

Original article:

Nephrostomy tract block with ropivacaine and dexmedetomidine decreases analgesia requirement in renal failure patients undergoing tubeless percutaneous nephrolithotomy - a prospective double blind randomised control study

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ABSTRACT

Introduction: Peripheral nerve block is the preferred modality to decrease post operative pain in renal failure patients. Hence we evaluated the efficacy of nephrostomy tract infiltration with ropivacaine and dexmedetomidine in renal failure patients undergoing tubeless percutaneous nephrolithotomy (PCNL) in reducing analgesic requirement.

Material and Methods : Patients undergoing PCNL with serum creatinine more than 1.5mg/dl were included in the study. Patients were randomized into RD and S group. Post PCNL, Nephrostomy tract infiltration with 20 ml of 0.25% Ropivacaine and 0.5 microgram per kg bodyweight of dexmedetomidine in RD group and 20 ml of normal saline in S group under fluoroscopic guidance was given. Post operatively Visual Analog score (VAS) and dynamic visual analog score(DVAS) were recorded at 1,2,4,6,12 and 24 hours. Patient controlled analgesia (PCA) pump was used to deliver tramadol on demand. The first analgesic dose time and total analgesic requirement were recorded.

Results : 52 patients were randomized into group RD and S. The mean age of the patients was 52.3 years, with male to female ratio of 2 :1. The mean Serum creatinine value was 2.02mg/dl and the average stone size was 2.15 cm. The VAS , DVAS , total analgesic requirement (60.58mg vs 158.65mg) ,analgesia -dose per kilogram bodyweight (0.98mg/kg vs 2.63mg/kg) were significantly lower and the first analgesic dose time (10hrs vs 5.5hrs) was prolonged in RD than S group. The success rate of tubeless PCNL was 94.2 %.

Conclusion : Nephrostomy tract block is effective in reducing analgesic requirement in renal failure patients undergoing tubeless PCNL.

Keywords ; Nephrostomy tract block, Renal failure, Tubeless PCNL

Introduction:

Tubeless Percutaneous Nephrolithotomy (PCNL) is one of the minimally invasive methods of treatment of large renal stones^{1,2}. Compared to the standard PCNL the analgesic requirement in tubeless PCNL is less as nephrostomy tube is not placed¹⁻⁴. Still tubeless PCNL experience pain along the nephrostomy tract and require analgesics in the first 24 hours post surgery. But the use of analgesics in renal failure patients poses certain challenges⁵. The pain management protocol depends on the degree of renal function and changes when there is decline in renal function. Commonly used analgesics like nonsteroidal anti-inflammatory drugs (NSAID's) and opioids require dose modification in renal failure patients^{6,7}. Hence peripheral nerve block is the preferred modality of analgesia in renal failure patients⁴. Various studies have shown infiltration of local anesthetic along the nephrostomy tract from the renal capsule to the skin in patient undergoing conventional Percutaneous Nephrostomy (PCNL) is effective^{8,9}. Hence our study evaluates the usage of Nephrostomy tract infiltration of Ropivacaine and Dexmedetomidine under fluoroscopic guidance to reduce the analgesic requirement in renal failure patients undergoing tubeless PCNL.

Material and Methods

Study Population

Patients with renal failure (S.Cr > 1.5mg/dl) who had renal calculi or large proximal ureteric calculi planned for PCNL in PSG Institute of Medical sciences and Research from March 2014 to June 2016 were recruited for the study after obtaining informed consent.

Procedure

Patient underwent PCNL under balanced general anesthesia. After placing a ureteric catheter patients

were placed in prone position. Using a 18 Fr Chiba needle initial access to PCS was obtained. A 0.035'' Zebra guidewire was passed into the needle into the PCS. A central rod was used to steady the guidewire and 28fr screw dilator was used to perform single step dilation and a 28 Fr Amplatz sheath was positioned in the collecting system. Using 24Fr Rigid Nephroscope, pelvicalyceal system was inspected and stone fragmented with pneumatic lithoclast and fragments removed. Clearance was checked using fluoroscopy and nephroscopy. 5 Fr double J stent was placed in an antegrade fashion.

Exclusion Criteria

Patient who required more than one Puncture, patient who has excessive intra operative bleeding (estimated blood loss > 300ml), body mass index more than 30, operative duration more than 4 hrs and those who had percutaneous nephrostomy tube placement post surgery were excluded from the study.

Randomisation

Patient meeting the inclusion and exclusion criteria were allotted to group RD or S by computer generated random numbers. Patient in Group RD received 20 ml of 0.25 % Ropivacaine with 0.5 microgram/kg bodyweight Dexmedetomidine and Group S received 20 ml of Normal saline as Nephrostomy tract infiltration. Nephrostomy tract infiltration was done by inserting 23 gauge spinal needle up to renal capsule under fluoroscopy guidance along the amplatz sheath at 6 and 12 O'clock position. The Amplatz sheath was removed and PCN tract closed using 3-0' silk. Post operative pain was assessed by visual analogue scale (VAS) at rest and dynamic visual analogue scale on deep breathing and coughing. VAS and DVAS was recorded at 1,2,4,6, 12 and 24 hrs post operatively. Patient controlled analgesia (PCA) pump was

programmed to deliver tramadol of 200 mg in 92 mL of 0.9% saline, lockout interval 15minutes, no background infusion, 5 mL per pump for a period of 24 hours.

The surgeon and VAS / DVAS score interpreter (Post operative ward Nurse) were both blinded as only the operative theatre nurse would give 20ml saline or ropivacine and dexmedetomidine based on the computer generated random numbers.

At one week post surgery patient underwent S.Creatinine testing, X-ray KUB and ultrasound to assess renal function and residual calculus.

Results

Out of 66 patients who met the inclusion criteria and consented for the study, 3 patients were excluded preoperatively as their BMI was greater than 30. Another 11 patients were excluded intraoperatively due to multiple punctures, excessive bleeding and prolonged surgery time. Finally 52 patients who met

inclusion and exclusion criteria were included in the study.

The mean age of the patients was 52.3 years. The male to female ratio was 2 :1. the average BMI was 22.1.The mean Serum creatinine value was 2.02mg/dl, the average stone size was 2.15 cm, The mean duration of surgery was 103 minutes. The average estimated blood loss was 120ml. The puncture was lower calyceal in 38%, middle calyceal in 58% and upper calyceal in 4%. Demographics data of both groups are depicted in table 1.

The total analgesic requirement and analgesic requirement per kilogram body weight were significantly lower in RD group when compared to the S group (table 2).The First Analgesic dose time was significantly prolonged in RD group than S Group.Further 4 patients in RD group did not require analgesics. The mean VAS and DVAS scores are depicted in figure 2 and 3 were lower in RD group.

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The surgical outcome and complications are shown in table 3.

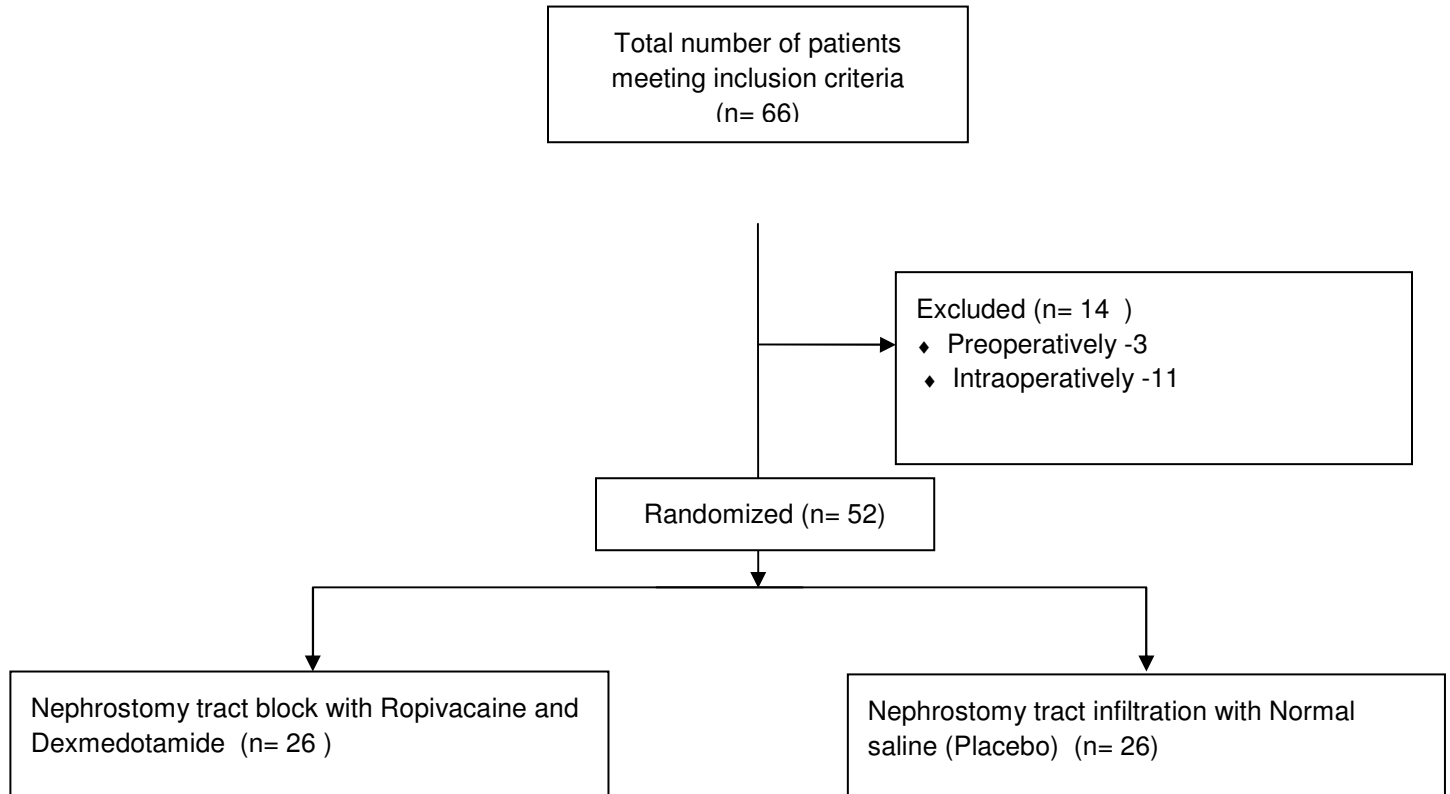


Figure 1 : Flow chart

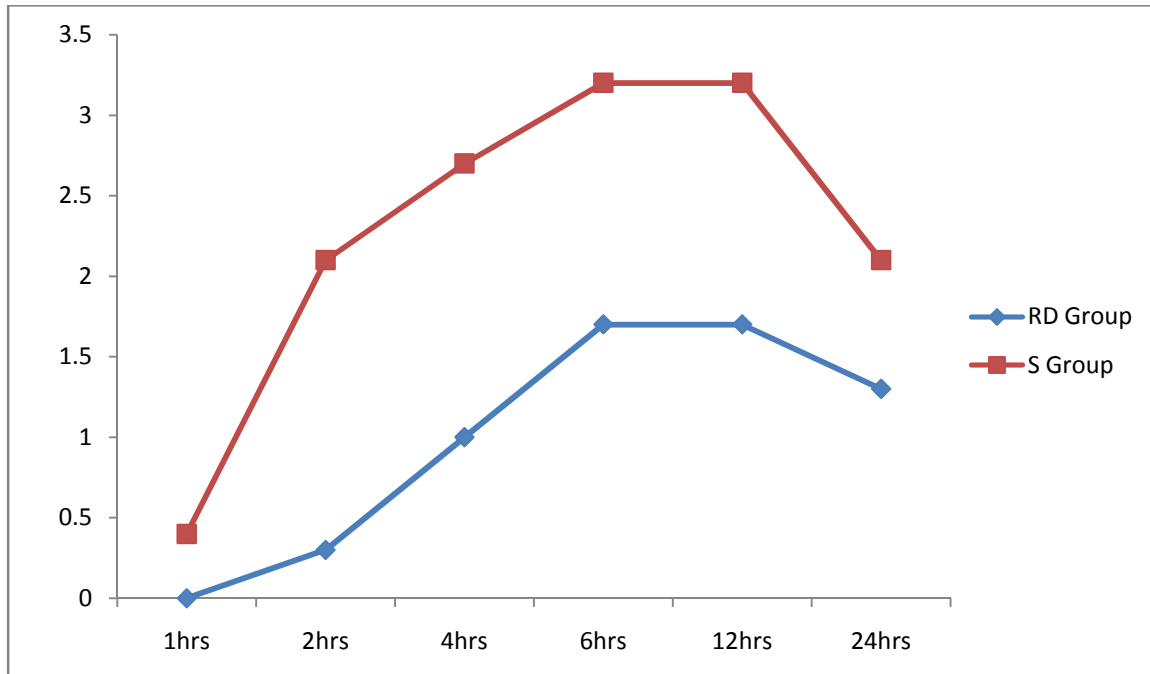


Figure 2 : Graph showing VAS score

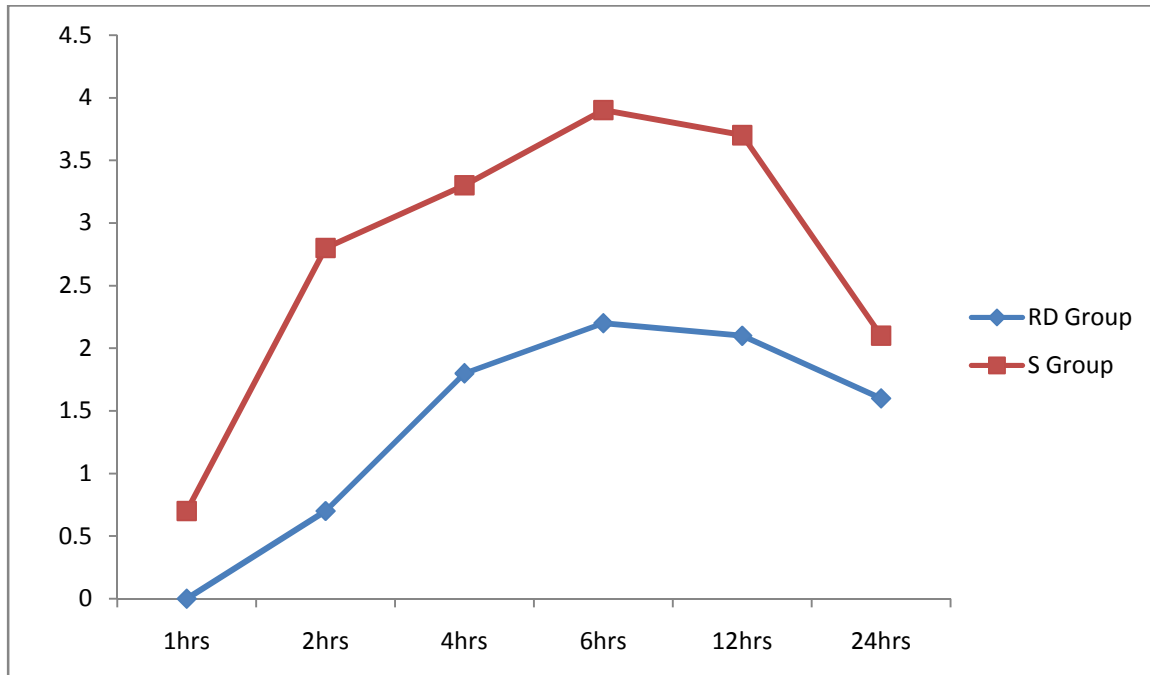


Figure 3 : Graph showing DVAS score

Characteristics	RD Group	S Group
n	26	26
Age	50.5 +/- 9.2	54.0 +/- 12.6
Sex	1.6:1	2.7:1
Weight	63.4 +/- 7.3	62.1 +/- 9.6
Body Mass Index	22.2 +/- 1.6	22.1 +/- 2.2
Serum Creatinine	2.0 +/- 0.5	2.1 +/- 0.8
Stone size	2.2 +/- 0.3	2.1 +/- 0.4
Puncture Site		
1. Upper calyx	1	1
2. Middle calyx	17	13
3. Lower calyx	8	12
Operative duration	100.8 +/- 23.4	105.6 +/- 21.1

Table 1 : Demographic data of both groups

	RD Group	S Group	P value
First Analgesic Dose (hours)	10.04 +/- 2.2	5.54 +/- 1.2	<0.0001*
Total Analgesic Requirement (milligrams)	60.58 +/- 49.1	158.65 +/- 38.5	<0.0001*
Analgesic requirement in milligrams/Kilogram body weight	0.98 +/- 0.7	2.63 +/- 0.7	<0.0001*
Post op change in serum creatinine	-0.20 +/- 0.4	-0.26 +/- 0.4	0.59*

* Independent Student 't' test used to calculate p value

Table 2 : Analgesic Usage pattern in both groups

	RD Group	S Group
Complete Stone Clearance	25	24
Need for ESWL	1	2
Post op change in Serum Creatinine		
Significant Haematuria	2	1
Postoperative fever	3	2
Paralytic ileus	1	3
Hydrothorax	0	0

Table 3: Postoperative Outcomes

Discussion

Worcester et al¹⁰ have reported that there is significant decrease in creatinine clearance in patients with nephrolithiasis per se. In addition the renal function further deteriorates in the presence of obstruction and infection. Hence it is necessary to minimize the renal injury during the surgery for the stone disease and in the postoperative period.

Since Bellman et al¹ challenged the requirement for routine placement of a nephrostomy tube following PCNL, tubeless percutaneous nephrolithotomy has evolved and is accepted as procedure of choice for large renal calculi and large proximal ureteric calculi. It is less morbid when compared to standard PCNL and open renal surgery. But tubeless PCNL is not recommended in patients with significant bleeding, multiple punctures and if residual calculus is suspected. In these patients placement of nephrostomy tube is advisable.

Post operative pain in tubeless PCNL is secondary to inflammation along the nephrostomy tract and stretching of the renal capsule¹¹. Nephrostomy tract infiltration with local anesthesia has found to be effective in patients undergoing PCNL in relieving pain⁸⁻⁹. Parikh et al¹² reported the duration of analgesia is more with Ropivacaine when compared

to bupivacaine. Jonnavithula et al¹³ reported the addition of opioids to bupivacaine increased the duration of analgesia. In our study addition of dexmedetomidine to Ropivacaine resulted in longer duration of analgesia. The analgesic dose requirement was significantly lower in Ropivacaine with dexmedetomidine when compared to placebo group. Post operative change in serum creatinine was not significant when both groups were compared.

The overall success rate of tubeless PCNL in our study is 94.2% which is comparable to the stone free rate reported by Sofer et al¹⁴. The success rate of tubeless PCNL was higher when the stone size was small (< 1.5cm) and in radioopaque stones.

The study is limited by the absence of glomerular filtration rate estimation before and after surgery and absence of Ropivacaine alone arm to justify that Ropivacaine and dexmedetomidine is superior to Ropivacaine alone.

Conclusion

Nephrostomy Tract block of Ropivacaine and Dexmedetomidine significantly reduces analgesic requirement in renal failure patients undergoing tubeless PCNL for renal and proximal ureteric calculus.

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