Original Article

Tubed vs Tubeless PCNL in children

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Abstract

Objective: To compare post-operative outcomes between tubeless and conventional large-bore nephrostomy tube drainage following percutaneous nephrolithotomy in children.

Methods: The study comprised 54 patients under 14 years of age who were undergoing percutaneous nephrolithotomy at 60 renal units and met the inclusion criteria. They were randomised to placement of a 16F nephrostomy tube (Group A, 30 renal units) or tubeless drainage (Group B, 30 renal units) at the end of the procedure. Patient age, number and position of stones, operating time, change in haemoglobin, post-operative analgesia requirement, length of hospital stay and post-operative complications were compared between the two groups, using SPSS version 17 and t test.

Results: Group A had 28 patients, while Group B had 26. The mean age in Group A was 7.2±3.2 years, and in Group B it was 6.3±3.6 years (age range 3-13 years and 1-13 years respectively). The mean size of stone was 28.6±16.7mm and 20.4±9.3mm; mean change in Hb was 0.78±0.69mg/dl and 0.63±0.54mg/dl; and the mean operating time was 54±20.7 minutes versus 66.9±22.9 minutes in the two groups respectively. There was significantly less requirement for post-operative pethidine in Group B versus Group A (p=0.01). The post-operative clearance and complications were comparable between the two groups, while the duration of hospital stay was significantly shorter in Group B compared to Group A (p=0.007).

Conclusion: Tubeless percutaneous nephrolithotomy in children is safe and effective. Post-operative analgesia requirement is less and hospital stay is shortened compared to the conventional nephrostomy placement after percutaneous nephrolithotomy.

Keywords: Paediatric urolithiasis, Percutaneous nephrolithotomy, Nephrostomy tube. (JPMA 62: 892; 2012)

Introduction

Percutaneous nephrolithotomy (PCNL) is currently recognised as the standard method of managing renal stones that are not amenable to extracorporeal shockwave lithotripsy (ESWL). The placement of a nephrostomy tube at the end of the procedure is considered standard practice. However, an increasing number of studies have shown that a ureteric stent is sufficient to ensure adequate drainage in uncomplicated cases. The advantages quoted are decreased post-operative pain and shorter hospital stay.[1-8] In our practice, we see a large number of children with stone disease, and have not found age and weight to be a barrier to performing PCNL successfully.[9] This study was conducted to compare our experience of performing tubed and tubeless PCNL in children. To our knowledge this is the first series comparing the two procedures in children.

Patients and Methods

All children ages 14 years and below undergoing percutaneous nephrolithotomy (PCNL) at The Kidney Centre, Karachi under the care of a single surgeon (ZZ) between January to August 2008 were included in the study. It was an analytical case controlled study. During this time 54 children requiring PCNL in 60 renal units met the inclusion criteria. Selection was in consecutive patients with first patient assigned to Group A (placement of the nephrostomy tube, n=30 renal units) and second patient to Group B (no tube drainage, n=30 renal units) and this alternation continued till there were 30 renal units in each group. If a child underwent bilateral PCNL, then both renal units underwent the same fate i.e tubed or tubeless. Inclusion criteria defined were stone size larger than 1.5 cm, no perforation or tear in pelvicalyceal system during procedure, absence of anatomical obstruction e.g. pelviureteric junction obstruction (PUJO), single puncture for achieving access tract, absence of significant bleeding during the procedure, no other procedure performed under same anaesthesia and no previous surgery or minimally invasive procedure on the ipsilateral kidney.

Each child was reviewed in the outpatient clinic with an intravenous pyelogram. After a decision for PCNL was taken, the child was admitted one day prior to the surgery and a complete blood count, serum urea, creatinine and electrolytes were obtained. Under general anaesthesia, the child was placed in the lithotomy position, a ureteric catheter was passed up to the kidney(s), the contrast was infused and anatomy of the pelvicalyceal system was visualized using fluoroscopic guidance. A Foley catheter was passed, and the patient was turned to the prone position. Percutaneous access was gained with a 17F nephroscope after serial dilatation with semi-rigid fascial dilators. Stone(s) were fragmented using a pneumatic lithoclast and an attempt to achieve complete clearance was made. If all points in the inclusion criteria were met, patients was alternately assigned to groups A or B. A 16F Foley catheter with its balloon port cut was inserted in the first group and anchored with a deep mattress suture using 2/0 nylon. In the latter group, after the removal of nephroscope, a deep mattress suture was applied with a covering waterproof dressing. NSAID suppository was placed in each child at the end of the procedure, and on a routine basis for the first 48 hours. Additional intramuscular pethidine was prescribed on an SOS basis, and total amount in mg was calculated until the time of discharge. Patients in Group A were discharged after the removal of the ureteric catheter, Foley catheter and nephrostomy tube. Children in Group B were discharged after the removal of the ureteric and Foley catheters, once the dressing was found to be dry. A follow-up out-patient visit was scheduled one week post-discharge. Ultrasound scan was done in the first 17 patients of Group B in the post-operative period, but no collection was observed in any of these patients. This practice was, therefore, discontinued on a routine basis.

Data on patient age, number and position of stones, operating time, change in haemoglobin, post-operative analgesia requirement, length of hospital stay and post-operative complications were recorded and compared between the two groups. Data was analysed using SPSS version 17, and the two groups were compared using T-tests to see if there was a significant difference between the groups with a cutoff p-value of 0.05.

Results

Both groups were comparable in their demographic characteristics. Group A included 2 patients and Group B included 4 patients who underwent bilateral simultaneous PCNL. Group B also included one child with horseshoe kidney with a single stone in one moiety. A tubeless PCNL was successfully carried out through a single puncture in that case.

The mean change in haemoglobin was less in Group B compared to Group A, but this was not found to be statistically significant (P=0.46). The mean stone burden was lower in Group B compared to Group A, but conversely the mean operating time was found to be higher in Group B. Both trends were found to be statistically significant (p= 0.023 and p=0.025 respectively) (Table).

Post-operative ultrasound scans were done in 17 of the patients in Group B, just to be certain that there was no post-operative collection. In all the 17 cases, no evidence of leakage or collection was found.

Postoperative complications were seen in 5 children

Table: Demographic and clinical data of the two groups.

	Group A - nephrostomy tube	Group B - tubeless	p-value
Number of patients	28	26	-
Number of renal units	30	30	-
Male:female	15:13	16:10	-
Mean age	7.2 years ± 3.2	6.3 years ± 3.6	-
Age range	3-13 years	1-13 years	-
Size of stone (mean)	28.6 mm ± 16.7	20.4 mm ± 9.3	0.023
Mean change in Hb	0.78mg /dl ± 0.69 (range 0-3.3)	0.63 mg/dl ± 0.54 (range 0-2.1)	0.46
Mean operating time (minutes)	54.0 ± 20.7	66.9 ± 22.9	0.025
Ureteric stent in situ	30	29	-
Duration of retaining stent	1.5 days ± 1.3	1.0 day ± 0.2	0.08
Post op abdominal tenderness	Nil	Nil	-
Analgesic (pethidine) requirement	6.8 mg. ± 14.0	1.12 mg ± 1.2	0.01
Urinary leakage	Nil	Nil	-
Post Op USS	0	17	-
Collection present	-	0	-
Post Op duration of hospital stay	2.4 days ± 1.3	1.6 days ± 0.7	0.007
Post Op complications	5 (16.7%)	9 (30%)	-
Stone clearance	26 (86.7%)	28 (93.3%)	-
Post-operative ESWL	4 (13.3%)	2 (6.7%)	-
Final complete clearance	30 (100%)	30 (100%)	-

ESWL: Extracorprial Shock Wave Lithotripsy. USS: Ultrasound Scan. Hb: Haemoglobin.

in Group A. This included 2 who developed urinary tract infection and 3 had fever with no identifiable reason. In Group B, 5 children had post-operative urinary tract infection while 4 children developed fever. In all cases, urinary tract infection was culture-proven and was treated successfully with antibiotics. In each child with fever, no cause could be ascertained and urine cultures showed no growth. The fever settled within 24 hours without any specific treatment.

The post-operative analgesic requirement was significantly less in Group B compared to Group A (P=0.01). The hospital stay was also significantly shorter for Group B (p=0.007).

Discussion

Percutaneous nephrolithotomy (PCNL) has become the standard surgical approach for most renal stones. With the widespread use of this technique, its safety in a wide variety of clinical situations, including use in small children, has been reported.[9] The recent focus has been to minimise patient discomfort and hospital stay following PCNL in uncomplicated cases. In this regard, recent literature has looked at either the use of small-bore nephrostomy tubes or eliminating the use of nephrostomy tubes, double J stent (DJS) and externalised ureteric catheters.

The cited reasons for placement of a nephrostomy tube include aiding haemostasis, decreasing urinary leakage, promoting healing, providing reliable drainage and providing access for further endoscopic procedure or chemolysis.[3,10] Pain around the nephrostomy tube is one of the major patient concerns following a standard PCNL. Infiltration of a local anaesthetic around the nephrostomy tube has been shown to significantly reduce pain scores and analgesic requirements.[11] A study has advocated using a nephrostomy tube following all PCNL procedures, while acknowledging that a small-bore tube decreases patient discomfort.[10] The emphasis on decreasing pain and the duration of hospital stay following PCNL encouraged the development of the tubeless PCNL technique, whereby the placement of nephrostomy tube was eliminated in uncomplicated procedures. Since the first reported series of 50 tubeless PCNLs in 1997,[12] there have been a number of reports supporting this technique. Tubeless PCNL has been reported with success in all age groups, with safe results in even the very elderly.[13] A comparison of 11 randomised studies on tubeless PCNL summarised that in all studies the outcomes and complication rates were comparable between tubeless PCNL and standard PCNL.[8] Nine out of these eleven studies demonstrated patient comfort to be superior in the tubeless PCNL group. They concluded that this was a safe procedure even in solitary kidney, previous ipsilateral renal surgery, raised serum creatinine levels, bilateral synchronous PCNL or contralateral endourological stone treatment. Another randomized comparison between standard and tubeless PCNL cited significant decrease in pain, analgesic requirement, urinary leakage, hospital stay and post-operative convalescence in the tubeless group.[4] The complications were comparable between the two groups.

Beiko et al[14] have reported the first "completely

tubeless" PCNL. They did not use a nephrostomy tube, DJS or ureteral stent, and performed the procedure on an out-patient basis, with the patient going home 4 hours after leaving the operating room. The post-operative course was uneventful. Completely avoiding the use of stents has been shown to be successful by Gupta et al.[15] They cite DJS insertion to be costly and requiring separate stent removal. Karami and Gholamrezaie[6] also reported a series of totally tubeless PCNLs with satisfactory results.

Minimising patient discomfort by eliminating the use of nephrostomy tubes has a direct impact on decreasing the duration of hospital stay. However, an equal emphasis needs to placed on minimising the number of post-discharge hospital visits that the patient is required to make. Several authors[2,4,5,8,13] have reported routine placement of DJ stent following tubeless PCNL in adults with a short hospital stay. In a review of 86 patients, Limb and Bellman have reported same-day discharge following a tubeless PCNL with DJS placement.[16] They showed an average hospital stay of 1.25 days in this series, and an even shorter duration of stay (average of 0.6 days) in a previous publication by the same group.[12] However, their patients were required to return to the clinic the following day for removal of Foley catheter and haematocrit verification. The presence of the DJS necessitated an additional visit to hospital 1 week post-operatively for removal. In a resource-poor community like ours, repeated hospital visits are a significant burden on the patient and family. Almost half of our stone patients are children and this means an additional admission and general anaesthesia to remove the DJS. Some children do not tolerate a DJS well, and complain of persistent discomfort. It is, therefore, preferable to externalise ureteric catheter initially reported by others.[3,17,18] In our opinion, a ureteric catheter is convenient to remove along with the Foley catheter on post-operative day 1 or 2, and offers the advantage of allowing clearance of residual fragments, without the disadvantages of a DJS. In a previously reported series,[9] a second look through the nephrostomy tract was not required in any of the patient, and leaving a tract behind for that purpose may not provide benefit to the patients.

Bilateral simultaneous tubeless PCNL was performed in 4 of our patients with satisfactory results. Similar success has been reported by Shah et al.[2] This reinforces is in line with previous studies[9] whereby meticulous technique ensured that PCNL can be performed safely in children.

Early ultrasound scans (within 72 hours of the PCNL) not surprisingly showed perinephric fluid, while a repeat scan one week following surgery invariably showed complete resolution.[3,4,19] Our initial scans at 1 week post-op were so reassuring, that we discontinued this as a routine practice and encountered no problems clinically.

Bleeding remains a source of concern in the absence of a nephrostomy tube to tamponade the tract. In a series of 99 patients undergoing tubeless PCNL, Gisuti et al,[1] reported two instances of major bleeding which required urgent radiological intervention and embolisation. The use of diathermy as an adjunct to the tubeless technique has been suggested,[19] with no effect on operative time and drop in haemoglobin, but significant decrease in hospital stay and analgesic requirements. Fibrin sealant has also been used with good results.[20] However, the number of patients in this study was small with no comparison group. We achieved satisfactory results even in small children without the use of diathermy or sealants. While these techniques may add to the safety of the procedure, we are of the opinion that they are not routinely required.

The absence of validated pain questionnaires and a limited number of cases were two limitations of our study.

Conclusion

As shown by the results, tubeless PCNL is as safe and effective in children - as it has proved to be in adult patients. Consistent results of minimal patient discomfort and a significant reduction in hospital stay are huge advantages in a population where urinary stone disease is very common.

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