
1st hour	A	0.08	0.2740	0.5099
	B	0.12	0.3283	
2nd hour	A	0.2	0.4041	0.1173
	B	0.34	0.4785	
3rd hour	A	1.36	0.4849	0.6840
	B	1.4	0.4949	
4th hour	A	2.22	0.4185	0.1851
	B	2.34	0.4784	
5th hour	A	2.6	0.4949	<0.001
	B	3.22	0.4185	
6th hour	A	3.48	0.5047	0.0036
	B	3.76	0.4314	
12th hour	A	4.32	0.4712	0.1045
	B	4.48	0.5047	
24th hour	A	5.26	0.4431	0.0800
	B	5.54	0.5425	

Table 6: Comparison of the time for rescue analgesia

Groups	Time for rescue analgesic (min)		
	Mean	SD	P value
A	257.30	28.501	<0.0001
B	213.18	17.370	

The mean time after operation, when the patient demanded rescue analgesic was significantly longer in Group A (257.3 min) than that in Group B (213.18 min) ; P value = < 0.0001.

Table 7: Comparison of postoperative sedation

Filo's sedation scale	Groups	Mean	SD	P value
1st hour	A	2.56	0.5014	0.0020
	B	2.26	0.4431	
6th hour	A	1.96	0.1979	0.4048
	B	1.92	0.2740	
12th hour	A	1.84	0.3703	0.6070
	B	1.8	0.4041	
24th hour	A	1.42	0.4986	0.3213
	B	1.52	0.5047	

The mean postoperative sedation scale score was significantly higher in group A than that in group B at 1st hour (Group A = 2.56 ± 0.5014, Group B =2.26 ± 0.4431, P value = < 0.05).

Table 8: Comparison of intraoperative heart rate (beats / minutes) between the groups

Time	Groups	Mean	SD	P Value
Baseline	A	85.66	8.83	0.3232
	B	87.40	8.7	
0 min	A	91.50	9.01	0.8245
	B	91.04	10.8	
2 min	A	93.46	8.79	0.1251
	B	90.40	10.88	
4 min	A	91.96	10.8	0.1090
	B	88.38	11.33	
6 min	A	90	10.61	0.7185
	B	89.26	9.85	
8 min	A	87.42	10.87	0.9472
	B	87.56	10.19	
10 min	A	85.86	10.74	0.1345
	B	88.78	8.48	
15 min	A	87.26	10.9	0.6633
	B	88.18	10.16	
30 min	A	89.88	10.01	0.9564
	B	89.98	8.15	
45 min	A	90.60	8.73	0.1681
	B	88.24	8.26	
60 min	A	89.90	8.61	0.0978
	B	87.18	7.64	
90 min	A	88.16	7.23	0.1971

	B	86.36	6.62	
120 min	A	86.66	6.98	0.6791
	B	86.08	6.998	
150 min	A	84.67	6.34	0.5398
	B	86.75	2.5	

The mean value of the heart rate changes per minute recorded in Group A and Group B were almost similar and statistically not significant.

Table 9: Comparison of intra operative mean arterial pressure (mm of Hg) between the groups

Time	Groups	Mean	SD	P value
Baseline	A	93.4	4.49	0.4630
	B	92.78	3.87	
0 min	A	89.2	7.9	0.1150
	B	91.36	5.46	
2 min	A	84.8	9.3	0.0861
	B	88.17	10.12	
4 min	A	87.11	8.69	0.1095
	B	89.29	3.89	
6 min	A	86.06	8.34	0.0598
	B	88.62	4.61	
8 min	A	84.67	8.78	0.0646
	B	87.38	5.31	
10 min	A	86.57	8.52	0.7758
	B	86.97	5.21	
15 min	A	83.19	7.51	0.1134
	B	85.75	8.46	
30 min	A	85.14	7.42	0.1020
	B	87.6	7.46	
45 min	A	86.56	7.18	0.1939
	B	88.45	7.31	
60 min	A	88.24	7.05	0.1361
	B	90.13	5.44	
90 min	A	89.44	6.43	0.6578
	B	89.97	5.39	
120 min	A	88.98	5.69	0.1193
	B	90.54	2.57	
150 min	A	89.97	5.11	0.9125
	B	90.28	3.5	

Applying the independent samples t – test between the mean of the mean arterial pressures in each group at various time points of operation, we observed that there was no significant statistical difference between the groups.

Table 10: Comparison of postoperative heart rate (beats/minute) between the groups

Time	Groups	Mean	SD	P value
0 min	A	88.76	5.81	0.6368
	B	88.18	6.43	
15 min	A	87.92	5.5	0.4929
	B	85.72	5.49	
30 min	A	84.72	5.74	0.4295
	B	83.76	6.35	
45 min	A	82.92	6.45	0.1023
	B	81.06	4.7	
60 min	A	81.62	6.76	0.1832
	B	80.02	5.06	
90 min	A	79.2	6.33	0.3856
	B	78.24	4.54	
120 min	A	80	6.1	0.0920
	B	78.24	4.03	
150 min	A	79.82	6.11	0.1032
	B	78.04	4.6	
180 min	A	80.32	5.86	0.2666
	B	79.14	4.63	
6 hours	A	80.56	6.43	0.2621
	B	79.26	5.01	
12 hours	A	80.84	6.36	0.1185
	B	79.16	4.06	

The mean value of the heart rate changes per minute recorded in Group A and Group B were almost similar and statistically not significant.

Table 11: Comparison of postoperative mean pressure (mm Hg) between the groups

Time	Groups	Mean	SD	P value
0 min	A	91.57	4.34	0.9484
	B	91.47	3.74	
15 min	A	91.35	4.43	0.7328
	B	91.63	3.77	
30min	A	91.27	3.87	0.8765
	B	91.39	3.5	
45 min	A	90.91	3.8	0.6604
	B	91.24	3.63	
60min	A	91.46	4.06	0.9898
	B	91.45	3.55	
90 min	A	91.3	4.29	0.9837
	B	91.29	3.39	
120 min	A	90.99	3.58	0.9753
	B	90.97	3.31	
150 min	A	90.9	2.96	0.3918
	B	91.46	3.56	
180 min	A	90.63	3.53	0.2846
	B	91.39	3.5	
6 hr	A	90.61	3.34	0.1660
	B	91.6	3.72	
12 hr	A	90.12	2.66	0.0581
	B	91.31	3.5	

Applying the independent samples t – test between the mean of the mean arterial pressures in each group at various time points of operation, we observed that there was no significant statistical difference between the groups.

Table 12: Comparison of the incidences of adverse effects between the groups

Adverse effects	Groups	Incidence	P value
Nausea	A	2 (4%)	0.6464
	B	3 (6%)	
Vomiting	A	2 (4%)	0.6464
	B	3 (6%)	
Pruritus	A	1 (2%)	0.00
	B	1 (2%)	
Bradycardia	A	3 (6%)	0.00
	B	3 (6%)	
Hypotension	A	2 (4%)	0.00
	B	2 (4%)	
Shivering	A	2 (4%)	0.6464
	B	3 (6%)	
Urinary retention in non-catheterised patients	A	0 (0%)	0.00
	B	0 (0%)	
Respiratory depression	A	0 (0%)	0.00
	B	0 (0%)	

P=0.1281

The overall adverse effects in group a (1.5 +/- 1.0690) and group B (1.875 +/- 1.356) were found to be comparable. The incidence of nausea, vomiting and shivering were found to be less in group A than in group B. The incidence of pruritus, hypotension and bradycardia were very less and found to be similar in both the groups. In both the groups, respiratory depression and urinary retention in non-catheterised patients were not seen.

Discussion

The demographic profile such as mean age, weight, height were comparable between the two groups. The mean duration of surgery were also comparable. Only elective lower abdominal, perineal and lower limb surgeries were considered in our study.

Sensory Characteristics

The duration of onset of sensory block, was taken the time taken from the administration of the drug to the loss of pin prick sensation at the T_{10} dermatomal level bilaterally.

In our study the mean time of onset of analgesia to T_{10} level in group A was 3.726 ± 0.6445 minutes and in group B the corresponding value was 4.202 ± 0.6754 minutes ($p= 0.0005$).

Sapate *et al*., [1] in their study comparing 3 ml of hyperbaric bupivacaine with 5 ml of normal saline and 5 ml of 0.5 mg nalbuphine intrathecally in patients aged 50 to 70 years, found the onset of sensory blockade to be 60 sec in the control group and 58 sec in the nalbuphine group. The difference in the results with our study may be due to the different demographic profile of the patients and due to the different drug dosage used.

Jyothi B *et al*., [2] in 2014 conducted a study on 100 patients undergoing lower limb and lower abdominal surgeries, they were divided into four groups A, B, C, D; each group receiving 3 ml of 0.5% heavy bupivacaine with 0.5 ml of normal saline, 0.8 mg, 1.6 mg and 2.4 mg nalbuphine with normal saline (total volume 3.5 ml) respectively, injected intrathecally. The time to onset of sensory blockade in the group injected with 0.8 mg of nalbuphine was found to be 3.3 ± 0.8 min which was comparable with our study.

In a study conducted by Gomaa *et al*., [3] comparing 0.5 ml of 2 mcg fentanyl with 0.5 ml of 0.8 mg nalbuphine with 2 ml of 0.5 % hyperbaric bupivacaine, the time of onset of sensory block was found to be 1.64 ± 0.09 min and 1.60 ± 0.10 min respectively. The difference in the results with our study may be due to the difference in the demographic profile of the patients selected for the study, the type of operation conducted (caesarean section) as well as the different drug dosage used keeping in mind the demography of the patients.

Cheun *et al*., [4] in 1988 conducted a study on 50 patients undergoing total abdominal hysterectomy by injecting 1.5 mg/kg pentazocine intathecally. The onset of sensory blockade was found to be 3.2 ± 0.9 min.

Similarly, Tiwari CS *et al*., [5] conducted a study in the year 1997, on 60 patients undergoing various surgeries below umbilicus. Intrathecal pentazocine 1.5 mg/kg was compared with equal volume of 5 % heavy lignocaine. Sensory blockade was achieved within 5.35 ± 3.28 min in the group injected with pentazocine. The effects were comparable to that of lignocaine but the onset was slightly delayed.

So from the above mentioned studies it was observed that the onset of sensory blockade was faster in the nalbuphine group than in the pentazocine group.

The highest level of sensory block achieved in our study in both the groups was T_4. In group A majority of the patients achieved a sensory level of T_6 whereas in group B majority achieved a sensory level of T_8. The difference between the two groups was statistically insignificant ($p= 0.8149$)

In studies conducted by Sagar SM *et al*., [6] with intrathecal nalbuphine, majority attained a maximum sensory level of $T_{6.}$

In studies conducted by Cheun JK *et al*., [4] with intrathecal pentazocine 1.5 mg/kg, the maximum sensory level achieved was T_4 while majority achieved a level of $T_{6.}$

In another study conducted on intrathecal pentazocine by J Nair *et al*, the highest level of sensory level achieved was T_6 while majority achieved a sensory level of $T_{11.}$

The discrepancies in our result in comparison to the studies may be due to the different volume of the drugs used.

In the present study, time for sensory regression to S_1, in group A, i.e nalbuphine group, was 139.84 ± 8.115 min while in the pentazocine group, i.e Group B, it was 125.68 ± 6.232 min. Difference between the two durations was extremely significant ($p < 0.0001$).

In a study conducted by Mukherjee *et al*., [7] with 0.8 mg intrathecal nalbuphine, the time for sensory regression to S_1 was found to be 153.3 ± 6.05 min.

In another study conducted by HM Gomaa *et al*., [3] the time for sensory regression to S_1 was 123.00 ± 5.66 min. While Apeksha Patwa *et al*., [8] found the sensory regression to S_1 to be 98.16 ± 9.86 min after injecting 0.5% 15 mg heavy bupivacaine (3 ml) with 1 mg of nalbuphine (0.5 ml).

Most of the studies on pentazocine did not mention about the sensory regression time.

Motor Blockade Characteristics

In the present study the time of onset of grade III motor blockade was not statistically significant ($p > 0.05$) in both groups. The mean time of onset of grade III motor blockade in Group A i.e nalbuphine group was 5.45 ± 0.4362 minutes while in the pentazocine group i.e. Group B it was 5.334 ± 0.4138 minutes.

In a study conducted by H.M. Gomaa *et al*., [3] with intrathecal nalbuphine, the time of onset of grade III motor blockade was found to be 5.72 ± 0.17 minutes. Similarly, in studies conducted by Mukherjee *et al*., [7] Sagar *et al*., [6] the time of onset of grade III motor blockade was found to be 5.6 ± 0.53 minutes and 5.9 ± 0.4 minutes respectively.

In a study conducted by Tiwari *et al*., [5] and Cheun *et al*., [4] with 1.5 mg/kg intrathecal pentazocine, the time to achieve grade II Bromage (i.e weakness at knee) was 3.16 ± 2.33 minutes and 4.1 ± 1.9 minutes respectively. Nair *et al*., [9] conducted a study with 60 mg (2 ml) intrathecal pentazocine and found the onset of motor blockade to be 3.29 ± 1.06 minutes.

While most of the results in the studies mentioned above regarding the nalbuphine group correspond with our result, but with respect to the pentazocine group most of the studies have mentioned about achieving weakness at the knee level which corresponds to Bromage scale II. This may be the reason for the variation of the results in the studies as compared to our observation. Moreover, the studies regarding pentazocine were done using pentazocine solely without any local anaesthetic drugs so this may also be a reason for the variation observed.

In our study, the mean regression time to reach Bromage-0, i.e the duration of motor blockade in Group A was 234 ± 9.846 minutes while in Group B the corresponding value was 143.62 ± 15.878 minutes and the difference between the two timings was extremely significant with $p < 0.0001$.

Our observation was similar with the studies conducted on intrathecal nalbuphine by Shakooh *et al*., [10] Patwa *et al*., [9] where they found the duration of motor blockade to be 243.3 ± 56.46 minutes and 205.33 ± 16.70 minutes respectively. In studies conducted by Mukherjee *et al*., [7] H.M Gomaa *et al*., [3] Sagar *et al*., [6] the duration of motor blockade was found to be 141.0 ± 5.83 minutes, 125.33 ± 5.71 minutes and 142.2 ± 6.7 minutes respectively which was little less than our observation.

In the studies conducted on intrathecal pentazocine by Nair *et al*., [10] Cheun *et al*., [4] in total abdominal hysterectomy cases and Cheun *et al*., [4] in cesarean section cases the duration of motor blockade was found to be 138.83 ± 16.44 minutes, 108 ± 10.5 minutes and 83.5 ± 17.3 minutes respectively.

So, from these studies it was observed that the duration of motor blockade was prolonged in nalbuphine group than in pentazocine group.

Characteristic of Analgesia

In our study, no patients required additional analgesics intra operatively and the mean intra operative VAS score was comparable in the two groups. Postoperative pain was assessed using a 10 cm Visual Analogue Scale (VAS) where '0'indicated 'No Pain' and '10' indicated 'worst imaginable pain'. The mean postoperative VAS scores at 1st, 2nd, 3rd, 4th, 12th and 24th hours were also comparable.

The duration of analgesia, defined as the time between the onset of block and time to first analgesic requirement was noted. Rescue analgesic was provided when VAS score was >3. The time to first rescue analgesic requirement in Group A was 257.3 ± 28.5.1 minutes whereas in Group B, it was 213.18 ± 17.370 minutes. This difference was statistically significant ($P < 0.0001$).

HM Gomaa[3] *et al*, Mukherjee *et al*., [7] Shakooh *et al*., [10] Sagar *et al*., [6] and Patwa *et al*., [8] found the duration of analgesia in patients injected with intrathecal nalbuphine to be 231.83 ± 15.73 minutes, 278.5 ± 6.04 minutes, 298.0 ± 51.02 minutes, 270.0 ± 27.4 minutes and 302.4 ± 27.59 minutes respectively. They used 0.4 mg to 1 mg nalbuphine intrathecally.

Tiwari *et al*., [5] found the duration of analgesia in patients injected with intrathecal pentazocine 1.5 mg/kg to be 115.9 ± 18.6 min. Whereas in studies conducted by Cheun *et al*., [4] with 45 mg pentazocine as the sole anaesthestic and Cheun *et al*., [4] with 1.5 mg/kg pentazocine as the sole anaesthetic intrathecally, the duration of analgesia was found to be be long, 496 ± 283.7 minutes and 5.24 ± 1.98 hours respectively. In our study we had used only 3 mg (5 ml) of intrathecal pentazocine along with 0.5 % heavy bupivacaine (3 ml).

Sedation Score

In our study, sedation was assessed using Filo's sedation scale score. Intra operatively the sedation scores in both the groups A and B were comparable. The patients were well sedated. Post operatively, in the 1st hour the sedation score was significantly higher in group A than in group B.

In most of the studies on intrathecal nalbuphine, sedation score was not observed. In one study which was conducted by Shakooh *et al*., [10] comparing intrathecal bupivacaine with intrathecal bupivacaine + nalbuphine, the sedation score was significantly higher in the group injected with bupivacaine + nalbuphine. This shows that addition of nalbuphine increased the sedation score.

While none of the studies on intrathecal pentazocine cited in

the present study mentioned about the sedation score. But as observed in the present study, the addition of pentazocine to hyperbaric bupivacaine intrathecally provided good sedation both intra operatively as well as post operatively.

Haemodynamic Parameters

Hypotension is considered as fall in systolic blood pressure of more than 20 % of the baseline systolic pressure or systolic pressure < 90 mm Hg. Heart rate less than 60 bpm is considered bradycardia. Hypotension was due to the decrease in the sympathetic efferent activity after spinal anaesthesia and is said to be dose related to bupivacaine. Hypotension was observed in 4 % patients in both group A and B and these patients were treated with intravenous fluid increments and injection mephentermine IV. The mean values of heart rate changes per minute recorded in Group A and Group B were almost similar and statistically not significant.

The mean value of mean arterial blood pressure changes in mmHg between

Group A and Group B were almost similar. This was statistically not significant.

In the study conducted by Mukherjee *et al*., [7] with 0.5 % hyperbaric bupivacaine (2.5 ml) with 5 ml of normal saline, 0.2 mg, 0.4 and 0.8 mg of nalbuphine, there was no statistically significant difference in the intra operative mean pulse rate, systolic and diastolic blood pressure, respiratory rate and SpO2 between the groups.

Sapate[1] *et al*. conducted a study of the effects of adding 0.5 % nalbuphine (3 ml) to 0.5 ml of normal saline and 0.5 mg nalbuphine intrathecally in lower abdominal surgeries in elderly patients. They found that there statistically significant difference in hemodynamic parameters like heart rate, mean, systolic and diastolic BP, but clinically these parameters were within normal limits and did not require intervention.

Shakooh *et al*., [10] and Patwa *et al*., [8] too in their studies, while comparing intrathecal bupivacaine alone with bupivacaine + nalbuphine found no significant differences in hemodynamic (blood pressure, heart rate) and vital parameters (respiratory rate, SpO2) between the two groups.

Similarly in a study conducted by Mostafa *et al*., [11] where a comparison among intrathecal bupivacaine alone with normal saline, bupivacaine with nalbuphine and bupivacaine with nalbuphine + magnesium sulphate was drawn, it was observed that there was no significant differences in the hemodynamic variables viz. noninvasive blood pressure, pulse rate, SpO2 and respiratory rate among the groups.

Cheun *et al*., [4] in their study on intrathecal pentazocine (1.5 mg/kg) found that there was significant decrease in mean arterial pressure within five minutes and ten minutes after drug administration in 6 % and 4 % of the patients respectively.

In another study conducted by Cheun *et al*., [4] on intrathecal pentazocine with meperidine, lignocaine and bupivacaine, there was no significant difference in the hemodynamic parameters among the groups.

In the study conducted by Nair *et al*., [9] on intrathecal pentazocine as the sole anaesthetic (60 mg) and heavy bupivacaine only, the heart rate was comparable in both the groups. When comparing the mean arterial pressure between the two groups, there was significant fall in the bupivacaine group than in the pentazocine group at 1, 3, 5, 30, 45, and 60 minutes intraoperatively.

Adverse Effects

The incidence of nausea (group A= 4%, group B= 6%), vomiting (group A= 4%, group B= 6%), pruritus (2% in both the groups), bradycardia (3% in both the groups), hypotension (2% in both the groups), shivering (group A= 2%, group B= 3%) were comparable in both the groups. Urinary retention and respiratory depression were not seen in both the groups. None of the patients experienced any neurological complication, post dural puncture headache or radicular irritation in the postoperative period.

Patwa *et al*., [8] in their study on intrathecal nalbuphine with bupivacaine and bupivacaine alone, hypotension was seen in 2 and 5 patients respectively in a group of 30 patients each. Nausea occurred in two patients in each group.

Shakooh *et al*., [10] in their study with hyperbaric bupivacaine alone and with nalbuphine intrathecally, found that the incidence of nausea and urinary retention were less in the nalbuphine group (nausea 1 of 50 patients, urinary retention 1 of 50 patients) than in the buipivacaine alone group (nausea 2 of 50 patients, urinary retention 2 of 50 patients). There was no vomiting in the group injected with bupivacaine alone, one patient had vomiting in the nalbuphine group.

In a study conducted by Moustafa *et al*., [11] comparing intrathecal hyperbaric bupivacaine with morphine and nalbuphine, it was found that the incidence of nausea, vomiting and itching were significantly higher group in the bupivacaine alone group than in the nalbuphine group. Urinary retention occurred in both the groups in a few patients but was not significant.

Jyothi *et al*., [2] conducted a study on different doses of intrathecal nalbuphine (0.8 mg, 1.6 mg, 2.4 mg) and normal saline with heavy bupivacaine. The incidence of adverse effects were found to be very low in all the groups except in the group injected with 0.8 mg nalbuphine where the side effects like nausea, vomiting, urinary retention, shivering, pruritus, hypotension, respiratory depression were not seen.

Tiwari *et al*., [5] in their study on intrathecal pentazocine 1.5 mg/kg compared with intrathecal lignocaine found that adverse effects like vomiting (15%), urinary retention (15%) and minor headache (3.3 %) were present in the pentazocine group. Respiratory depression was not seen. The presence of the side effects may be due to the high dose of pentazocine used.

Similarly, Cheun *et al*., [4] in their study with 1.5 mg/kg intrathecal pentazocine found that nausea, vomiting, pruritus were not seen it the study. There were few patients who complained of frontal headache (2 %), neck stiffness (2 %), voiding difficulty (16 %), mild respiratory depression (2 %) and sinus bradycardia (2 %) most of which did not require any active management.

Conclusion

From our study it was observed that nalbuphine hydrochloride (0.8 mg) when added to intrathecal 0.5 % hyperbaric bupivacaine provided longer duration of sensory blockade, excellent quality, and longer duration of postoperative analgesia with good sedation and minimal side effects when compared to pentazocine added intrathecally to 0.5% hyperbaric bupivacaine in lower abdominal, orthopaedic and perineal surgeries. So, it can be said that Nalbuphine hydrochloride (0.8 mg) can be a very useful adjuvant to intrathecal 0.5% Bupivacaine for lower limb, lower abdominal and perineal surgeries particularly

where the duration of surgery is prolonged. However, more studies with larger population is required to come to a final conclusion.

Refernces

1. Sapate M, Sahu P, Thatte WS, Dubey R. A randomized, double blind, control study of the effects of adding nalbuphine to spinal bupivacaine fo lower abdominal surgeries in elderly patients.; Anesth pain intens care. 2013: 17(2):145-8.
2. Jyothi B, Shruthi Gowda, Safiya I Shaikh. A comparison of analgesic effect of different doses of intrathecal nalbuphine hydrochloride with bupivacaine and bupivacaine alone for lower abdominal and orthopaedic surgeries; Ind J Pain. 2014; 28(1):18-23
3. HM Gomaa, NN Mohammad, HAH Zoheir, MS Ali. A comparison between post opeartive analgesia after intrathecal nalbuphine with bupivacaine and intrathecal fentanyl with bupivacaine after caesarean section; Egyptian J Anesthesiol, 2014, 03.
4. Cheun JK, Kim AR. Effects of meperidine, pentazocine, bupivacaine and lidocaine in spinal anaesthesia for caesarean section; journal of anaesthesiology, Japan. 1988; 2:242-246.
5. Tiwari CS, Agnihotri VM. Intrathecal pentazocine as sole anaesthetic agent: Ind J Anaesth. 1997; 40:30-36.
6. Sagar SM, Vishwas GK, Chiragbabu PS, Gude MP, Mevin Kumar G. Comparison of efficacy of butorphanol and nalbuphine as intrathecal adjuvants to bupivacaine: A randomized double blind controlled study; Journal of international academic research for multidisciplinary. 2013; 1(6):527-32.
7. Mukherjee A, Pal A, Agrawal J, Mehrotra A, Dawar N. Intrathecal nalbuphine as an adjuvant to subarachnoid block:what is the most effective dose? Anesth essays res. 2011: 5:171-175.
8. Patwaa AA, Endigeri A, Upadhyay MR. A comparison of intrathecal nalbuphine hydrochloride with hyperbaric bupivacaine 0.5% and hyperbaric bupivacaine 0.5% alone in patients undergoing abdominal hysterectomy: International Journal of research in medicine: 2014:3(2):7-11.
9. Nair J, Rajan S, Paul J, Andrews S. Efficacy and safety of intrathecal pentazocine as a sole anaesthetic agent for lower limb surgeries; Anesth essays and res. 2013; 7(1):49-53.
10. Shehla Shakooh, Pooja Bhosle. Intrathecal nalbuphine: an effective adjuvant for post-operative analgesia; Innovative J Med and Health Science. 2014; (4):79-82.
11. Moustafa MA, Saleh RS. Nalbuphine added to intrathecal morphine in total knee arthroplasty; effect on postoperative analgesic requirements and morphine related side effects; Alexandria J of Medicine. 2012; (48):175-178.