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Comparative Study of Efficacy of Bupivacaine with Dexmeditomidine and Fentanyl as Adjuvant on Hemodynamic Changes in Lower Abdominal and Lower Limb Surgeries

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Abstract

Background: In regional anaesthesia and analgesia, maintaining better hemodynamic stability and minimal side effects is very much essential. A number of adjuvants have been combined with local anaesthesia's (LA) to improve the effectiveness of LA. Therefore, in the present study, the efficacy of Bupivacaine with dexmedetomidine or Fentanyl as adjuvant in maintaining better hemodynamic stability was studied. *Materials and Methods:* 60 patients of ASA group-I and II aged between 18-60 years undergoing elective lower abdominal, urologic, lower limb surgeries were selected and divided into two groups of 30 each. Group "BP" received intrathecally 12.5mg 0.5% of Bupivacaine +5 µg of dexmeditomidine while group "BF" received 0.5% Bupivacaine +12.5µg of Fentanyl. *Result:* Group-BD and in Group-BF did not differ significantly ($p>0.05$) with respect to heart rate, SBP and DBP at any interval of time. There was an insignificant variation in the side effects of anaesthesia.VAS was 0.03± 0.18 in group BD and 0.10 ± 0.31 in group BF, which was statistically in- significant. Whereas, VAS of patients anesthetized by Bupivacaine with Dexmeditomedine or Fentanyl as adjuvantwas statistically significant at 3 hours and 12 hours($p<0.05$). *Conclusion:* Bupivacaine with dexmeditomidine provided good quality of intraoperative analgesia with minimal side effectsandbetter hemodynamic stability.

Keywords: Bupivacaine; Dexmeditomedine; Fentanyl; Limb Surgeries.

Introduction

Though major advances have been made in local anaesthetic chemistry, synthesis of an ideal agent remains to be explored. An agent with a longer duration of action, shorter onset time, and a more selective site of action is sought. In lieu of finding such an ideal agent, a number of adjuvants have been combined with local anaesthesia's (LA) to improve the effectiveness of local anaesthesia's [1].

Subarachnoid block (SAB) is the most commonly used anaesthetic technique in patientsundergoing lower abdominal and lower limb surgeriesas it has the advantages of rapid onset, superior blockade, less failure rates and cost effectiveness. Being technically easier, SAB provides the optimal operative conditions with minimal intra-operative blood loss [2,3]. However post-operative pain control remains a concern as SAB using only local anaesthetic is associated with relatively short duration of action and thus early analgesic intervention is needed in the post-operative period [4].

Dexmedetomidine, an imidazole compound, exhibits a high ratio of specificity for the alpha-2 versus alpha-1 adrenergic receptor. This property makes it more effective hypnotic, sedative and analgesic agent with a more favourable pharmacodynamic profile [5]. This agent causes sedation, anxiolysis, and analgesia. Dexmedetomidine had been approved for sedation

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in adults during mechanical ventilation in intensive care unit settings [6]. There are few data addressing the use of this drug for regional anaesthesia. Further clinical trials are needed to fully determine the potential clinical application of both clonidine and dexmedetomidine in children [7].

Fentanyl is another more widely used opiates in conduction anaesthesia. This agent is combined with a local anaesthetic to act additively, if not synergistically, with LA to improve a variety of characteristics of the block. Fentanyl is a short acting opiate that is Adjuvants in Regional and Neuraxial Anaesthesia, which is stronger than morphine [8]. The side effects of using Bupivacaine are related to higher doses, as well as unintentional injection into alternative sites [9]. Absorption into the blood stream may lead to the side effects like low blood pressure, slow heart rate, strong or irregular heartbeat, and cardiac arrest, nausea, vomiting, faecal and urinary incontinence, loss of sexual function, blurred vision, ringing in the ears, and loss of joint cartilage [10]. Rare, but serious complications include decreased function of the nervous system, activation of the nervous systemresulting in seizures, paraplegia, nerve disorder, total block of spinal nerves, and respiratory arrest. Specific warnings exist about using the 0.75% dose in obstetrical anaesthesia as there have been reports of cardiac arrest [11].

Since, Bupivacaine, Dexmeditomidine and Fentanyl individually has disadvantageous as local anaesthetic agent, the present study was designed to study and compare the efficacy of Bupivacaine with Dexmeditomidine and Bupivacaine with Fentanyl as adjuvant on hemodynamic changes in lower abdominal and lower limb surgeries with the primary outcome measure as the quality of intraoperative analgesia and the secondary outcome measure as the side effects, duration and quality of post-operative analgesia.

Materials and Methods

This is a prospective observational study conducted on 60 patients of ASA physical status I/ II in the age group of 18year to 60 years of either sex, posted for elective lower abdominal, urologic, gynaecologic, lower limb surgeries, under spinal Anaesthesia after taking written informed consent. A sample size of 60 patients were recruitedin order to report significant difference with respect to efficacy of the drugs. Approval from the hospital ethical committee was taken prior to the study. Patients were randomly divided into two groups of 30 each by lottery method. Patients were divided into two groups. Group BD: Received intrathecally 12.5mg of 0.5% hyperbaric Bupivacaine with 5 µg of Dexmeditomidine as adjuvant. Group BF: Received intrathecally 12.5mg of 0.5% hyperbaric Bupivacaine with 25µg of Fentanyl as adjuvant. Maximum level of spinal anaesthesia was achieved in both the groups.

Patient refusal, ASA grade III & IV, Patients with dependency of narcotic, patients with gross spine anomalies and localized skin lesions, Patients with cardiac, Pulmonary, hepatic or renal disorders, Patients having inadequate subarachnoid blockade and who were later supplemented by general anaesthesia were excluded from the study.

Visual Analogue scores of patients, Heart Rate at different interval of time, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) in mm Hg and other side effects were recorded as end points in patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant.

Post operatively, monitoring of vital signs, VAS scores were continued every 30 minutes until the time of regression of sensory block to L_1 dermatome. The duration of surgery was 45±5.0 minutes in any of the patients. The heart rate, Blood pressure and the side effects were recorded. Monitoring of Heart Rate, Systolic blood pressure and Diastolic blood pressure in postoperative period was recorded and reported as hypotension and bradycardia. The incidence of hypotension (arterial blood pressure <20% baseline) was recorded and treated with injection Mephenteramin 5 mg intravenous increments. Bradycardia (pulse rate <50/M) was recorded and treated by inj. Atropine 0.6mg intravenously. Catheterisation was done in all urological procedures.

Statistical Analysis

Thedemographic data were analysed by student 't' test and qualitative data were analysed by chi-square test. All values were expressed as mean±standard deviation. P<0.05 was considered statistically significant.

Results

The mean age of patient in group BD was 38.6±11.8 and in group BF was 38.3±12.8. This difference was insignificant (p=0.89). In both the groups, there were 20 males and 10 females. There

was no significant difference in Height and weight characteristics of patients (p>0.05, Table 1).

Intraoperative Visual Analogue Scale (VAS) score was 0.03±0.18 in group BD and in group BF it was 0.10±0.31, which was statistically not significant (p>0.05 Table 2). Whereas, VAS scores of patients anesthetized by Bupivacaine with Dexmeditomedine or Fentanyl as adjuvantwas statistically significant at 3 hours and 12 hours (p<0.05) implying that patients in group BD had better pain relief than the patients in BF group in postoperative period (Table 2).

The two groups did not differ significantly (p>0.05) with respect to heart rate at any interval. In group BD two patients had bradycardia which was treated by 0.6 mg atropine. No incidence of bradycardia in group BF (Table 3).

The two groups did not differ significantly (p>0.05) with respect to systolic blood pressure (Table 4) diastolic blood pressure (Table 5) at different interval of time. The usual side effects of anaesthesia like nausea, vomiting, pruritus, respiratory depression, hypotension, bradycardia and urinary retention were recorded in patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant. These side effects did not show much variation between each group (Table 6).

Table 1: Demographic Profile of patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant N=60

Parameter	Group BD	Group BF	t	P value
Age (Y)	38.6 ±11.8	38.3 ±12.8	0.1335	0.89 NS
Sex M/F	20:10	20:10	-	-
Height (Feet)	5.49 ±0.31	5.46 ±0.35	0.37	0.71 NS
Weight (KG)	56.2 ±6.7	58.1 ±8.4	0.99	0.33 NS

Values are expressed as Mean ± S.D, NS = Not Significant.

Table 2: Visual Analogue Scale (VAS) scores of patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant N=60

Time	Group BD	Group BF	t	P value
Intraoperative VAS	0.03 ±0.18	0.10 ± 0.31	1.03	0.32 NS
Post op 3 hrs	0.07 ± 0.25	`0.73 ± 1.05	3.39	<0.05 S
Post op 6 hrs	2.93 ± 1.41	3.03 ± 0.89	0.33	0.75 NS
Post op 12 hrs	5.80 ± 0.89	6.30 ± 0.84	2.25	<0.05 S

Table 3: Heart Rate at different interval of time in patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant. N=60

Time interval in (Minutes)	Group BD (mean ± SD)	Group BF (mean ± SD)	t	P value
0	82.0 ± 7.4	80.9 ± 11.6	0.43	0.67 NS
5	77.1 ± 8.7	78.5 ± 11.2	0.52	0361 NS
10	73.9 ± 7.8	74.8 ± 9.3	0.44	0366 NS
15	71.0 ± 7.5	73.3 ± 10.2	1.00	0.32 NS
20	70.5 ± 7.31	73.5 ± 12.4	1.12	0.27 NS
30	73.1 ± 5.4	73.9 ± 9.6	0.38	0.70 NS
120	75.2 ± 4.8	76.3 ± 8.8	0.58	0.56 NS

Table 4: Systolic Blood Pressure (SBP) in mmHg in patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant. N=60

Time interval in (Minutes)	Group BD (Mean ± SD)	Group BF (Mean ± SD)	t	P value
0	130.0 ± 9.7	133.0 ± 12.5	1.00	0.32 NS
5	120.1 ± 12.1	123.1 ± 14.9	0.85	0.46 NS
10	112.5 ± 11.6	118.4 ± 15.0	1.70	0.09 NS
15	110.9 ± 11.7	114.6 ± 13.0	1.16	0.25 NS
20	112.4 ± 9.7	114.7 ± 10.8	0.87	0.39 NS
30	114.0 ± 9.0	116.7 ± 9.5	1.14	0.26 NS
120	120.5 ± 8.8	121.5 ± 9.3	0.43	0.67 NS

Table 5: Diastolic Blood Pressure (DBP) in mm Hg in patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant. N=60

Time interval in (Minutes)	Group BD (Mean ± SD)	Group BF (Mean ± SD)	t	P value
0	81.2 ± 7.94	78.9 ± 7.9	1.12	0.27
5	72.5 ± 8.4	73.4 ± 6.7	0.46	0.65
10	67.5 ± 9.4	69.0 ± 7.4	0.72	0.47
15	66.5 ± 8.3	69.0 ± 7.6	1.22	0.23
20	68.5 ± 6.7	70.1 ± 6.8	0.92	0.36
30	71.0 ± 4.5	72.9 ± 6.0	1.44	0.16
120	76.5 ± 4.4	74.2 ± 6.8	1.56	0.12

Table 6: Side Effects recorded in patients anesthetized by Bupivacaine with Dexmeditomidine or Fentanyl as adjuvant. N=60

Adverse effects	Group BD N (%)	Group BF N (%)
Nausea	1 (3.33%)	2 (6.56%)
Vomiting	0	1 (3.33%)
Pruritus	0	1 (3.33%)
Respiratory Depression	0	0
Hypotension	3 (1. %)	2 (6.6%)
Bradycardia	2 (6.6%)	0
Urinary retention	1 (3.33%)	2 (6.6%)

Discussion

Opioids added to local anaesthetics for spinal anaesthesia improve the quality of intraoperative analgesia and also provide post-operative pain relief for longer duration [8]. There is antinociceptive synergism between intrathecal opioids and local anaesthetic during visceral and somatic nociception. Fentanyl, a lipophilic opioid has rapid onset of action following intrathecal administration. It does not tend to migratetofourth ventricle in sufficient concentration to cause delayed respiratory depression when administered intrathecally. A common problem during lower abdominal surgeries under spinal anaesthesia is visceral pain, nausea, vomiting [9]. The addition of Fentanyl to hyperbaric Bupivacaine improves quality of subarachnoid block [10]. The disadvantages with opioids are pruritus and respiratory depression. The advantage of selective α-2 agonist is that it produces prolonged postoperative analgesia with minimal side effects [11-13]. There were no significant differences in the demographic profile of the studied groups.

The mean duration of effective analgesia (timeup to first pain medication) in BD group was 362.7 minutes while it was 210.8 minutes in BF group. These results are comparable with the previousstudies [4,5].

VAS at end of 3 hours in the group BD was 0.07 while it was 0.73 in group BF. VAS at the end of 12 in group BD was 5.80 while it was 6.30 in BF group. VAS scores were statistically significant at 3 hours and 12 hours implying that patients in group BD had better pain relief (lower VAS) in postoperative period than the patients ingroup BF. Addition of dexmedetomidine to intrathecal Bupivacaine results is significantly prolonged duration of analgesia and the time to first pain medication is longer with improved quality of analgesia and reduced requirement of analgesics postoperatively as compared to intrathecal Bupivacaine with Fentanyl.

Heart rate (HR). The two groups did not differ significantly with respect to HR at any interval. In group BD two patients had bradycardia which was treated by 0.6 mg Atropine intravenously. No incidence of Bradycardiaoccured in group BP. Rajni Gupta et al [14] in their study have concluded that one patient had developed bradycardia in dexmeditomedine group and no patient developed bradycardia in Fentanyl group. Gehan A Tarbeeh et al [15] showed in their study that there was no statistically significant difference in the groups. Al. Ghaneem SM et al [11] who have concluded that there was no significant difference in HR the groups where incidences of bradycardia were 2 and 3 in dexmeditomedine and Fentanyl groups respectively.

In our study, the two groups did not differ significantly with respect to mean systolic and mean diastolic pressure. Three patients in BD and two patients in BF group developed hypotension which was not statistically significant. Hypotension in both

the groups was treated with small doses of Mephenteramin. These results are comparable with the studies of Rajni Gupta et al [14], Ghaneem SM et al [11] and Gehan A. Jarbech et al [15]. Haemodynamic profile of the patients was found to be stable throughout the intra operative period in both the groups.

In group BD, 10% patients had hypotension, 6.5% patients had bradycardia, 1% had nausea and 1% patient had urinary retention. In group BF 6.6% had hypotension and urinary retention, 6% of patients had nausea, 3.3% of patients had vomiting and pruritus. Catheterisation was done in all urosurgical procedures. Studies of Rajni Gupta et al [14] and Al Ghaneem et al [11] also show similar side effects which are comparable with our studies. Though the inclusion criteria were up to 60 years, patients recruited in our study were below 50 years. So, absence of geriatricpopulationwas the limitation of the study.

Conclusion

Bupivacaine with dexmeditomidine provided good quality of intraoperative analgesia with minimal side effects, longer duration and excellent quality of post-operative analgesia than Bupivacaine with fentanyl. Therefore, from this study, it can be concluded that 5µg dexmeditomidine seems to be an attractive alternative to fentanyl as an adjuvant along with bupivacaine in surgical procedures of lower abdomen and lower limbs.

References

1. Borgeat, A. & Aguirre, J. Update on local anaesthetics. Current Opinion in Anaesthesiology, 2010;23:460-66.
2. Adams BW. Lignocaine spinal analgesia. Anaesthesia. 1956;11:297-307.
3. Mackenzie AR. Influence of anaesthesia on blood loss in transurethral prostectomy. Scott Med J. 1990;35: 14-16.
4. Yuen, V.M.Y. Dexmedetomidine: perioperative applications in children. Paediatr Anaesth, 2010:20; 256–264.
5. Klaso EA, Poyhia R, Rosenberg PH. Spinal antinociception by dexmedetomidine, a highly selective alpha-2 adrenergic agonist. Pharmacol Toxicol. 1991;68:140-43.
6. Ilfeld, B.M. Continuous Peripheral Nerve Blocks: A Review of the Published Evidence. Anesth Analg, 2011;12:194-202.
7. Alahuhta S, Kangas, Saarila T, Hollman AI, Edstrom; Visceral pain during caesarean section under spinal and epidural anaesthesia with Bupivacaine in Acta anaesthesiology Scandinavia, 1990;34:95-98.
8. Hunt co, Naulty JS, Bader AI, Hanch BM Vartikar JV, Dattta S Et al. Perioperative analgesia with subarachnoid Fentanyl Bupivacaine for caesarean delivery 1989;71:535-40.
9. Al-Mustafa MM, Abu Halaweh SA, Aloweidi AS, Murshidi MM et al. Effect of dexmeditomidine added to spinal Bupivacaine for urologic procedures; Saudi Medical Journal 2009;30:368-70.
10. Eanazi GE, Aouad MT, Jabbour – Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, et al. Effect of low dose clonidine on the characteristics of Bupivacaine spinal block. Acta Anaesthesiology Scandinavia, 2006;50:222-227.
11. Al-Ghaneem S M, Al-Mustafa MM et al. Effect of adding dexmeditomidine vs. Fentanyl to intrathecal Bupivacaine on spinal block characteristics in Gynaecological procedures. A double blind controlled study. American Journal of Applied sciences, 2009; 6(5):882-887.
12. Grewal. Dexmeditomidine: New advances, Journal of Anaesthesiology and clinical Pharmacology, 2011; 27(3):297-30.
13. B.N. Biswas. Intrathecal Fentanyl with hyperbaric Bupivacaine improves analgesia during caesarean delivery and in early postoperative period, Indian Journal of Anaesthesia. 2002;46(6):469-472.
14. Rajni Gupta, Reetuvarma. A comparative study of intrathecal Dexmeditomidine and Fentanyl as adjuvants to Bupivacaine. Journal of Anaesthesiology and clinical Pharmacology, 2011;27(3):339-343.
15. Gehan. A Tarbeeh. Effect of intrathecal Bupivacaine, Fentanyl versus Bupivacaine dexmeditomidine in diabetic surgical patients Egyptian Journal of Anaesthesia, 2013;29:13-18.