

Peritubal Local Anaesthetic Infiltration in Postoperative Pain Relief Following Percutaneous Nephrolithotomy - Is It Really Effective? - A Prospective Randomized Controlled Study

Chandranath Mukhopadhyay, Anshuman Aashu*, Pramod Kumar Sharma, Jay Kumar, Souvik Chatterjee, Kanishka Samanta, Sudipta Kumar Singh, Soumendranath Mandal, Dilip Karmakar

Department of Urology, Calcutta National Medical College & Hospital, Kolkata, India

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*Corresponding author

Anshuman Aashu

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Abstract: Percutaneous nephrolithotomy (PCNL) has become the standard treatment of large renal stones since its advent in 1990s. Post-operative pain is a common problem in patients undergoing PCNL. Several agents have been used to control this post-operative pain. This study was performed to know the efficacy of peritubal analgesic infiltration following PCNL in relieving the postoperative pain. It was a prospective randomized control study conducted in the period from March 2016 to May 2017. Total 58 patients undergoing PCNL during this period were taken in the study and divided into cases (n=30) and controls (n=28) groups. Of these patients, supracostal access was performed in 5 patients of case group and 6 patients of control group. The case group received peritubal injection with ropivacaine at the culmination of the procedure. Postoperative pain as the primary outcome was assessed by using visual analogue scale at 2, 6, 12, 24 and 48 hours postoperatively. The secondary outcomes were the total postoperative analgesic usage in 24 hours and time of the first analgesic demand. The average VAS score at 2 and 4 hours after the operation in the case group were significantly lower than the control group ($P \leq 0.0001$). Doses of analgesic usage required for controlling pain was significantly lower in case group than in the controls. The first analgesic demand was seen to be significantly delayed in the case group as compared to the control. Similar results were noted in patients undergoing supracostal access. To conclude, peritubal local anaesthetic infiltration is effective in alleviating immediate postoperative pain after PCNL even with supracostal access.

Keywords: Percutaneous Nephrolithotomy, Postoperative pain, Analgesia, Peritubal infiltration.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) has attained the status of gold standard procedure in the treatment of large renal stones. As compared to the conventional open surgeries for renal stone diseases, PCNL remains a minimally invasive technique with significantly lower morbidities for the patients. Pain remains an important cause of significant morbidity in the immediate postoperative period and its relief still remains a challenging problem. Traditionally, opioid analgesics were used in postoperative pain management. However, these drugs have higher rates of side effects that include postoperative nausea and vomiting, drowsiness, respiratory depression, ileus, urinary retention and constipation [1, 2-5]. Non-steroidal anti-inflammatory drugs (NSAIDs) are also frequently used but they are also not free of side effects. Several techniques such as multimodal analgesic regimens, PCNL with small nephrostomy tube, tubeless PCNL, mini-PCNL, local analgesic infiltration and renal capsule analgesic infiltration have been used to

overcome these problems [1, 6, 7-9]. Another modality is peritubal local anaesthetic infiltration which was developed under the rationale to relieve the pain that might be originated in renal capsule after PCNL surgery [1, 10-12].

The present study was aimed at studying the efficacy of peritubal infiltration of 0.75% ropivacaine following percutaneous nephrolithotomy with percutaneous nephrostomy tube in reducing the postoperative pain and the requirement of analgesic dosage.

MATERIALS AND METHODS

The study was conducted in the department of Urology, Calcutta National Medical College & Hospital, Kolkata during the period from March 2016 to May 2017. All the patients undergoing PCNL for renal stone were included in the study. The patients who required multiple access tracts for stone removal and those in whom the nephrostomy tube was not placed at

the end of surgery were excluded from the study. Patients who underwent relook PCNL for residual fragments were also excluded from the study. The patients were randomized into two groups, cases and controls. Patients in the case group received peritubal infiltration of 0.75% ropivacaine at the culmination of the procedure and rest were included in the control group who didn't receive any drug locally for pain control.

After anaesthesia was administered, an open-end 6 F ureteral catheter was placed transurethrally into the ureter in lithotomy position. Under fluoroscopic guidance in prone position, retrograde pyelogram was obtained by injecting radio contrast via ureteral catheter. Renal access was obtained by the triangulation technique of standard PCNL. After confirming the tip of the puncture needle in the collecting system, guide wire was inserted followed by single-step tract dilatation with Amplatz dilators of 24F or 26F depending upon the dilatation of the collecting system and the size of the stone. Stone was disintegrated with

pneumatic lithotripsy. The nephrostomy tube size 20F was inserted after the completion of the procedure.

In the case group, a spinal needle (23 gauge) was inserted upto renal capsule under fluoroscopic guidance along nephrostomy tract at cranial and caudal positions. Inj Ropivacaine(0.75%) was infiltrated @ 3mg/kg along the nephrostomy tract in the renal capsule, muscle, subcutaneous plane and skin (Figure 1). The control group did not receive any infiltration. Inj tramadol HCL 50mg was given as analgesic on demand in both groups.

Postoperative pain was assessed as the primary outcome using a 0–10 point visual analogue scale for pain (VAS pain) where 0 on the scale meant no pain and 10 meant very severe pain. VAS score was recorded at 2, 6, 12, 24 and 48 hours postoperatively. The total analgesic dosage required on demand for pain control, the time of the first such demand after the procedure and adverse effects were noted. The data were collected and analysed using simple statistical tools.



Fig-1: Peritubal infiltration under fluoroscopic guidance

RESULTS

A total of 58 patients were included in the study after applying the inclusion and exclusion criteria as stated above. Out of these 58 patients, 30 patients

were included in the case group and 28 were included in the control group. Patients in the two groups were comparable on the basis of age, sex, BMI and stone size (Table 1).

Table-1: Patient Characteristics

	Case group (n=30)	Control Group (n=28)	p value
Mean age ± S.D. (Years)	53.45 ± 10.56	52.56 ± 11.38	0.7585
Gender (M/F)	22/8	21/7	0.95549
Mean BMI ± S.D. (Kg/m ²)	25.2 ± 3.2	25.1 ± 3.1	0.9043
Mean stone size ± S.D. (cm)	3.5 ± 1.2	3.4 ± 1.4	0.7708

The average VAS score of pain at 2 and 6 hours after the operation in the case group was 3.21 and 4.67 compared with 6.45 and 7.86 in the control group (P<0.0001), respectively. The postoperative VAS score of pain at 12, 24 and 48 hours were not significant different between both groups as shown in Table 2.

Doses of analgesic (Tramadol) usage for controlling postoperative pain was 184.46 ± 54.72 mg in case group and 278.86 ± 46.84 mg in control group (P<0.0001, Table 3). The first analgesic demand was significantly delayed in case group compared with the control group (6.42±3.56 hrs vs 2.36 ±1.84 hrs, P<0.0001) (Table 3).

Table-2: Comparison of postoperative VAS score in two groups

Time	Case group (n=30)	Control Group (n=28)	p value
2 hours	3.21	6.45	<0.0001
6 hours	4.67	7.86	<0.0001
12 hours	2.92	3.45	0.1427
24 hours	2.16	2.25	0.7343
48 hours	1.67	1.84	0.6661

Table-3: Comparison of analgesic requirement in two groups

	Case group (n=30)	Control Group (n=28)	p value
Mean analgesic dose required \pm S.D. (mg)	184.46 \pm 54.72	278.86 \pm 46.84	<0.0001
Time at first requirement (hours)	6.42 \pm 3.56	2.36 \pm 1.84	<0.0001

Of the total patients, 5 patients in the case group and 6 patients in the control group required supracostal access for stone removal. The average VAS score of pain at 2 hours and 6 hours after operation in the case group were 3.86 and 5.56 compared with 6.94 and 7.96 in the control group (Table 4, $P \leq 0.05$). The postoperative VAS score of pain at 12, 24 and 48 hours were not significantly different between both groups.

Doses of analgesic (Tramadol) usage for controlling postoperative pain was 190.86 \pm 45.82 mg in case group and 286.92 \pm 32.56 mg in control group ($P=0.0028$, Table 4). The first analgesic demand was longer in case group compared with the control group, but was not significantly different (5.64 \pm 3.54 hrs and 2.56 \pm 1.89 hrs, $P=0.0973$) (Table 4).

Table-4: Comparison of VAS scores and analgesic requirements in patients undergoing supracostal access

	Case group (n=30)	Control Group (n=28)	p value
VAS score at 2 hours	3.86	6.94	0.0088
VAS score at 6 hours	5.56	7.96	0.0293
VAS score at 12 hours	3.42	3.23	0.8612
VAS score at 24 hours	2.12	2.56	0.5619
VAS score at 48 hours	1.86	1.98	0.8674
Mean analgesic dose required \pm S.D. (mg)	190.86 \pm 45.82	286.92 \pm 32.56	0.0028
Time at first requirement (hours)	5.64 \pm 3.54	2.56 \pm 1.89	0.0973

DISCUSSION

Postoperative pain remains a significant source of comorbidity for the patients following PCNL affecting the postoperative quality of life and may lead to increased period of hospitalisation [2-5]. Better understanding of the pain mechanisms and development of newer agents for the pain control have led to the use of several new techniques for improvement of postoperative pain management [10-13].

The level of pain experienced by the patients depended upon a lot of factors. Gender being one of the important factors, women have been seen to have more pain sensitivity and therefore most women need more analgesic consumption than men [14, 15]. The size of the tube used for nephrostomy is also seen as an important factor determining the pain after the procedure. Patients with small bored nephrostomy tube have less postoperative pain score and less analgesic requirement [6, 8]. Tubeless PCNL is recommended in uncomplicated cases without increasing complication [7, 9]. As standard technique of PCNL, the placement of large nephrostomy tube follows completion of the procedure. Postoperative pain usually is caused by the dilatation of renal capsule and parenchyma of access tract with local inflammation reaction along the nephrostomy tube [10-12].

Opioid analgesics are traditionally used for controlling postoperative pain, but these drugs usually have significant side effects. Several studies demonstrated the efficacy of acetaminophen with and without opioid in management of postoperative pain [2-5, 16, 17].

The benefit of local anaesthesia was demonstrated in previous studies in surgeries such as cesarean sections, hysterectomy, thyroid surgery, mastectomy, total-hip arthroplasty and cervical spine surgery [18-21]. Haleblian et al. studied the effect of local anaesthetic (Marcaine R) infiltration at the incision wound (subcutaneous) of PCNL with 10 Fr. nephrostomy tube in 10 patients compared with 12 patients with saline infiltration. It was observed that there were no significant differences between both groups in the aspect of pain scores and postoperative narcotic use [12].

Jonnavithola et al. in their randomized control study of peritubal infiltration of bupivacaine of renal capsule demonstrated the effectiveness of this technique. The technique consisted of the use of a 23 gauge spinal needle (10cm in length) along nephrostomy tube at 6 and 12 o'clock and each infiltrated 10mL of 0.25% bupivacaine. The pain free

period and mean total consumption of tramadol following operation of controlled group and blocked group were 4.6 ± 5.4 hours and 105 ± 85 mg and 14.7 ± 9.6 hours and 31 ± 44 mg, respectively. The mean AUC-UAS was 39.2 hours in control group and 18.9 hours in infiltration group [10].

Bannakij Lojanapiwat *et al.* published their randomized trial in which they included all single tract PCNL patients with postoperative nephrostomy tube placement including supracostal puncture without considering operative time and stone size. This study showed the benefit and safety of peritubal analgesic infiltration in controlling postoperative pain (lower VAS number), lower use of morphine and longer time of first analgesic requirement [22].

Shim *et al.* in their randomized 3-arm trial showed that continuous analgesic infiltration through special catheter infusion device is more efficacious than single dose local anaesthetic infiltration [23].

In our study, we included all patients with single tract (sub or supracostal) and excluded patients with multiple punctures or relook PCNL. We confirmed the findings of Bannakij Lojanapiwat *et al.* that peritubal analgesic infiltration reduces the postoperative pain especially in early period (even in patients with supracostal access). It also reduces the total analgesic dose and prolongs the time of first analgesic requirement. These results were also observed in the subgroup analysis of supracostal access, which, otherwise, should have more pain after this operation.

CONCLUSION

Peritubal local anesthetic infiltration with 0.75% ropivacaine is very effective in reducing immediate postoperative pain after percutaneous nephrolithotomy even with supracostal access. This effect resulted in lower early postoperative pain (lower VAS score), lower doses of analgesic usage and longer time of first analgesic demand. As it is easily available and does not require any special device, it should be routinely used after PCNL with nephrostomy tube till other effective methods are available.

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