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Percutaneous Nephrolithotomy In The Management of Pediatric Renal Calculi

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ABSTRACT

Introduction and Aim: In india there is a high prevalence of Urolithiasis both in adults as well as in children. Minimally invasive techniques for the treatment of urinary calculi in children are recommended due to an increased probability of stone recurrence. Percutaneous nephrolithotomy (PCNL) is an established technique used in children with renal calculi. The concerns with PCNL include the use of large instrument in pediatric kidneys, parenchymal damage and the associated effects on renal function, radiation exposure with fluoroscopy, and the risk of major complications including sepsis and bleeding.. We report our experience with PCNL for treating nephrolithiasis in children. The aim of this study was to assess the safety and efficacy of PCNL in the treatment of pediatric renal calculi

Methods :We retrospectively analyzed the results of PCNL in 22 children treated at our institute over a period of three years. The safety, efficacy, and outcome were analyzed and compared.

Results:A total of 22 children underwent PCNL. A total of 25 renal units were operated upon . The a mean age of patients was 9.5 years (2-15 years) .The average calculus size was 1.91 cm (1.5-3.3 cms). 23 units could be managed with a single tract, while 2 required multiple tracts. One patient had excessive intra-operative hemorrhage, for which she underwent open exploration with complete stone clearance, this patient had undergone dilatation to 30 Fr and also required post operative blood transfusion .The average hemoglobin drop was 1.05mg%.There was no grade III, IV, V complications and no angiographic embolization required in pediatric group .24 out of 25 renal units (96%) were stone free at the time of discharge.

Conclusions: Percutaneous nephrolithotomy is a suitable and safe procedure in children including pre-school age group for both simple and complex stones.

KEYWORDS pediatric , percutaneous nephrolithotomy , renal stone

Introduction and Aim

Paediatric stone disease is an uncommon condition which is often complex and related to underlying metabolic or renal anatomical abnormalities where high recurrence rates are seen. The management of renal stones has changed over the past few decades from open surgery to a minimally invasive approach. Extracorporeal shock wave lithotripsy (ESWL) was pioneered in the 1980s and established itself rapidly as a good treatment option in children but it can be limited by patient compliance and may require general anaesthesia. ESWL has been shown to be effective, safe and to achieve good stone fragmentation rates but bulky stones can lead to large ureteric fragments that can be difficult to manage in children. Paediatric percutaneous nephrolithotomy (PCNL) was first described in 1985 and allows the treatment of patients with a larger stone burden or those in whom ESWL is contraindicated or unlikely to be successful.

Percutaneous nephrolithotomy (PCNL) is widely performed in the treatment of kidney stones in children. [1] Factors contributing to its safety, efficacy and popularity are improved instrumentation, miniaturization of endoscopes, better anesthesia drugs monitoring and improved surgical techniques . [2] Despite these, concerns remain especially as PCNL is a major surgical exercise in pediatric age group. [2,3] The concerns with PCNL include the use of large instrument in pediatric kidneys, parenchymal damage and the associated effects on renal function, radiation exposure with fluoroscopy, and the risk of major complications including sepsis and bleeding . [2,3,4] Evolution of pediatric PCNL technique such as miniaturization of instruments, limitation of tract size and advanced intracorporeal lithotripters have resulted in this technique being widely utilized for achieving stone-free status in appropriate patients . [1,5 6]

The aim of this study was to assess the safety and efficacy of PCNL in the treatment of pediatric renal calculi

MATERIALS AND METHODS

We retrospectively analyzed the results of PCNL in 22 children treated at our institute between Jan 2008 and Feb 2011. The operations were performed under fluoroscopic guidance. Factors studied were : PCNL route, Calyceal access, Number of tracts Operative time, Hemoglobin drop, Stone clearance, Post operative creatinine change and Complications

RESULTS

A total of 22 children underwent PCNL A total of 25 renal

units were operated upon .Three patients underwent bilateral PCNL. The mean age of patients was 9.5 years (2-15 years) .The average calculus size was 1.91 cm (1.5-3.3 cms) .The mean operating time was 75.95 minutes . 22 units could be managed with a single tract, while 2 required multiple tracts. Supracostal access was done in 3 (12%) patients and infracostal (88%) in 22 patients.Access was upper pole puncture in 3, posterior middle calyx in 11, lower pole calyx in 8, and multiple in 3.Dilatation size was 30 Fr in 2, 26 Fr in 1, 22 Fr in 10, and 18 Fr in 12.Lithotripsy was done using 22 Fr nephroscope in 12 cases, 26 Fr in 2 cases , ureteroscope in 10 cases, and pediatric cystoscope in 1 case .

One patient had excessive intra-operative hemorrhage, for which she underwent open exploration with complete stone clearance, this patient had undergone dilatation to 30 Fr and also required post operative blood transfusion The average hemoglobin drop was 1.05mg%. 24 out of 25 renal units (96%) were stone free at the time of discharge, with 1 patient requiring relook PCNL after 1week. The average hospital stay in our study was 6 days.

Discussion

The management of urolithiasis in children is still evolving. PCNL is an effective treatment option for large upper urinary tract stones in children. However, the less robust and smaller pelvicalyceal system, the hypermobility of the kidney, and the lower tolerance of blood loss in children were some of the factors making this procedure more challenging.[7] Many studies now have shown the efficacy and safety of pediatric PCNL. [,3,4 8] In our study too PCNL was performed successfully in all but one patient . Although debatable, indications for PCNL as primary therapy in children include large upper tract stone burden (greater than 1.5 cm, lower pole calculi more than 1 cm, concurrent anatomical abnormality impairing urinary drainage and stone clearance, or known cystine or struvite composition . [9] . In our study the average stone size was 1.91 cms and two patients had staghorn calculi which required multiple tracts. Both of these patients did well and none required blood transfusions, again demonstrating that PCNL is safe in this subpopulation.

Since the advent of PCNL in 1976, the techniques have been greatly improved. Instrument size is a major concern in the paediatric population . There are studies that have compared instrument and tract size in PCNL and complication rates. Bilen et al looked at a cohort of 46 paediatric patients and compared using adult instruments via a 26Fr tract, paediatric instruments via a 20Fr tract and minimal access via 14Fr tract. [1] They found that smaller tracts did not significantly affect stone-free rates but achieved lower transfusion rates.. The drawback with pediatric instruments is small instrument port, which necessitates use of small probes and forceps .[8,10] The advantages of larger instruments are better visibility, quick, effective stone fragmentation and retrieval using adult size energy probes and stone graspers. One can avoid buying separate pediatric set of instruments which may result in considerable cost saving for a department in a developing country . [6,8,10,11] 22 of our patients had 22 Fr size or less tracts and we did not have any major complications .In our study the stones were completely removed using slender nephroscope (22Fr), ureteroscope (8-9.8 Fr) and pediatric cystoscope. The procedure was associated with a low complication rate (4%), where only 1 patient required blood transfusion.Assessing the factors affecting hemoglobin drop only the size of the tract was found to be significant. Using multiple tracts when necessary avoids the excessive use of torque to gain entry into adjacent calices, which may cause infundibular tear and bleeding[6,12,13,14] . Two of our patients had multiple tracts with no complications. We believe that judiciously making multiple tracts does not significantly increase intraoperative complications and transfusion.

Zeren et al ., reported a 24% incidence of hemorrhage requiring transfusion.[8,] Chest complications are known after supracostal percutaneous access. The majority of hydrothoraxes are asymptomatic, and intervention is required in only a small percentage of patients. Another potential complication of percutaneous nephrolithotomy is hypothermia, especially in this age group . [9,10] The decrease in body temperature is correlated with the duration of the procedure and preoperative preparation.[9,11,12] In our study there were no major complications. Transfusion was required in only one patient and in this patient tract size was 30 Fr. None of our supracostal puncture patients had any chest complications. We used intra-operative chest fluoroscopy at the end of the procedure to identify a fluid collection and had a chest Xray on second post operative day. The local damage to the renal cortex and parenchyma during PCNL should also be considered. Some authors have reported cortical defects (renal scars) on Tc-DMSA (Tc99) scan in these patients. [5,15,16] Last but not the least, the radiation exposure to the pediatric patient population should be minimized. Obviously the less the renal puncture, the less the radiation is required.

Our average hospital stay was comparatively higher . The cultural difference in the Indian health care kept our postoperative hospital stay longer than many other countries. In the U.S. as well as many other western nations, the removal of nephrostomy tube and management of nephrostomy tract drainage were done on outpatient settings; whereas, in India, it is socially unacceptable for the patients to go home with tube in place or with urine drainage.[8,17,18] On the other hand, our hospital stay was only a fraction of cost as compared to the others.[19,20]

Conclusion

PCNL is a suitable and safe procedure in children for both simple and complex stones Miniaturization of instruments, particularly smaller nephroscopes and newer energy sources will decrease the morbidity and improve the clearance rates.

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