International Surgery Journal
Sharma E et al. Int Surg J. 2020 Jan;7(1):54-57
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20195604

Original Research Article

A comparative study on the use of holmium laser and pneumatic lithotripser for intracorporeal lithotripsy of upper ureteric stones

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Received: 07 November 2019
Accepted: 03 December 2019

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ABSTRACT

Background: In the last decade different minimally invasive modalities for management of urolithiasis have been available requiring an intelligent decision by the urologist to choose one as per patients need and preferences.
Methods: The present cross sectional study was conducted among patients who underwent ureterorenoscopic lithotripsy for proximal ureteric stones in the Department of Urology. Using consecutive sampling technique, patients were randomly allocated to two groups for treatment with either pneumatic lithotripser (group A) or Holmium laser lithotripser for fragmentation of calculi (group B) and the comparison of both these techniques was done.
Results: 117 patients were included (57 and 60 in group A and group B respectively) in the study. The difference in age in the two groups was found to be statistically significant (p=0.03). The total operative time, length of stay in hospital and complications were more in group A patients. The difference in two groups for total operative time and length of stay in hospital was statistically significant (p=0.00 and 0.00 respectively).
Conclusions: Holmium laser lithotripser has better safety profile when compared to pneumatic lithotripser especially in stone clearance rate and retropulsion rates and could be used as modality of choice in proximal ureteric stones.

Keywords: Ureterorenoscopic lithotripsy, Pneumatic lithotripser, Holmium laser lithotripser, Stone retropulsion

INTRODUCTION

Urinary calculi disease is the third most common complaint presented by patients in urology department after urinary tract infection and prostatic pathologies.[1] Several treatment modalities have been employed for removal of such ureteral stones. These include medical treatment for expulsion of stones or surgical management such as extracorporeal shockwave lithotripsy, percutaneous nephrolithotomy and ureterorenoscopic lithotripsy.[2] Removal of ureteric calculi is mostly done endoscopically anywhere.[3] Ureterorenoscopic lithotripsy has been the choice of urologists for removal of proximal renal stones.[4]

Ureterorenoscopic lithotripsy involves fragmentation of calculi by either a pneumatic lithotripser or holmium laser lithotripser.[5] Pneumatic lithotripsers are more commonly used by urologist because they are easy to use, easy to install and cost effective. Henceforth was providing a cheap modality of treatment to patients. However its use is limited by increased incidence of retropulsion of calculi in kidney and in fragmentation of larger calculi.[6] Being able to coagulate as well as vaporize tissue, holmium laser has emerged as a good alternative to pneumatic lithotripser with its ability to clear all types and sizes of stones. However its high setup cost and high maintenance cost limits its use in developing countries.[7]

In this study, we have tried to compare the two types of lithotripser for use in ureterorenoscopic lithotripsy in proximal ureteric stones.

METHODS

A cross sectional study was carried out in the Department of Urology, GMC Jammu from August 2015 to September 2017. The patients who underwent ureterorenoscopic lithotripsy for proximal ureteric stones during the study period were included. Patients with coagulopathy, pregnancy and any other renal abnormality or congenital defect were excluded from this study. Two categories of patients were made by non-probability consecutive sampling technique (group A and group B). Patients in group A were treated with pneumatic lithotripser while those in group B were treated with Holmium laser lithotripser for fragmentation of calculi. All the patients were subjected to all baseline investigations including complete blood count, kidney function test, urine culture, KUB (kidneys, ureters, bladder), chest X-ray, PT/INR and electrocardiography. Position of stone was confirmed either on an intravenous urography or non-contrast-enhanced computed tomography KUB. Consent was obtained from the patients in detail before starting the procedure, prophylactic antibiotics were administered prior to the procedure. 6 - 7.5F Semi rigid ureteroscope (Karl Storz) was used for the procedure. Procedure was done under general/spinal anaesthesia.

Fragmentation in group A was done with a pneumatic lithotripser, while fragmentation in group B was done with holmium laser (100) watts and energy levels were used at 1.2 J and 10 Hz with a 325 nm fibre. The particles that were fragmented were removed. Postoperatively after the procedure a double J stent was placed. Procedure time was counted after insertion of cystoscope to the placement of DJ stent. Patients were given post op antibiotics and analgesia.

The success of the procedure the criteria was determined by the stone free rate (i.e. percentage of no residual stones or stones less than 2 mm in dimension after the procedure). It was determined by KUB and USG in the postoperative periods at one month and six months interval.

Patients were also assessed for complications arising out of procedure such as haemorrhage, sepsis, retropulsion of stones, fever, colics and urinary tract disorders.

Statistical analysis

All the data collected was entered in Microsoft Excel. Mean±SD was calculated for quantitative data. Qualitative data was presented as percentages. Analysis was done using Open epi. ver 3.1. The tests of significance were chi square test for qualitative data and student t test for quantitative data. P<0.5 was considered to be statistically significant.

RESULTS

This retrospective study comprised of 117 patients who underwent ureterorenoscopic lithotripsy for proximal ureteric stones. Out of these 117 patients, 57 were placed in group A for whom pneumatic lithotripser was used for fragmentation of calculi while rest of 60 patients were placed in group B for whom holmium laser lithotripser was used.

Table 1: Preoperative parameters in two groups of patients.

Parameter	Group A	Group B	P value
Number (N)	57	60	
Mean age (±SD)	28±2.34	29±2.66	0.03*
Male/female ratio	44/13	49 /11	0.54
Laterality (L/R)	39/18	45/15	0.42
Mean stone burden (in mm)	14±2.4	14.6±2.1	0.59

The patients in group A were slightly more in age than the patients in group B, This difference in the two groups was statistically significant (p=0.03). The male: female ratio in group A was 3.38:1, where as in group B it was 4.45:1. In both the groups more number of stones were placed on left side as compared to right side, the L:R ratio being 2.16:1 in group A and 3:1 in group B. The mean burden of stones was slightly more in Group B patients as compared to group A patients. The difference in two groups for all these three parameters failed to achieve statistical significance (p=0.54, 0.42 and 0.59 respectively). Figure 1 gives the distribution of males and females in the two groups.

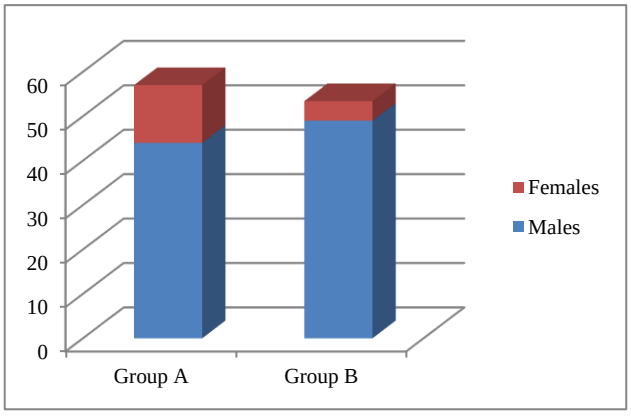

Figure 1: Distribution of males and females.

There were 39 patients (68.42%) with stones on left side and 18 (31.58%) on right side in group A while 45 cases (75%) had stone on left side and 15 (25%) on right side in group B (Figure 2).

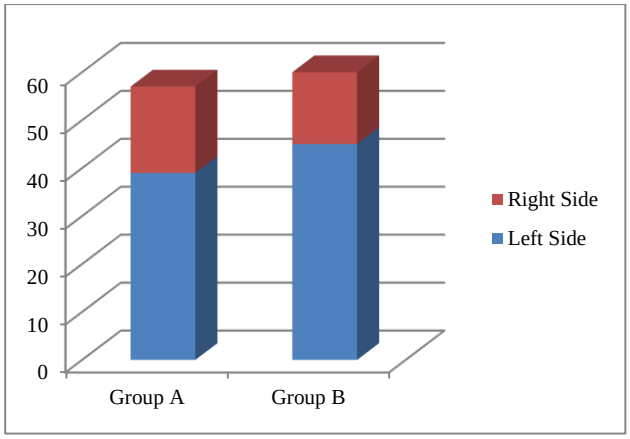

Figure 2: Placement of ureteric stones in two groups of patients.

Table 2: Postoperative parameters in two groups of patients.

Parameters	Group A	Group B	P value
Total operative time (in mins)	48±6.4	39±4.8	0.00*
Length of hospital stay (in days)	2.8±0.6	2.5±0.5	0.00*
Double J stent	57	60	
Complications			
Stone retropulsion	17	6	0.30
Residual stone	9	3	
Sepsis/fever	13	11	
Haemorrhage	02	00	

P<0.05- statistically significant.

Total operative time in group A ranged from 32 minutes to 74 minutes with mean of 48±6.4 minutes while operative time in group B ranged from 29 minutes to 64 minutes with an mean of 39±4.8 minutes. The p value for difference in mean operative time being 0.00 indicating significant difference. Length of hospital stay ranged from 2 days to 7 days in group A and 2 to 5 days in group B patients. The mean length of stay in hospital for Group A patients was more as compared to group B patients and this difference in mean was statistically significant (p=0.00). A double J stent was placed in all the patients.

The incidence of various complications including stone retropulsion, residual stone, sepsis and haemorrhage are shown in Table 2. Total number of complications was more in group A patients as compared to group B patients. Patients who had retropulsion of stone during the procedure were treated with retrograde intra renal surgery (RIRS) with the help of a flexible ureteroscope. Postoperative sepsis was treated with antibiotics according to urine culture. While two patients suffered from hemorrhage in pneumatic lithotripser, there were no such events in group B. These patients were successfully treated with medical management.

DISCUSSION

With the advent of new and improved versions of ureteroscopes, the urologists job has been made easy with less chances of stone retropulsion and decrease in morbidity. Newer and advanced lithotripsers have widened the horizon of innovation and research. The holmium laser lithotripser is an example of such technical improvement with its fragmentation rate reaching to levels of around 90% to 100%.[8] We also achieved a similar rate of fragmentation which was 95% in our study.

The study was conducted on considerable number of subjects. Age group of 25 to 35 years was predominant in the study. This is in agreement with the previous studies in literature.[9] Our study had a greater number of males as compared to females. This is due to the greater prevalence of stone disease in males as compared to females in our region.[10] More patients had stone disease on left side as compared to right side in our study.

Our total operative time was significantly down for group B where holmium laser was used for lithotripsy as compared to Group A where pneumatic lithotripser was used. This is in agreement with many studies in literature.[3,11] However many studies also show an increase in operative time when using holmium laser which may be due to the learning curve of the surgeons.[12] As we had a long learning curve with use of holmium laser, operative time was significantly reduced. In most of the cases length of stay in the hospital was 2 to 3 days. Complication such as sepsis or hemorrhage led to increased hospital stay in patients. We find similar duration of hospital stay in many other studies in literature.[13]

A DJ stent was placed in all the patients in the study which was removed after 3 weeks. There was a greater rate of retropulsion of stones in group A (29.82%) as compared to group B (10%). The retropulsed stones were fragmented with the aid of RIRS using a flexible ureteroscope. Such a significant difference in the retropulsion of stones is also seen in recent studies in literature and is attributed to its photothermal effect as compared to the oscillatory effect of pneumatic lithotripser.[14] The residual stone rate was 79% for group A whereas it was 5% for group B. Thus holmium laser lithotripser showed greater effectiveness in clearing of stones. This is also confirmed in many previous studies and is attributed to fact that pneumatic lithotripser fragmants stones into small chunks whereas holmium laser vaporizes and de bulks the stone until one or only a few fragments remain.[15] The residual stones were confirmed radiologically at one month and six months interval. The rate of complications such as that of fever, sepsis were similar in both groups.

CONCLUSION

In this study we conclude that holmium laser lithotripser has better safety profile when compared to pneumatic lithotripser especially in stone clearance rate and retropulsion rates. Thus it is definitely the modality of choice in proximal ureteric stones. However its high cost and long learning curve limits its use in low volume centres.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Sharma E, Langer R, Dogra V, Langer B. A comparative study on the use of holmium laser and pneumatic lithotripser for intracorporeal lithotripsy of upper ureteric stones. Int Surg J 2020;7:54-7.