

# Pain relief using continuous bupivacaine infusion in the paravertebral space after loin incision

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## ABSTRACT

**Objectives:** Continuous bupivacaine paravertebral nerve block after thoracotomy has been shown to reduce postoperative pain. This study was designed to determine whether paravertebral nerve block using bupivacaine infused through a catheter placed intraoperatively, can reduce postoperative pain, and analgesia requirements after loin incision.

**Methods:** Thirty-four patients undergoing renal surgery through loin incision at Jordan University Hospital, Amman, Jordan, from October 2001 to March 2003, were randomized either to receive bupivacaine 0.5% or normal saline through a catheter positioned intraoperatively against the costovertebral joints in the paravertebral space. The infusions were continued until the evening of the third postoperative day. Patients had access on request to intramuscular Morphine sulphate 5-15 mg, or Diclofenac sodium 50-100 mg, or both depending on body weight. Pain after operation was assessed at rest using linear visual analogue scale. Patient scores were recorded in the recovery room, at 4 hours, 8 hours, and at 9 am, and 5 pm.

**Results:** The analgesia requirements for each patient were recorded. Pain scores in the recovery room were significantly lower in the bupivacaine group (mean 4.5 versus 8.0,  $p=0.001$ ). At 4 hours, the pain score was lower in the bupivacaine group though not significant (mean 3.5 versus 4.37,  $p=0.393$ ). Thereafter, the pain scores were significantly lower in the bupivacaine group. Mean morphine requirement in the bupivacaine group was 13.3 mg (ranges 0-50), while in the saline group 40.13 mg (range 10-112.5),  $p<0.001$ . Morphine requirements in the first and second postoperative days were significantly less in the bupivacaine group ( $p=0.015$  and  $p=0.03$ ).

**Conclusion:** Paravertebral blockade using bupivacaine is an effective and safe method for pain relief following renal surgery through loin incision.

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Pain following loin incision, which is similar to posterolateral thoracotomy has long been associated with postoperative morbidity.<sup>1</sup> Inadequate pain relief results in needless suffering, and may delay early ambulation and deep breathing. Analgesia using narcotics can be effective in reducing postoperative pain, but can cause respiratory depression and suppression of the cough reflex.<sup>2</sup> Non-steroidal anti-inflammatory drugs

(NSAID) are used in the management of postoperative pain though they may have side effects such as gastrointestinal upset.<sup>3</sup> Thoracic paravertebral analgesia is advocated for pain relief following surgical procedures of the thorax and abdomen, especially whenever the afferent input is predominantly unilateral for example, thoracotomy, cholecystectomy, and nephrectomy.<sup>4</sup> Continuous infusion of bupivacaine through an indwelling

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catheter placed in the paravertebral area at the end of surgery was shown to be an effective and safe method of pain relief after thoracotomy.<sup>5</sup> Following renal surgery through loin incision percutaneous continuous paravertebral nerve block has been reported to reduce pain after operation.<sup>6</sup> In this prospective randomized study, we assess the efficacy of continuous paravertebral nerve block using an indwelling catheter, placed intraoperatively to reduce pain in patients undergoing renal surgery through flank incision.

**Methods.** This study was approved by the local scientific and ethics committee. Patients undergoing renal surgery through loin incision were included in the study. The study was explained to the patients and consent forms were signed by all patients who agreed to participate. Exclusion criteria included children below the age of 16 years, patients treated with NSAID or opiates preoperatively, and patients who had additional incisions. Before the operation the patients were instructed on the use of linear visual analogue scale for pain assessment.

**Operative details.** Anesthesia was induced using intravenous thiopental 5 mg/kg, and depolarizing muscle relaxant Succinylcholine 1.5 mg/kg. For maintenance of anesthesia, we used sevoflurane in nitrous Oxide 60%, with oxygen 40%, incremental doses of nondepolarizing muscle relaxant atracurium, and fentanyl. Patients are positioned in loin position with breaking the table. Surgery was performed by the same surgeon. Loin incision was made through the bed of the twelfth rib with resection of part of the rib in the standard way. Towards the end of the operation, and before closure of the wound, the psoas fascia was peeled medially starting from the lateral edge of the wound to the lateral border of vertebral bodies. The resulting space was extended cranially as high as possible. An epidural catheter (B/BRAUN, Prefix, 20 Gauge, with bacterial filter), was inserted through a skin puncture 4 cm below the wound edge and lateral to the border of the erector spinae (Figure 1). The epidural catheter was positioned against the costovertebral joints and as cranially as possible in the paravertebral space. The catheter was secured inside the wound using plain catgut, and to the skin using silk. The psoas fascia was repositioned to the posterior edge of the wound using continuous plain catgut. Any drains inserted were kept away from the paravertebral catheter. Patients were randomized by drawing a card in theatre, either to receive bupivacaine 0.5% or normal saline. Twenty mls of the appropriate fluid were infused via the catheter before closure of the wound. A continuous infusion of either 0.5% bupivacaine 0.1 ml kg<sup>-1</sup>/hour or normal saline was started in the recovery room. The infusion was continued until the evening of the third

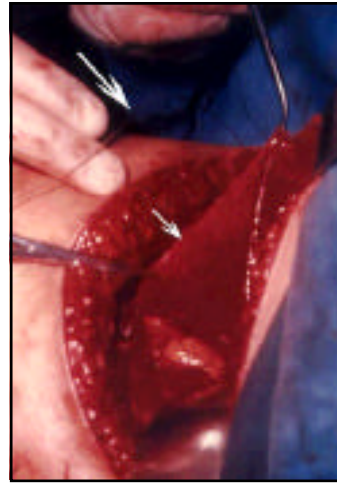


Figure 1 - Photograph showing the left loin incision. The psoas fascia peeled medially (short arrow) and the epidural catheter (long arrow) already inserted into the paravertebral space.

Table 1 - Summarizes the patient's characteristics, type and site of operations.

Patient's characteristics	Bupivacaine group 15	Saline (control) group no 17
Age (years)	45.93 (18-75)	40.06 (18-75)
<b>Gender</b>		
Female	3	3
Male	12	14
<b>Side</b>		
Left	7	10
Right	8	7
<b>Type of operation</b>		
Pyeloplasty	2	2
Renal cyst excision	1	1
Nephrectomy	3	3
Pyelolithotomy	9	11

Table 2 - Record of time observations and *p*-values for pain scores.

Time observations	<i>p</i> value
8 hours	<i>p</i> =0.017
9 am first day	<i>p</i> =0.002
5 pm first day	<i>p</i> =0.002
9 am second day	<i>p</i> =0.002
5 pm second day	<i>p</i> =0.001
9 am third day	<i>p</i> =0.013
5 pm third day	<i>p</i> =0.026

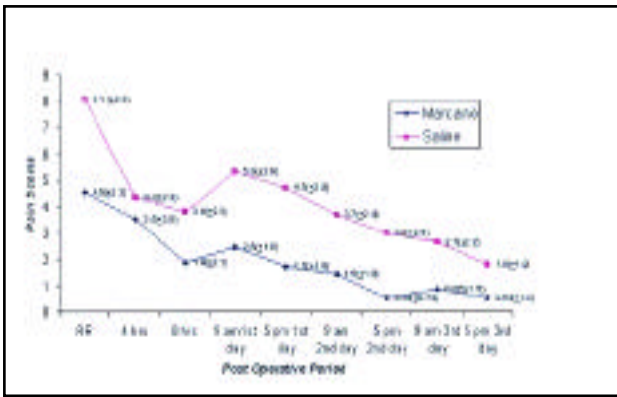


Figure 2 - Pain scores in both groups.

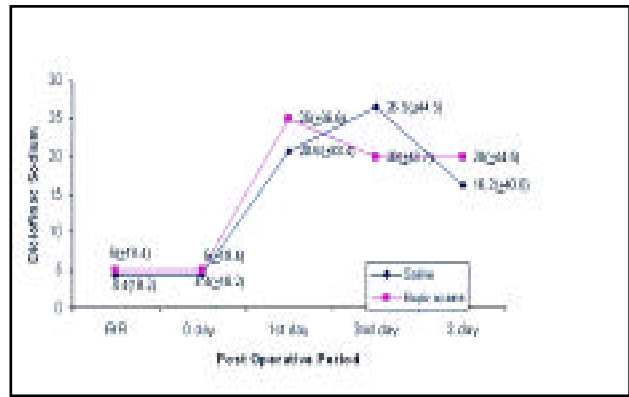


Figure 4 - Diclofenac Sodium requirements in both groups.

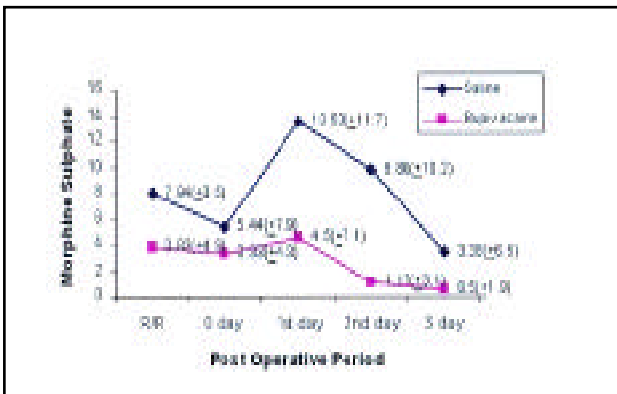


Figure 3 - Morphine requirements in both groups.

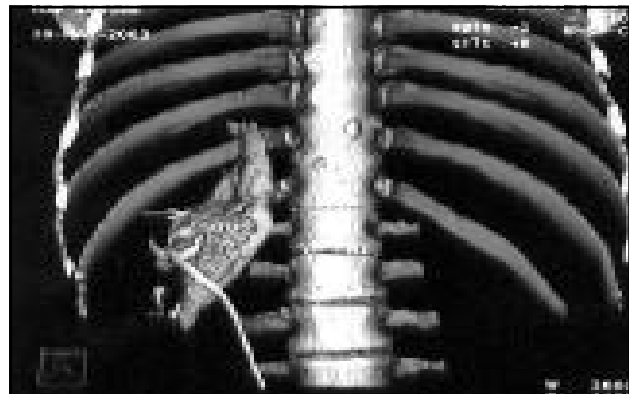


Figure 5 - Three D shaded surface display reconstruction from axial computerized tomography scan after injection of 15 mls of non-ionic contrast media (white arrow) through the paravertebral catheter showing spread of the contrast from L3 up to T11.

postoperative day. Patients had access on request to intramuscular Morphine sulphate 5-15 mg, or Diclofenac 50-100 mg, or both depending on body the weight, and no attempt was made to withhold analgesia. The analgesia was provided using the visual analogue scale according to the following regiment ; from 0-2 either diclofenac or nothing, from 3-6 Morphine and/or diclofenac according to the patient and whether the pain is tolerable or not, and from 7-10 Morphine. Patient controlled analgesia was not used because the machines are not available in our hospital.

**Data collection.** Postoperative loin pain was assessed and recorded by the attending urology resident. The pain was assessed at rest using linear visual analogue scale, graduated from 0-10. The score of zero represented no pain, while the score of 10 represented the worst imaginable pain. Pain scores were recorded in the recovery room at 4 hours and at 8 hours, then at 9 am, and 5 pm. In the first, second and third days after operation. The

analgesia requirement for each patient was recorded by calculating the number and amount of administered doses and the total amount of Morphine and Diclofenac sodium.

The results obtained were analyzed using the student T-test. A *p* value of less than 0.05 was considered statistically significant. For analysis of the data we used Statistical Package for Social Sciences version 10.

**Results.** Originally, 34 patients were recruited in the study, 2 patients from the bupivacaine group were withdrawn because of malfunctioning of the bupivacaine pump. In the remaining patients, the 2 groups were matched regarding age, gender ratio, type and side of operation (Table 1).

**Pain relief.** The pain relief was superior in the bupivacaine group (Figure 2). Pain scores in the recovery room were significantly lower in the bupivacaine group (mean 4.5 versus 8.0, *p*=0.001). At 4 hours, the pain scores were lower in the

bupivacaine group though not statistically significant (mean 3.5 versus 4.37,  $p=0.393$ ). Thereafter the mean pain scores were significantly lower in the bupivacaine group (Table 2).

**Morphine requirements.** Morphine requirements were less in the bupivacaine group throughout the study (Figures 3). The mean morphine requirement for the period of the study in the bupivacaine group was 13.3mg, range 0-50, while it was 40.13 mg in the control group, range 10-112.5 ( $p<0.001$ ). Morphine requirements in the first and second postoperative days were significantly less in the bupivacaine group ( $p=0.015$  and  $p=0.03$ ). The difference in morphine requirements were not significantly different in the zero day (after leaving recovery room and until 12 midnight day of surgery), and in the third postoperative day. Four patients in the bupivacaine group did not need morphine analgesia while all patients in the saline group needed morphine analgesia  $p<0.001$ . One of those 4 patients only needed one injection of 75 mg Diclofenac sodium.

**Diclofenac sodium requirements.** There was no significant difference in the mean Diclofenac requirements between both groups (Figure 4). The mean Diclofenac requirement for the period of the study in the bupivacaine group was 75 mg, range 0-300 mg, while in the control group it was 63.82 mg, range 0-375 mg ( $p=0.765$ ).

**Complications.** No complications were recorded such as hematoma formation, or misplacement in relation to the insertion of the catheter. Although there are reports of complications such as Horner's syndrome caused by spread of bupivacaine to the sympathetic ganglions in the neck following paravertebral block after thoracotomy,<sup>7</sup> no similar complications were observed in this study and in particular, no lower limb weakness or loss of sensation in relation to spread of the bupivacaine to the lumbar plexus. In addition, there were no complications observed in relation to bupivacaine toxicity such as hypotension or confusion.

**Discussion.** Several methods can be used for pain relief after renal surgery through flank incision. Systemic use of narcotics or anti-inflammatory drugs administered either alone or in combination do not often result in satisfactory pain relief.<sup>8</sup> Pain management by local administration of drugs to the pain causing anatomic region provides an optimum strategy with minor side effects and reduced morbidity.<sup>9</sup> Regional analgesia for pain management has been reported extensively for pain control after thoracotomy.<sup>4,5,9-11</sup> However regional analgesia after flank incision has not received similar interest in the literature. Thoracic epidural analgesia combining local anesthetics and opiate analgesia has been shown to be effective in the control of pain after

thoracic surgery, though local complications such as bleeding and dural puncture, as well as side effects such as pruritus, hypotension, and urinary retention should be taken into consideration.<sup>10</sup> Continuous extrapleural intercostal nerve block (paravertebral) was shown to be safe and highly effective in reducing post-thoracotomy pain.<sup>5</sup> Moreover comparison of thoracic epidural and paravertebral block for pain relief after thoracotomy showed similar good analgesia for both, but with fewer side effects in the paravertebral group.<sup>11,12</sup> Intercostal nerve block performed classically at multiple levels in the posterior axillary line has been reported to relieve pain in the first 24 hours after thoracotomy,<sup>9</sup> however others reported the need for repeated blocks.<sup>13</sup>

In a prospective randomized study,<sup>14</sup> it was shown that intercostal nerve block using bupivacaine was effective in reducing postoperative pain, and morphine requirements, after flank incision with no complications. The effect last for 5 days study period. However in another study,<sup>15</sup> to evaluate intercostal nerve blockade analgesia following renal transplantation, the patients had reduced pain and used less morphine in the first 4 hours postoperatively only. However there was no significant reduction in overall pain score or total 24 hours morphine requirements. Additionally pneumothorax developed in 8% of the patients.

Continuous paravertebral block was reported to be effective in reducing pain after renal surgery in children.<sup>6</sup> Furthermore, continuous paravertebral block was equal to epidural analgesia in relieving postoperative pain in children undergoing renal surgery.<sup>16</sup> In this study, the effectiveness of continuous paravertebral block in relieving pain after renal surgery in adults was assessed. In comparison to previous studies where the paravertebral catheter was introduced through a skin puncture preoperatively, open technique was used where the catheter was inserted under vision at the end of surgery and before closure of the wound. We found that the paravertebral block reduced pain scores significantly in the recovery room and in the first, second, and third postoperative days. Furthermore, there was a significant reduction in the morphine requirements. Four patients in the bupivacaine group did not require any morphine analgesia, and only one of those required one injection of Diclofenac sodium, this is in comparison to the control group where all patients needed morphine analgesia. There was no significant difference in the requirements of Diclofenac sodium because it was used for mild to moderate pain as background analgesia. The effectiveness of the paravertebral blockade can be explained by the extent of spread of the local anesthetic to above the eleventh thoracic vertebra (Figure 5). In addition, the segmentation of the

intercostal nerves in small bundles lying freely in the paravertebral space without any enclosing facial sheaths exposes them favorably for blockade.<sup>4</sup>

Although failure of catheter insertion through the percutaneous route, and other complications, such as vascular puncture, hematoma, and pneumothorax were reported,<sup>17</sup> we found no complications related to the insertion of the catheter using the open technique, also there were no complications related to the bupivacaine infusion.

In conclusion, although we recognize that the number of cases in this study is small, it is still important to notice that this method may decrease the postoperative pain and morphine requirements after renal surgery using loin incision. Larger studies determine the effectiveness of this method in pain relief.

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