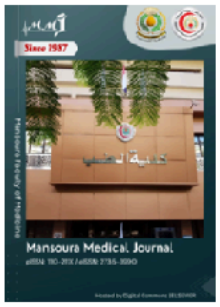
MANSOURA MEDICAL JOURNAL

ISSN - Print: 1110-211X - Online: 2735-3990

journal homepage: mmj.mans.edu.eg




Volume 31 | Issue 2 Article 14

# EFFECTS OF EPIDURAL INJECTIONS OF 0.25% BUPIVACAINE ON SPINAL ANAESTHESIA WITH 0.5% PLAIN OR HYPERBARIC BUPIVACAINE-FENTANYL

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# EFFECTS OF EPIDURAL INJECTIONS OF 0.25% BUPIVACAINE ON SPINAL ANAESTHESIA WITH 0.5% PLAIN OR HYPERBARIC BUPIVACAINE- FENTANYL

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## ABSTRACT

Background and Objectives: combined spinal epidural anaesthesia is a suitable anaesthetic technique for pelvic surgery. The effects of baricity of spinal local anaesthetics have been studied during spinal anaesthesia. Yet, there is a need to study these effects during combined spinal epidural anaesthesia. We aimed to compare block characteristics, haemodynamics, analgesia and side effects of epidural/ hyperbaric bupivacaine-fentanyl spinal anaesthesia and epidural/ plain bupivacaine- fentanyl spinal anaesthesia.

Methods: 50 patients subjected to pelvic urologic procedures were randomly allocated to receive either spinal hyperbaric bupivacaine- fentanyl (n=25) or spinal plain bupivacaine-fentanyl (n=25). Both groups received epidural bupivacaine 0.25% via epidural catheter at upper interspace. Heart rate, mean arterial blood pressure, motor block score, sensory level/ regression, drug supplementation and side effects were recorded.

*Results* : the plain bupivacaine group showed delayed regression of sensory block in 4 (16%) of patients. Patients in the plain group needed more vasoacative drugs than the hyperbaric group (36% and 12% respectively). Otherwise, there were no striking differences in haemodynamics, block characteristics or the side effects between plain and hyperbaric groups. Both techniques produced comparable analgesia.

Conclusion: block characteristics and analgesic effects of epidural injections of bupivacaine after spinal plain or hyperbaric bupivacaine-fentanyl are comparable. Using either solution (plain or hyperbaric), a satisfactory block can be achieved and prolonged urologic surgery can be completed with no added inhalational or intravenous agents.

*Key words :* Combined spinal-epidural; Bupivacaine; Urologic surgery; Analgesia.

## INTRODUCTION

Combined spinal epidural anaesthesia (CSEA) has gained increasing interest as it combines the reliability of spinal anaesthesia and the flexibility of epidural analgesia. Unlike the standard spinal block, CSEA seems to require smaller total dose of local anaesthesia for the same height of sensory block. (1)

Haemodynamics and block characteristics of isobaric local anaesthetics are different from those of hyperbaric local anaesthetics during spinal anaesthesia. The decrease in mean arterial pressure was significantly more severe with hyperbaric than with isobaric bupivacine suggesting a higher cephalad spread with the former. (2-4)

During combined spinal epidural anaesthesia, an epidural top-up dose reinforces the block partly by an epidural volume effect and partly by an effect of the local anaesthetic itself (5). Accordingly, epidural injection of local anaesthetic is expected to produce variable effects on the subarachnoid spread of plain or hyperbaric bupivacaine. Subsequently, haemodynamics and block characteristics may be altered during CSEA with plain or hyperbaric solutions. To test this hypothesis, this study was planned to compare haemodynamic changes and block characteristics of both intrathecal hyperbaric and plain bupivacaine during two segments combined spinal epidural technique.

## PATIENTS AND METHODS

This randomized comparative study was carried out on 50 adult patients of either sex. Approval of the Hospital Research Ethics Committee and informed written consent from all patients were obtained. Patients subjected to lower abdominal urological operations requiring combined spinal epidural anaesthesia were included. Exclusion criteria were patients with

known contraindications to spinal and epidural anaesthesia namely; patient refusal, coagulopathy, infection at the injection site, psychological troubles and neuromuscular disorders.

*Patient preparation*

Patients underwent routine medical and laboratory investigations including blood picture, liver function tests, creatinine, random blood sugar and coagulation profile. All patients received oral diazepam (5mg) at the night and morning of surgery. A suitable intravenous cannula was inserted and 500 ml of saline 0.9% was infused at the operation suite and continued at a rate of 15 ml $kg^{-1}$ $h^{-1}$.

*Anaesthesia*

All patients underwent combined spinal epidural anaesthesia in the sitting position. Epidural catheter was inserted at L2-3 space through G18 Tuohy needle and threaded 4-5 cm cephalad. Lidocaine 2% (2 ml) and adrenaline (15 µg) were injected through the catheter to confirm its correct placement. Following a negative test, spinal anaesthesia was conducted at a lower space using 25G needle with, according to a computer-generated randomization, either hyperbaric bupivacaine 0.5% or plain bupivacaine 0.5% in a dose of 12.5 mg for either solution. Fentenyl 20 µg was added to spinal bupivacaine using an insulin syringe. Patients were immediately laid supine after conduction of block. Spinal anaesthesia was considered the zero point of the study. Ten minutes later, 25 mg plain bupivacaine in 10 ml volume (0.25%) was injected through the epidural catheter. The need for drug supplementation and top-ups in the form of 5 ml bupivacaine 0.25% through the epidural catheter were recorded. Patient discomfort was considered a call for analgesic supplementation through the epidural catheter.

*Monitoring and Measurements*

Patients were monitored with ECG, non invasive automated blood pressure and pulse oximetry. Heart rate and mean arterial blood pressure were recorded every two minutes until 16 minutes then every 5 minutes. Atropine and ephedrine were used to treat bradycardia and hypotension respectively. Blood pressure deviation of 20% below the baseline value was defined as hypotension. Heart rate less than ~55 was considered as bradycardia.

The sensory level was tested by pinprick at the midline using 25-G

needle at 3,5,7,10,15,20,30 minutes after conduction of spinal block. The degree of motor block was evaluated by the use of Bromage score [6], after intrathecal injection and in the recovery room as follows;

*Grade 0:* the ability to flex fully extended leg (no paralysis),

*Grade I:* inability to flex leg at hip joint (able to move knee only),

*Grade II:* inability to flex leg at knee joint (able to move foot only),

*Grade III:* inability to flex ankle joint (complete motor blockade).

*Recovery and ward*

Postoperative pain was graded, as no, mild, moderate or severe and epidural top-up doses were given accordingly. Postoperative side effects namely; nausea, vomiting, and headache were recorded. Complete recovery from motor block was recorded. Time of two-segment regression was also assessed at 4 and 5 hours after conduction of spinal/epidural anaesthesia.

*Statistical analysis*

Data were analyzed through an SPSS program using independent-samples T-Test and repeated measures ANOVA. Non-parametric values were handled with chi square test. Percentile values were subjected to Fisher's exact test. P values less than 0.05 were considered significant.

## RESULTS

The computer- generated randomization assured equal number of 25 patients in each group. Patient's characteristics, type and duration of the procedure were homogenous in both groups (Table 1).

Table 2 shows intraoperative heart rate and mean arterial blood pressure. There was no significant difference between the two groups all through the procedure.

The number of patients exhibiting motor block score of 0, I, II, III over a twenty minutes period is shown in table 3. There was no significant difference between the two groups. At 10 and 20 minutes after conduction of block, 20 (80%) and 25 (100%) of patients in each group attained full motor blockade respectively. Time taken to reach full motor recovery after conduction of block is also shown in

table 3 with no significant difference between both groups.

Figure shows number of patients with sensory block at or higher than T8. Building up the sensory blockade over 30 minutes was comparable in both groups. All patients reached > T8 block at 20-25 minutes. Two segments regression was significantly delayed in the plain group where 4 (16%) patients were delayed at the 4th hour after conduction of block.

Table (4) shows the need for epidural top-up doses and vasoactive drugs. There was more need for vasoactive drugs.(28%) in the plain group than in the hyperbaric group (8%).

Side effects occurring within 24 hours was not significantly different between the two groups. In plain and hyperbaric group 6 and 5 patients suffered nausea respectively while headache occurred in 5 and 8 patients respectively.

**Table 1.** Patients' characteristics and surgical procedure in patients subjected to spinal plain or hyperbaric bupivacaine reinforced with epidural bupivacaine.

| | Plain | Hyperbaric |
|---|---|---|
| Age (y) | 50 ± 7 | 48 ± 11 |
| Sex (M/F) | 17/8 | 18/7 |
| Weight (kg) | 76 ± 14 | 76 ± 12 |
| Height (cm) | 166 ± 5 | 167 ± 6 |
| Surgical procedure (n) | | |
| Pubovaginal sling | 6 | 6 |
| Prostatectomy | 14 | 11 |
| Pelvic uretrolithotomy | 5 | 8 |
| Duration (min) | 135 ± 40 | 143 ± 47 |

Data are mean ± SD or number of patients (n).

**Table 2.** Intraoperative heart rate (HR, bpm) and mean arterial blood pressure (MBP, mmHg) in patients subjected to combined epidural/ plain spinal anaesthesia (plain) or epidural/ hyperbaric spinal anaesthesia (hyperbaric).

| Time (min) | HR (bpm) | | MBP (mmHg) | |
|---|---|---|---|---|
| | Plain | Hyperbaric | Plain | Hyperbaric |
| 0 | 84 ± 15 | 88 ± 16 | 96 ± 11 | 93 ± 13 |
| 2 | 87 ± 20 | 89 ± 18 | 92 ± 12 | 89 ± 15 |
| 4 | 87 ± 22 | 90 ± 13 | 91 ± 9 | 89 ± 13 |
| 6 | 86 ± 19 | 91 ± 19 | 89 ± 12 | 88 ± 13 |
| 8 | 87 ± 19 | 90 ± 17 | 87 ± 12 | 86 ± 15 |
| 10 | 86 ± 17 | 90 ± 18 | 85 ± 12 | 83 ± 13 |
| 12 | 80 ± 17 | 88 ± 18 | 82 ± 12 | 82 ± 14 |
| 14 | 82± 15 | 85 ± 16 | 83 ± 13 | 81 ± 14 |
| 16 | 80 ± 16 | 86 ± 18 | 82 ± 12 | 80 ± 14 |
| 20 | 81 ± 17 | 83 ± 16 | 82 ± 12 | 80 ± 17 |
| 25 | 78 ± 15 | 82 ± 14 | 80 ± 14 | 80 ± 14 |
| 30 | 77 ± 17 | 80 ± 15 | 79 ± 12 | 80 ± 13 |
| 35 | 76 ± 16 | 80 ± 16 | 78 ± 12 | 79 ± 12 |
| 45 | 73 ± 17 | 79 ± 14 | 79 ± 12 | 79 ± 11 |
| 60 | 74 ± 18 | 78 ± 16 | 80 ± 10 | 81 ± 13 |

Data are mean ± SD.

**Table 3.** Number of patients exhibiting motor blockade (0,I,II,III) and time ± SD to full motor recovery after epidural/ plain spinal anaesthesia or epidural/ hyperbaric spinal anaesthesia .

| | Plain | Hyperbaric |
|---|---|---|
| Motor block (0,I,II,III )* | | |
| 3min | 10, 9, 1, 5 | 12, 4, 5, 4 |
| 5min | 3, 11, 2, 9 | 3, 6, 6, 10 |
| 7min | 1, 1, 8, 15 | 2, 1, 5, 17 |
| 10min | 0, 1, 4, 20 | 0, 2, 3, 20 |
| 15min | 0, 0, 1, 24 | 0, 0, 2, 23 |
| 20min | 0, 0, 0, 25 | 0, 0, 0, 25 |
| Time to full motor recovery (min) | 247 ± 47 | 222 ± 59 |

* Grade 0: the ability to flex fully extended leg (no paralysis).

Grade I: inability to flex leg at hip joint (able to move knee only).

Grade II: inability to flex leg at knee joint (able to move foot only).

Grade III: inability to flex ankle joint (complete motor blockade).

**Table 4.** Epidural top-up doses and nomber of patients needed vasoactive drugs during epidural/ plain spinal anaesthesia or epidural/ hyperbaric spinal anaesthesia.

| | Plain | Hyperbaric |
|---|---|---|
| Time to first top-up (min) | 95 ± 18 | 105 ± 23 |
| Time to second top-up (min) | 175 ± 40 | 165 ± 45 |
| Number of top-ups | 3 ± 1 | 3 ± 1 |
| No of patients (%) needed Ephedrine 5mg | 7 (28)* | 2 (8) |
| No of patients (%) needed atropine 0.4mg | 2 (8) | 1 (4) |

* Significant difference between both groups (P value less than 0.05).

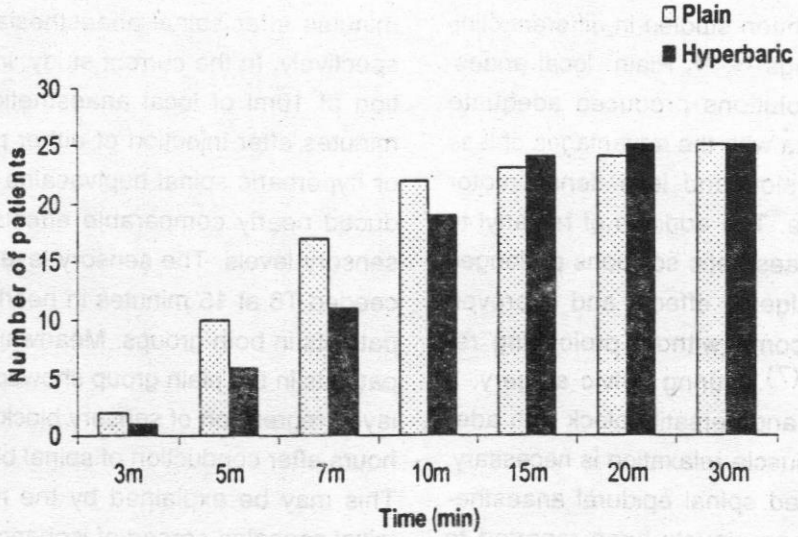


**Figure.** Number of patients attained a sensory level ≥T8 in patients subjected to combined epidural/ plain spinal anaesthesia (plain) or epidural/ hyperbaric spinal anaesthesia (hyperbaric).

## DISCUSSION

The results of this study demonstrated that spinal anaesthesia with hyperbaric bupivacaine- fentanyl is comparable to plain bupivacaine- fentanyl when augmented with epidural bupivacaine regarding haemodynamics, block characteristics, analgesia and side effects. However, more need for vasoactive drugs and delayed sensory regression in the plain group was found.

Baricity of spinal local anaesthetics has been studied in different clinical sittings [2-4]. Plain local anaesthetic solutions produced adequate analgesia with the advantages of less hypotension and less dense motor blockade. The addition of fentanyl to local anaesthetic solutions prolonged the analgesic effects and improved the outcome without prolonging recovery [7]. During pelvic surgery, a reliable and versatile block with adequate muscle relaxation is necessary. Combined spinal epidural anaesthesia has previously been reported to have properties that make it a useful technique for obstetric and outpatient anaesthesia [8, 9].

In this study, we tended to evaluate block characteristics, analgesia and side effects with different baricities of spinal local anaesthetics during combined spinal epidural anaesthesia. Block characteristics and analgesic levels during combined spinal epidural anaesthesia were affected with the injected local anaesthetic and dural puncture hole [10, 11]. The injected volume of an epidural local anaesthetic also affects the block characteristics. Two independent studies [12, 13] reported that epidural injection of saline 10mL significantly increased the analgesic level 5 and 10 minutes after spinal anaesthesia respectively. In the current study, injection of 10ml of local anaesthetic 10 minutes after injection of either plain or hyperbaric spinal bupivacaine produced nearly comparable effects on sensory levels. The sensory level exceeded T8 at 15 minutes in nearly all patients in both groups. Meanwhile, 4 patients in the plain group showed delayed regression of sensory block at 5 hours after conduction of spinal block. This may be explained by the more initial cephalad spread of isobaric spinal solution produced by the epidural volume effect. Malinovsky et al reported that isobaric bupivacaine had longer sensory block and more delayed regression than hyperbaric bupivacaine [14]. Patient's position, baricity,

dose, volume and temperature [15, 16] affect the extent of sensory block after spinal anaesthesia. An in vitro study showed that the addition of fentanyl alters the density and spread of spinal local anaesthetic [17]. However, the addition of fentanyl 0.02 mg to isobaric 0.5% bupivacaine did not affect the maximal block height or time to maximal block in clinical practice[18].

We expected that epidural injection of a local anaesthetic might further affect the spread of spinal local anaesthetic of different baricties. Apart from the delayed sensory regression in the plain bupivacaine group, we failed to get clinically significant differences via haemodynamic variables, sensory or motor block characteristics. However, more patients in the isobaric group needed ephedrine to get their blood pressure within the baseline range.

Epidural injection of a local anaesthetic during combined spinal epidural anaesthesia produces a faster onset and more profound block than epidural anaesthesia alone. This may be explained by the flow of local anaesthetic from the epidural space to the subarachnoid space through the dural puncture hole (10, 11, 19). In our technique, we used the two-segment technique injecting the spinal local anaesthetic at a lower space via a 25-G needle. This may theoretically decrease the flow of epidural local anaesthetic to the subarachnoid space especially after cephalad disposition of the epidural local anaesthetic. The use of 25-G spinal needle was chosen due to technical ease of performance, less incidence of postdural puncture headache and minimal patient discomfort.

In conclusion, apart from the delayed sensory regression with the spinal plain bupivacaine, haemodynamics, block characteristics and analgesic effects of epidural injections of bupivacaine after spinal plain or hyperbaric bupivacaine-fentanyl were comparable. Using either solution for combined spinal epidural anaesthesia, a satisfactory block will be achieved and prolonged urologic surgery can be accomplished with no added inhalational or intravenous agents.

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