ULTRASOUND GUIDED PERITUBAL INFILTRATION OF 0.25% ROPIVACAINE FOR POSTOPERATIVE PAIN RELIEF IN PERCUTANEOUS NEPHROLITHOTOMY

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Abstract

Background: Percutaneous nephrolithotomy (PCNL) is a common endourologic procedure with less morbidity than open surgery. However, pain around the nephrostomy tube requires good post operative analgesia. So we hypothesize that infiltration of local anesthetic from the renal capsule to the skin around the nephrostomy tract would relieve the pain in the initial postoperative period.

Methods: 60 adult patients of either sex with ASA physical status I to III and undergoing percutaneous nephrolithotomy were randomized for a prospective double-blind controlled study. Patients were divided into control group (n=30) and ropivacaine group (n=30). Balanced general anesthesia was given. After completion of surgical procedure, 23 gauge spinal needle was inserted at 6 and 12 o'clock position under ultrasonic guidance up to therenal capsule along the nephrostomy tube. 10 ml of 0.25% ropivacaine or normal saline solution was infiltrated in each tract while withdrawing the needle from renal capsule to the skin. Post-operative pain was assessed using visual analogue scale (VAS) and dynamic visual analogue scale (D-VAS) during deep breathing and coughing on a scale of 0-10 during the initial postoperative 24 hours. Rescue analgesia was given in the form of injection tramadol 1.0 mg/kg intravenously when VAS > 4 and maximum up to 400mg in 24 hours. Time to first rescue analgesic, number of doses of tramadol and total amount of tramadol required in the initial postoperative 24 hours were noted. Patients were observed for any side effect and treated accordingly.

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Results: VAS at rest (VAS) as well as during deep breathing and coughing (DVAS) were significantly lower in ropivacaine group during first 24 hours. Mean time to 1st rescue analgesic in ropivacaine group was longer (10.7±2.64 hours) as compared to control group (2.05±1.44 hours) (P=0.0001). Mean number of doses of tramadol in 24 hours in group-R were less (2.25±0.51) than group-C (4.4±0.68) (P= 0.0001).The mean total amount of tramadol in 24 hours in group-R was significantly lower than group-C. Side effects like nausea and vomiting and sedation were minimum and non-significant in both groups.

Conclusion: Local anesthetic infiltration of 0.25 % ropivacaine along the nephrostomy tract is efficient in alleviating post-operative pain after percutaneous nephrolithotomy surgery. The number of doses and total consumption of rescue analgesic were also decreased in the initial postoperative 24 hours.

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Key words: Percutaneous nephrolithotomy, Post-operative pain, Ropivacaine, Ultrasound.

Introduction

The efficacy, safety and superiority of percutaneous approach to manage large renal calculi have been well established over the past two decades. Placement of nephrostomy tube after percutaneous nephrolithotomy (PCNL) is still considered a standard practice since not all patients are candidates for a tubeless PCNL and thus several investigations have focused on the impact of reduced percutaneous catheter size on post-operative pain, analgesic requirements and duration of cutaneous drainage[1]. Even though analgesics such as NSAIDS and opioids have been used for postoperative analgesia, pain around nephrostomy tube can be distressing. Skin infiltration of local anesthetic drug at surgical site is not so effective. So we hypothesized that infiltration of local anesthetic from the renal capsule to the skin along the nephrostomy tract would relieve the postoperative pain during the initial postoperative period.

The aim of present study was to investigate the efficacy of peritubal infiltration of 20 ml of 0.25% ropivacaine under ultrasonic guidance for postoperative pain relief after PCNL and to assess the of number of doses as well as total requirement of rescue analgesic during the first postoperative 24 hours.

Methods

A prospective randomized double-blind controlled study was conducted in 60 ASA physical status I -III adult patients posted for PCNL surgery after obtaining institutional ethics committee's approval and informed consent from each patient. Patients were randomly divided in two equal groups of 30 patients in each group. Group R is Ropivacaine group (0.25 % ropivacaine infiltration) and group C is Control group (normal saline infiltration). Patients' inclusion criteria were 18 to 60 years of age, 35 to 85 kg of weight with BMI <30 kg/m^2, renal stone size less than 3.0 cm requiring a single nephrostomy tube (22 F) and a duration of surgery less than 3 hours. Patients having supracostal puncture, excessive bleeding and more than one puncture were excluded from the study. In all patients, balanced general anesthesia was given using fentanyl as a premedication in dose of 2 µg/ Kg intravenously during induction. Anesthesia was induced with thiopentone sodium and succinylcholine. Trachea was intubated with appropriate sized endotracheal tube. Anesthesia was maintained with N2O, O2, Isoflurane and Atracurium. PCNL surgery was performed in the prone position. After insertion of nephrostomy tube and before the extubation of the patients, 23 gauge 90 mm spinal needle was inserted up to renal capsule under ultrasonographic guidance along the nephrostomy tube at 6and 12' O clock positions. In group R, 20 ml of 0.25% ropivacaine and in group C, 20 ml of normal saline was infiltrated (10 ml in each tract) while gradually withdrawing the needle from renal capsule to the skin and infiltrating renal capsule, perinephric fat, muscles, subcutaneous tissue and skin. Patients were extubated and kept in post-anesthesia care unit under observation for 24 hours.

During follow up, patients were assessed for pain and side effects by an independent observer blinded to the infiltration immediately after extubation, and at 0.5, 1, 1.5, 2, 4, 6, 8, 12, 16, 20 and 24 hours postoperatively. The pain score was assessed using 0-10 point visual analogue scale (VAS) at rest and

Table 1
Demographic Data

Parameters	Ropivacine group (mean ± SD)	Control group (mean ± SD)	P-Value
Age (Yrs)	43.9 ± 14.55	41.2 ± 11.94	0.435
Sex (male: female)	21:09	20:10	0.781
Weight (kg)	54.4 ± 9.18	62.5 ± 12.56	0.008
Duration of Surgery (Hrs)	1.45 ± 0.25	1.61 ± 0.32	0.678

dynamic visual analogue scale (DVAS) on deep breathing and coughing where 0 means no pain and 10 means unbearable pain.

When VAS score > 4, the patient was given1 mg/kg intravenous tramadol slowly as a rescue analgesia and the patient was reassessed for pain. Maximum 400 mg of tramadol was allowed in the initial 24 hours. Intravenous ondansetron was given if there was nausea and vomiting. Nausea was scored as 0-3 where 0 means none and 3 means severe nausea while sedation was scored as 0-3 where 0 means patient is awake and alert and 3 means deep sleep. Time for 1st need of rescue analgesic and duration of analgesia was noted. Number of doses of tramadol and total consumption of tramadol required in 24 hours were noted.

Statastical Analysis

Sample size calculation was done on the basis of total consumption of tramadol in 24 hours to compare the effect of ropivacaine infiltrated along the nephrostomy tract with control group. Power analysis was performed. This analysis was based on two samples with statistical significance of 0.05 and 90% power. The sample size required to detect the standardized difference of 0.87 are approximately 56 (28 in each group). Considering rejection in the study, we decided to take 30 patients in each group.

Statistical Analysis was performed using Statistical package of social sciences i.e. SPSS version 12. Continuous data are described as mean +/- standard deviation and categorical variables are given as percentages. Continuous variables were compared using t-test for two independent samples. Percentages were compared using Chi-square analysis. P-values < 0.05 were considered to be statistically significant.

Results

Sixty adult patients scheduled for PCNL were enrolled in the study. There was no dropouts or exclusions in the study. The demographic data regarding age, sex and duration of surgery were comparable and non-significant (Table-1). VAS (at rest) and DVAS (during coughing and deep breathing) were significantly lower in ropivacaine group than control group (Fig. 1 and 2). The mean time for first demand of analgesia was 10.7±2.64 hours in ropivacaine group and 2.05 ± 1.44 hours in control group (P=0.0001). The mean number of analgesic demands during initial 24 hours was 2.25± 0.51 in R group and 4.4± 0.68 in group C. The mean total consumption of tramadol in 1st 24 hours was 123.2±30.16 mg in group R and 276.8±62.45 mg in group C. The side effects like nausea and vomiting and sedation were non-significant in both groups (Table-2).

Fig. 1
Mean VAS

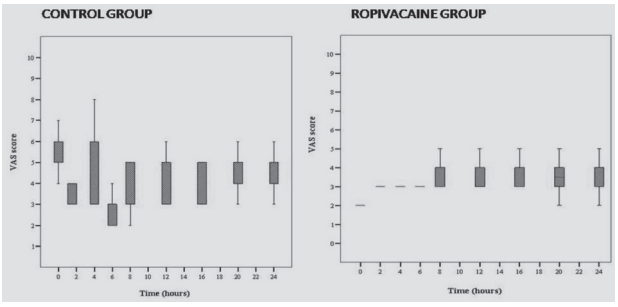
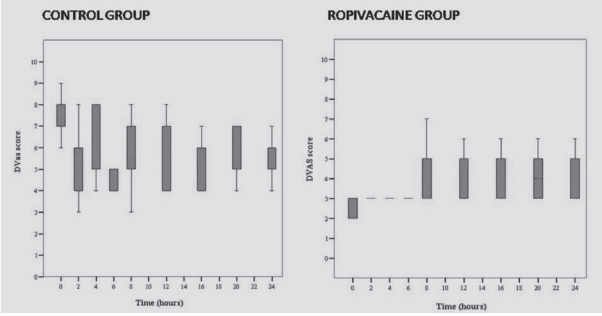


Fig. 2
Mean dynamic VAS



Discussion

In PCNL surgery, the cause of post operative pain is mainly due to nephrostomy tube which produces local inflammatory reaction. So we designed to infiltrate the nephrostomy tract by local anaesthetic solution, ropivacaine because local anesthetic can inhibit inflammatory and local sensitising responses by directly suppressing some phases of inflammation like neutrophil priming and by blocking some of the neuronal pathways which are activated by inflammation that is protein kinase C and G protein-coupled receptors[8]. We compared this study with control group and data assessed were post-operative pain score, time to 1st demand analgesia, number of analgesic demand and total requirement of rescue analgesic, tramadol in first 24 hours. In our study, VAS and DVAS scores of pain in ropivacaine group were significantly lower as compared to saline group and correlates with the studies of Dalela et al[10], Jornavithula et al[11], Gokten et al[12] and Ugras et al[13]. While Haleblian et al[9] evaluated the use of subcutaneous infiltration of 1.5 mg/kg of 0.25% bupivacaine after PCNL in 25 patients. Their results did not showed significant difference in VAS score and pain relief around nephrostomy site area after PCNL surgery in the study group. It was postulated that the cause for pain after PCNL surgery which requires nephrostomy tube could result from structures beyond the skin puncture site like the renal capsule. Dalela et al[10] performed PCNL under renal capsular block by infiltrating renal capsule with 2% lignocaine in 11 patints.They used a numeric pain rating scale (NRS) to quantitate the degree of pain. The NRS scores during the initial 1.5 hours were <3 in all patients. In two patients in whom the procedure extended beyond 1.5 hours, the NRS scores were 6 and 7. They confirmed that most of the pain during PCNL is felt at the time of dilatation of renal capsule and parenchyma that is heavily innervated by pain conducting neurons. Jornavithula et al[11] evaluated post-operative pain relief using 0.25% bupivacaine infiltration along the nephrostomy tract after PCNL under fluoroscopic guidance. The mean VAS and DVAS scores for pain observed were IQR of 5-7 and IQR 6-8 in control group while IQR of 2-5 and IQR 2-6 in the block group. Gokten et al[12] did the same study using 0.25% levobupivacaine infiltration followed by intravenous paracetamol infusion. They found lesser requirement of opioid, lower VAS score, shorter time to full mobilization and higher patient satisfaction score compared to the control group.

Ugras et al[13] used 30 ml of either 0.02% ropivacaine or saline instillation into renal puncture site, nephrostomy tract and skin after PCNLin 34

Table 2
Comparison of Analgesic Requirements and Side Effects

Parameters	**Ropivacine group (mean [95% C (mean ± SD)**	**Control group (mean [95% CI]) (mean ± SD)**	**P-Value**
Mean time for 1st demand of tramadol (hrs)	10.7 ± 2.64	2.05 ± 1.44	0.0001
No. of doses of tramadol required in 24 hours	2.25 ± 0.51	4.4 ± 0.68	0.0001
Total consumption of tramadol in 24 hours (mg)	123.2 ± 30.16	276.8 ± 62.45	0.0001
Side effects	Vomiting – 1 (3.3%) Nausea – 1 (3.3%) Sedation – 1 (3.3%)	Vomitting-2 (6.6%) Nausea-2 (6.6%) Sedation-1 (3.3%)	0.554 0.554

patients. They assessed the effect of ropivacaine infiltration on post-operative pain status and pulmonary functions.. Their results showed that VAS at 6 hours, time to first analgesic demand and total analgesic need were significantly lower in ropivacaine group.In our study, time to first rescue analgesia was prolonged and number of analgesic demand as well as total requirement of rescue analgesics in first 24 hours were decreased in ropivacaine group, which were comparable with studies by Haleblian et al[9], Dalela et al[10], Jornavithula et al[11], Gokten et al[12] and Ugras et al[13]. In our study, incidence of side effects like nausea vomiting or sedation were minimum and comparable in both groups since all patients had post-operative urinary catheter, urinary retention could not be evaluated.

The limitation of our study was that it was not performed in supracostal or multiple punctures or in patients having stone size >3.0 cm. We also excluded patients with BMI>30.

Conclusion

Local anesthetic infiltration with ropivacaine along the nephrostomy tract from renal capsule to the skin gives excellent postoperative analgesia and significantly reduced rescue analgesic requirement after percutaneous nephrolithotomy.

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