

Management of Lower Urinary Tract Stones in Paediatric Population. A Comparison of Endoscopic versus Open Procedures

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Abstract

Objective: To compare the safety and efficiency of endoscopic treatment methodology vs open surgical procedures in pediatric lower tract stone disease.

Method: This study was conducted in Department of Urology, Karachi Medical and Dental College & Abbasi Shaheed Hospital, from July 2010 to December 2012.

The characteristics of the patients in the two groups, and the outcomes of the two procedures, the endoscopic treatment (Group A) vs. the open surgery procedure (Group B) for lower urinary tract stone disease, were compared.

Results: In both groups, age range was 1 to 16 years with male to female ratio was 2:1 and 1.7:1. In group A and B in that order, size of stone was 0.8 to 1.6cm and 0.7 to 2 cm, average duration of surgery was 39 and 31 minutes. Stone clearance was 98 and 100 percent respectively. Total post operative hospital stay was 18 to 24 hours in group A, and 5 to 10 days in group B patients. The post operative duration of indwelling catheter was 0.8 to 1 day in Group A, and 5 to 15 days in Group B. No drains were placed in group A patients while group B patients had drains for minimum duration of 2 days. Significant wound infection was found in group B patients.

Conclusion: Endoscopic management of lower tract stones in paediatric population is the more effective treatment modality with minimum complications, short duration of indwelling urethral catheter and minimum procedure related hospital stay.

Keywords: Vesical calculi, indwelling catheters, wound infection, pediatric, endoscopes. (ASH & KMDC 19(2):56;2014).

Introduction

There is a high incidence of urinary stone disease (8-13%) all over the world¹. Different dietary, environmental and anatomical factors contribute in its prevalence². Malnourished child with imbalance protein deficient diet, are major factors responsible for high incidence of bladder stone in paediatric age group³. In our country high temperature, poor water quality, ignorance and poverty plays a major role for occurrence of stone disease⁴.

Historically in the paediatric population the treatment for such cases was open surgery i.e. Cystolithotomy^{5,6}. This procedure has been practiced from decades and has some important appreciable points i.e. easy to learn and to perform, quick, and almost hundred percent stone clearances rate⁷. However beside a scar on lower abdomen and its associated complications, open surgical method also demands prolong duration of indwelling catheter and abdominal drain placement. Both of these are associated with complications^{8,9,10}

In the adult population the algorithm for stone treatment has been completely revised in last two decades^{11,12,13}. The role of open surgery is declining and its application has become very limited¹⁴. In the paediatrics population the endoscopic management

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is still evolving¹⁵. Paediatric endoscopes with all basic accessories are not commonly available, surgical skills and expertise is also questionable.

The local urologists have little experience in the endoscopic treatment of paediatric patients with stones in the lower urinary tract, and not much data is available on this subject in our local population. Hence, we decided to conduct a study in the paediatric population who had stones in the lower urinary tract and compare the outcomes in the two treatment modalities, the endoscopic method and the open surgical method.

Patients and Methods

This comparative cross-sectional study was conducted among the paediatric patients with stone in lower urinary tract who attended the outpatient Urology Clinics of Abbasi Shaheed Hospital Karachi Medical and Dental College from July 2010 to December 2012.

All Paediatric population up to age 16 years of either gender with vesical stone size up to two centimeter were included in this study. Patients who were significantly underweight, malnourished, had impaired renal function, had upper urinary tract stones or urethral stricture disease were excluded from the study.

Ultrasound was used for the measurement of stone size^{16,17}. In history special emphasis was given to patients with a family history of stone disease, dietary and fluid intake habits. Radiological work up comprises of ultrasound of kidney, ureter, and bladder and X-ray KUB. Those who were stone passers or had upper tract stones, Intravenous Pyelogram (IVP) was recommended. Ascending Urethrogram was advised only in those patients where history was suggestive of bladder outlet obstruction or urethral stricture disease. Laboratory tests compulsory for all sample patients included, urine routine and culture sensitivity, complete blood count and renal function test. A preoperative anaesthesia evaluation was mandatory in study patients.

All patients were operated under general anaesthesia.

In Group A patients Cystolitholepaxy was performed. Wolf Ureterorenoscope (URS) and Pneumatic Swiss Lithoclast (PSL) was used for stone fragmentation and paediatric resectoscope sheath was used to evacuate stones gravels by Ellick evacuator.

In Group B patients, open Cystolithotomy was performed using Pfannenstiel's incision. Bladder was repaired in two layers by absorbable suture material. Peri vesical extraperitoneal drain tube was placed in all cases. Indwelling urethral catheter of size six to ten Fr. was mandatory in all cases for minimum duration of one week.

Data was analyzed via Statistical package for social sciences (SPSS) version 17. Quantitative (continuous) variables were presented as Mean and standard deviation (SD) while qualitative (categorical) variables were presented as frequencies and percentages (Table 1). Comparison of characteristics and outcomes were performed using t-test or chi-square test, as appropriate. A $p < 0.05$ was considered as statistically significant.

The characteristics of patients in the two treatment groups, Group A patients who had endoscopic procedure (cystolitholipaxy), and Group B patients, those treated with open surgical procedure, (Open cystolithotomy), were compared. Variables included, patient age, stone size, procedure duration, stone clearance, duration of post-operative stay in hospital, duration of post operative indwelling catheter, duration of drain placement, wound complication, fever, haematuria and re-do procedures were recorded and compared in two groups.

The outcome variable between the two groups were wound infection, haematuria (bleeding), duration of post-operative in hospital (in days), duration of post-operative indwelling catheter (in days), duration of surgical procedures (in minutes), need for a re-do procedure.

Wound Infection was defined as mild if there was only little hyperemia or cellulitis without dis-

charge, moderate if it is associated with purulent discharge with or without fever, and severe if purulent discharge with wound dehiscence.

Haematuria was defined as mild when urine color is light, patient clinically stable and it is self controlled within 6 hours. Significant red urine for more than six hour and patients needing bladder irrigation was considered as moderate. Severe haematuria was a condition which required blood transfusion and surgical re-explosion.

Results

In endoscopic treatment group (A), age range was 1 to 16 years, mean age was 4 ± 2 SD. Male to female ratio was 2:1. Average size of stone in this group was 1.2, with range of 0.8 to 1.6 cm and SD of 0.2 cm. The mean duration of surgery was 39 minutes, however after our first twenty cases; in many patients we were able to finish it in less than 20 minutes. Stone clearance was 98 percent. No drains were placed in this group. All except one who had residual fragment in endoscopy group, had indwelling urethral catheter for less than twenty four hours and their total post-operative hospital stay was only one day (Table 1).

Fever and haematuria were the commonest post-operative complications in this group. Twenty four percent patients developed fever, 9 had low grade and 3 had intermediate grade fever. Twenty percent patient had mild haematuria that was self controlled. There was mild hyperemia of urethral meatus in 3 cases. Only one child needed redo-procedure secondary to sizeable residual fragment (Table 1).

In open Cystolithotomy group (B), patient's age range was 1 to 16 years, with male to female ratio of 1.7:1. The average size of stone was 1.7cm with range of 0.7- 2cm and SD of 0.3 cm. The mean duration of surgery was 31 minutes with range of 15 to 60 minutes and standard deviation of 6 minutes. Because of impacted stone in bladder neck and prostatic urethra, in three patients the procedure duration was extended to 60 minutes. Stone clearance was 100 percent. Average post-operative hospital stay was 6 days, however in 12 patients because of wound infection and urinary leak it was extend to 10 days and in 3 patients who need re-exploration it was more than 10 days. The mean duration of indwelling catheter after surgery was 7 days, except in 6 patients where duration was ex-

Table 1. Comparison of Patient Characteristics between Endoscopic (Cystolitholipaxy) Group A and Open Surgery (Cystolithotomy) group B

Variables	Endoscopic Treatment (Mean±SD)* or n (%)**	Open Surgery Treatment (Mean ± SD) * or n(%)**	p-value
Patient's Age (in years)	4 ± 2	9 ± 4	
Stone Size (in cms)	1.2 ± 0.2	1.7 ± 0.3	
Procedure Duration (in minutes)	39 ± 8	31±6	
Stone Clearance (%)	49 (98)	50 (100)	
Re-Operation (%)	01 (2)	03 (6)	
Post op. Catheter Duration (in days)	1 ± 0	7 ± 6	
In situ Drain Duration (in days)	00	2 ± 5	
Total Post- Op Hospital Stay (in days)	1 ± 1	6 ± 9	
Fever	12 (24)	20 (40)	0.004
Haematuria	10 (20)	9 (18)	0.006
Wound Infection	3 (6)	20 (40)	0.001

*Mean ± SD for quantitative (continuous) variables

** n (%) for qualitative (categorical) variables

tended for two weeks. Three patients needed redo procedure in this group. All patient of this group had drain placement. Its mean duration was 2 ± 5 days with range of 2 to 6 days (Table 1).

The outcomes fever and wound infection were common in Group B compared to Group A. Forty percent patients in Group B developed fever, 6% had high grade fever for more than 5 days. Wound infection was the main complication in the open cystolithotomy group, 40% patient had wound infection. It was moderate in 18 children and severe with wound dehiscence in 4 patients. As compared to Group A, haematuria was less in Group B, 14% children had mild haematuria.

Discussion

Urinary “stone burden” is the commonest work load for an urologist that contributes for more than fifty percent of our in-patients ward load, and two third of our operative list load¹⁸. This general distribution gets more prominent when we have a stone patient with obstructive nephropathy, operative or post operative complications like urinary tract infection, wound infection or residual fragments that demands extended hospital stay and more surgical interventions¹⁹. All these factors contribute for prolong hospital stay, more pain and misery to the patient and his family. Financial strains to patients, hospital, and health ministry is also understandable. Keeping all above factors under consideration many new innovations were introduced in the recent past and now there is a very clear shift in treatment strategy of stone disease from open to endoscopic procedures²⁰.

In paediatric population the scenario has still not changed much. The reason for this is not that the importance of endoscopic procedures is less in this age group, but because proper endoscopic instruments and surgical skills to use them are not common. To emphasize the fact, the largest federal government Institute for child health in Sindh, Karachi does not have such facilities to treat this very common problem in children.

Even in this era, majority of general hospitals and some post graduate training centers including authors hospital, were performing cystolithotomy for a vesical stone, size less than one centimeter. As we mentioned in our comparison the operation duration, and stone clearance for open procedure is better, but these are not the only considerations. In this study though it's our learning curve but the comparison very clearly defines the main difference in the outcomes between the two treatment modalities. As far as total hospital stay of the patients, wound complications, duration of indwelling catheter and drains, the endoscopic procedures had a definite edge over conventional methods. Beside the immediate impact of surgery, the duration of prolonged indwelling catheter has its own complications. Urinary tract infection and urethral stricture disease are the major reservations after prolonged use of urethral catheter²¹. In cystolitholepaxy the duration of indwelling catheter is less than one day. In all trans-urethral procedures the chances of trauma to urethra is there. Trauma to urethra, bladder or even urethro-rectal and urethro-vaginal fistulas were reported in literature²². These horrendous complications can only be avoided by surgical skills, selection of appropriate instruments and careful handling of patient.

Wound is an essential part of all surgical procedures, but wound infection is not. Even during urethroscopy surgeon sometimes performed urethral meatotomy because of tight meatus. In our study a very high numbers of patient had wound infection that needs to be addressed aggressively. Poor socio-economic background, malnutrition and presence of prolonged indwelling urethral catheter and associated bacteriuria contributed towards its high prevalence. Comprehensive pre-operative patient evaluation to rule out infection, atraumatic tissue handling by avoiding excessive blunt dissection and diathermy use, good surgical techniques, and use of proper instruments and suture material can minimize the chances of wound infection.

Presence of the residual stone fragments after surgical procedure is bad for both patients and sur-

geon²³. The incidence of residual fragment after endoscopic surgery is high as compare to open methods²⁴. Mostly such residual fragments are those who were fragmented but could not be evacuated²⁵. In pediatric cystolitholepaxy it is extremely important to fragment stones as small as possible, evacuate them till the last piece and before completion, perform final check cystoscopy. The majority of fine residual pieces are evacuated by themselves after removing urethral catheter²⁶.

There was a time about 2-3 decades back when post-operative residual stone in the urinary tract was considered as failure of surgeon and procedure. It was because at that time open surgical procedures were the only treatment modality available. Now in modern urology we have many options available that includes extra-corporeal and intra-corporeal lithotripsy²⁷. In order to cut down extensive procedure duration and to minimize organ trauma, after major debulking we defer procedures and leave residual fragments for other treatment modality after few days^{28,29}. Recently since the last decade, urologists have started using laser energy for stone fragmentation. This further decreases the chances of residual stones, by its ability of stone evaporation^{30,31}.

Conclusion

Endoscopic treatment of vesical stone in paediatric population is a safe and effective method that has very clear benefits over conventional open surgical procedures. Before applying new methods of treatment, availability of instrument and surgical skills are important factors that impact on patient outcome and treatment success.

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