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Tubeless percutaneous nephrolithotomy, are there any real benefits?

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Abstract

Aims & objectives: To assess the benefits of Tubeless PCNL [T PCNL] with regard to cost, tolerability over conventional PCNL [C PCNL].

Materials and Methods: This prospective study included patients undergoing Percutaneous nephrolithotomy during a period between 2007 to 2017. The selection criteria for placing the patient in tubeless arm were - Maximum stone burden of 3 cm; Single access tract; Minimal or negligible hemorrhage during the procedure; Operative time of less than two hours; lack of collecting system perforations; clinically insignificant residual fragments. In those who met the criteria antegrade stenting was done without a nephrostomy. In those patients, who did not full fill the inclusion criteria, a 24 F Nephrostomy tube was placed at the end of procedure.

Results: The study cohort included 373 patients consisting of 211 males and 162 females in 3rd to 5th decades of their lives. Those under T PCNL and C PCNL arms were 301 and 72 respectively. The stone size varied from 17-27 mm with a mean of 22 mm. The procedure time varied between 35 to 97 minutes with a mean of 66 minutes. The T PCNL arm was analyzed with regard to Analgesic requirement; Duration of hospital stay and the total cost of the treatment and compared with those under C PCNL.

Patients under had their catheter removed on 2nd postoperative day and discharged on the same day afternoon if the operative site did not develop any leak. For those under C PCNL, Nephrostomy was clamped at 48hrs if the drainage was clear and X KUB did not show any significant residual fragments. Re look procedure was planned if there bigger residual fragments. The pain was assessed using visual analogue scale (VAS) at 6, 12 & 24 hrs. Post procedure and analgesia was administered as per requirement. Majority of patients (90.7%), under T PCNL rated their pain perception highest (4-6) at 6 hrs., which came down to 2-4 at 12 hrs. They did not need any analgesia at 24 hrs., rating their pain at 1-2. mean of 3.9. The same under C PCNL was higher at 8-9 on VAS at 6 hrs, 6-8 at 12 hrs and 4-6 at 24 hrs. Parenteral Diclofenac the drug of choice for pain relief and the mean analgesic requirement was 75 mg of Diclofenac. The Analgesic requirement was higher under C PCNL arm. None required blood transfusion as the fall in hematocrit was negligible under T PCNL. The mean hospital stay in those who underwent T PCNL was 3 days as compared to 5 days under C PCNL.

Conclusion: Tubeless PCNL offers a significant benefit in terms of lesser analgesic requirement, shorter hospital stay but necessitates an additional procedure with cost in stent removal. By using stents with setons might obviate stent removal and hence the cost.

Keywords: Renal calculi, percutaneous nephrolithotomy, tubeless PCNL, safety

Introduction

Percutaneous nephrolithotomy (PCNL) is recommended option for renal and upper ureteric calculi especially those larger than 2 cms. Historically, at the end of the procedure nephrostomy tubes of varying caliber have been left for various reasons like drainage, tamponade of bleeding and to allow second look surgeries if necessitated. Bellman *et al.* in their landmark study in 1997, questioned the need for nephrostomy and highlighted the advantages of a tubeless approach like shorter hospitalization, lesser analgesic requirement and hence the cost of the procedure [1]. Subsequently there has been an increasing literature reiterating the benefits of T PCNL [1, 2, 3]. The tubeless approach involves alternatively from a 'no stent' or totally tubeless to providing internal drainage by insertion of a double J stent. The Authors present their experience of tubeless PCNL performed at over a period of a decade.

Material and methods

This prospective study was conducted over a period of a decade between 2007 to 2017. Patients with renal calculi larger than 2 cm were offered PCNL as the treatment option. The preoperative work up included IVU or Contrast CT abdomen, coagulation profile and urine culture &

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sensitivity. Culture specific or broad-spectrum antibiotics were administered preoperatively depending upon the culture results. Puncture and access were obtained under C-arm control in prone position and tract dilated to 30 F. At the end of the procedure, the decision to convert to Tubeless procedure was taken if the inclusion criteria were met. In those who did not, 24 F Nephrostomy was placed and clamped in those with significant bleeding.

The patients were asked to rate the intensity of pain using visual analogue scale (VAS). Visual analogue scale is a subjective measure of pain with patient being asked to rate the intensity on a scale of 10, with the end points being No pain (1) and Worst pain imaginable (10). VAS was administered at 6, 12 and 24 hrs. after the procedure.

Hematocrit was repeated on first post-operative day and a X-ray KUB done to assess the residual calculi. In those under T PCNL arm, catheter was removed on second post-operative day and discharge planned on the same day if patient was asymptomatic. Nephrostomy was clamped after 48 hrs. in those who underwent C PCNL, if the drainage was clear and if the fragments were insignificant. The operative time, change in hematocrit, presence of urinary leakage, analgesic requirement, duration of hospital stay and return to normal activity were recorded.

Results

A total of 373 patients including 211 males and 162 females, with renal calculi larger than 2 cm were offered PCNL as mode of treatment. Patients were aged between 21-60 years with a mean of 40.5 years (Table 1).

Patients presented with dull ache (); frequency of micturition (); hematuria () and dysuria (). Majority of the stones on Intravenous Urography (IVU), had renal pelvic stones (%), followed by (%) in inferior calyx. Very few had stone in superior calyx (%). The average stone size was 22 mm (17-27 Cms). (Table 2).

Out of 211 under T PCNL, 178 (80.5%) had infracostal tract and 33 (14.92%) supracostal tract. On the other hand, 125 out 162(77.16%) of C PCNL had infracostal punctures, rest required supracostal punctures. Mean duration of surgery was 48.33 minutes for T PCNL and 84.33 minutes for C PCNL (Table 3).

Perception of pain and requirement of analgesia was assessed at 6, 12 and 24 hrs by Visual Analogue Score (VAS). Mean VAS score for patients in T PCNL arm was 3.9 (range of 2-6) and for those under C PCNL Was 5.7 (range of 4-9). The pain perception under T PCNL improved as the duration after procedure increased with no patient requiring analgesia after 12 hrs. On the contrary, in those who had C PCNL, the pain perception was marginally better with many requesting analgesia even after 36 hrs. As pain perception was lower with increasing duration after surgery, Analgesia requirement was low under T PCNL (mean of 75 mg v/s 300 mg of Diclofenac for C PCNL). Fall in hemoglobin after the procedure was lower in T PCNL arm (Mean of 0.53 g/dl; range of 0.4 to 0.6 g/dl) as compared to

those under C PCNL (Mean of 0.8 g/dl, range of 0.4 to 1.2g/dl). None of the patients required blood transfusions. Mean hospital stay for T PCNL was 3 days as compared to 5 days in C PCNL (Table 4).

The post op complications are listed under (Table 4). It is useful to note that 92 (56.79%) patients under C PCNL had nephrostomy site leak, which settled in majority of patients by watchful waiting and 22(23.91%) of them required retrograde stenting. Both of which necessitated prolonged hospital stay and additional cost.

36(22.2%) patients under C PCNL, had significant residual fragments which needed ancillary procedure like second look PCNL and ESWL both of which increased the cost of treatment.

Table 1: Demographic characteristics of study participants.

Age (in years)	Number (N)	Percentage (%)
21-30	90	24.12
31-40	150	40.21
41-50	110	29.49
51-60	15	4.02
	8	2.14
Sex		
Male	211	56.56
Female	162	43.43
Total	373	100

Table 2: Distribution of participants as per pre-operative evaluation

Symptoms	Number (N)	Percentage (%)
Dull aching pain	239	64.07
Increasing Frequency	80	21.44
Haematuria	33	8.84
Dysuria	21	5.63
Stone location (as per intravenous urography)		
Renal Pelvis	331	88.73
Inferior Calyx	30	8.04
Superior Calyx	12	3.21
Average stone size in mm (as per KUB)		
10-15	50	13.40
15-20	221	59.24
21-25	61	16.35
25 – 30	41	10.99
Total	373	100

Table 3: Duration of Surgery

Mean duration of Procedure (minutes)	T PCNL	C PCNL
31 – 40	54	10
41 – 50	206	21
51 – 60	51	41
Total	301	72

Table 4: Post-Operative complications

Complications	T PCNL	C PCNL	(%) T PCNL	% C PCNL
Wound Infection	1	-	0.26	-
Haematuria	35	20	9.38	27.77
Fever	18	10	4.82	13.88
Total	54	30	14.46	41.66

Discussion

Any treatment option for larger stones should aim at reasonable clearance of stone bulk with or without additional procedures at a reasonable cost ^[4]. For a given size of stone, duration

hospitalization has a direct bearing on the cost of the procedure. Since the beginning, Nephrostomy placement at the end of the procedure was an important step purportedly to drain the kidney and reducing bleeding by tamponade. This was challenged by

Bellman *et al.* [1] in 1997 and proven over and over again by subsequent published literature [2, 3, 5]. The proven advantage are shorter hospitalization, lesser analgesia and hence total cost of the procedure. Though our study was descriptive we feel valid conclusions can be drawn from the study.

The comparison was dealt in comparative outcome measures like Duration of procedure; Post-Operative pain scoring and analgesic requirement; Hospital Stay & Cost; Requirement of ancillary procedures and Complications, Major as well as minor. Duration of Procedure was more for conventional PCNL in our study as compared to Tubeless PCNL. In a systematic review, Tarik Amer *et al.* [6] analyzed 20 studies which compare the duration of procedures- 13 of the studies demonstrated lesser duration for T PCNL, though data culled from only one study could be proven statistically significant [7]. In only two studies, the Tubeless procedure was longer than the conventional [8, 9] but another study analyzing their results proved it to be statistically insignificant [10].

Post-operative pain scoring by Visual Analogue Scoring in our study was considerably less for T PCNL in contrast to C PCNL. Numerous studies have documented statistically significant decreases in pain scoring in the Tubeless arm at 24 hrs [7, 8, 11]. In our study the pain scoring improved as duration increased with maximum scores at 6 hrs. and lowest at 24 hrs. We did not compare the scores for the two arms at one-week post op. The same has been shown statistically insignificant. The analgesic requirement was also lesser in tubeless procedure as has been reported in literature [12, 13]. The average requirement for analgesia was 75 mg of Diclofenac under tubeless arm as compared to 300mg of the same in those under conventional arm. The same is corroborated by other similar studies.

The post operative fall in hemoglobin was slightly lower for T PCNL (Mean of 0.5 v/s 0.8 g/dl) as compared to conventional PCNL, possibly due to larger stone size and longer duration of procedure. No patient in either arm required blood transfusions. In the series presented by Tawfiq *et al.* [14] the fall in hematocrit was far greater in conventional PCNL and was explained by complex and larger stones requiring multiple tracts aimed for complete clearance.

The hospital stay for patients of T PCNL was shorter as the catheter was removed at 48 hrs and in the absence of operative site leak, they could be discharged on the same day. The same has been reported by numerous studies available in the literature. In the series of Lojanapiwat B, Soonthornphan S, Wudhikarn S. [15] the average length of hospitalization was 3.63 days and in the series of Gupta NP, Mishra S, Suryawanshi M *et al.* [16] The same was 1.8 days. Hospital stay in our study is comparable to both the series.

The Average cost of the procedure was lesser for T PCNL in our study as compared to C PCNL. Feng *et al.* [17] in their studies showed that the costs for tubeless with stent was significantly less as compared to Tubed PCNL. The requirement for an ancillary procedure was higher in Tubeless group. Most were ESWLs if we exclude cystoscopic stent retrievals. But the difference was not significant. Since the criteria to put the patient in tubeless arm was lower stone size and presence of insignificant residual fragments, post-operative KUB X ray corroborated the findings. Those few patients of Tubeless PCNL who had significant residual fragments could be easily cleared with ESWL.

Post-operative complications under tubeless arm were minimal and included such as hematuria, post-operative fever and wound infection as observed in 6 patients (15%), most being under grade 1 by Clavian-Dindo scale. Some under conventional had

persistent nephrostomy site leak which required DJ stenting (Clavian-Dindo grade 3). Pascal M, Romain S, Harve L [18] reported post-operative complication rate of 15% (5 patients). Low rate of post-operative complications reflects the safety of tubeless PCNL.

Conclusions

Tubeless PCNL in carefully selected patients is a safe procedure which carries lower morbidity, shorter hospitalization and hence lower cost. Though the procedure involves an additional procedure of stent removal, more frequent usage of stent with setons will even obviate the same.

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