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THE VALIDITY OF STONE CONE AS AN OCCLUSION DEVICE IN LASER ENDOSCOPIC LITHOTRIPSY FOR URETERIC STONE- A RETROSPECTIVE COHORT STUDY

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ABSTRACT

Introduction: Aim: This study is aiming for evaluating the valuably of the stone cone application during Laser ureteroscopic lithotripsy for ureteric stone. **Method:** A case-control was adopted in Medicano private hospital, Erbil over the period between Feb. 2018 to Dec. 2019. The included cases were diagnosed as having ureteric stones of variable sizes and locations and managed by Holmium Laser lithotripsy Dornier™ Mdilas. Rigid Ureteroscope Storz™. The 104 patients included in the studied sample were divided into 2 groups; Group A involved 52 patients where ureteric occlusion device (stone cone). The stone cone was introduced via the Ureteroscope in the closed state and opened proximal to the stone. The other 52 patients Laser ureteroscopic lithotripsy was conducted with no utilization of ureteric occlusion device and hence included under the control group (Group B). **Results:** Mean age for cases was 36 years and more than half of them were male. Residual stone was less frequently reported by using stone cone (p=0.000). It also significantly decreased the mean time consumed for completing the surgery (p<0.0001) and event of retropulsion of stones during lithotripsy (p<0.0001). **Conclusion:** Using stone cone with ureteroscopy in management of uretric stones is beneficial in many aspects. **Recommendations** Introduction of stone cone within ureteroscopy procedure is recommended to be routine.

KEYWORD: ureteroscopy, stone cone, case-contol, Medicano, Erbil.

INTRODUCTION

Intracorporeal lithotripsy is a well-recognized technique for the management of ureteric stones. Holmium-Yag Laser lithotripsy is a popular form for the successful management of ureteric stone despite its higher cost compared to pneumatic lithotripsy.[1] Multiple anti retropulsion devices have been utilized to prevent the stone migration. These are divided generally to three categories; the suction devices, stent devices and Gel based devices.[2]

Several types of ureteric occlusion devices have been used to prevent these complications including various stents such as Novel devices include the Lithovac® suction device, the Passport™ balloon, the Stone Cone™, the PercSys Accordion®, the NTrap®, and stone baskets such as the LithoCatch™, the Parachute™, and the Escape, the thermophilic polymers or the lidocaine gel.[3]

Thus the application of ureteric occlusion device has resulted in a great improvement in the prevention of retropulsion with minimum residual and there increasing chance of successful Laser ureteroscopic lithotripsy.

This study is aiming for evaluating the valuably of the stone cone application during Laser ureteroscopic lithotripsy for ureteric stone.

SUBJECTS AND METHOD

A case-control retrospective study design was adopted to achieve the aim of the present study. The study was conducted in Medicano private hospital/ Erbil over the period between February 2018 to December 2019. A studied sample of 104 cases of ureteric stones were managed by ureteroscopic lithotripsy. The included cases were diagnosed of ureteric stones of variable sizes and locations and managed by Holmium Laser lithotripsy Dornier™ Mdilas. Rigid Ureteroscope Storz™. All patients were subjected to preoperative evaluation including detailed surgical history, basic laboratory and

radiologic investigations including urine analysis, renal function tests, radiographic study including: ultrasound, excretory intravenous urogram (IVU), non-contrast computerized tomography (CT).

The 104 patients included in the studied sample were divided into 2 groups; Group A involved 52 patients where ureteric occlusion device (stone cone). The stone cone was introduced via the Ureteroscope in the closed state and opened proximal to the stone. The other 52 patients Laser ureteroscopic lithotripsy was conducted with no utilization of ureteric occlusion device and hence included under the control group (Group B).

Proximal migration of the stone (retropulsion) situation was observed during the procedure and assessed Per operatively by the portable X-ray with intravenous contrast study.

Residual stone fragments is designed in our study as the presence of more than 3mm stone fragment as evaluated approximately during ureteroscopy. Follow-up of the patients was done over a period of 30 days by postoperative ultrasound and KUB.

Cases in each group were studied and compared regarding the operative time, tone size, retropulsion, residual stones, double J insertion, need for secondary procedure.

All data were managed statistically by using the SPSS 21 and Miniab 17. Comparison of the means and significance estimation was performed 2 groups unpaired t-test. While the significance of the percentages was performed by the chi-square.

RESULTS

The current work studied 104 subjects complaining from attacks of ureteric colic. Careful clinical evaluation and imaging studies including ultrasonography, KUB, CT scan or IVU were performed. All the cases were candidates for ureteroscopy and Laser lithotripsy was decided for each case. The studied sample was divided into two groups:

1. Group A included 52 cases who were managed by ureteroscopy using the stone cone.
2. Group B included 52 cases who were managed ureteroscopy without stone cone.

Demographic characteristics of both studied groups were shown in table 1. The mean age for cases was 36.4 years among group A and 36.2 years among group B (p=0.8). More than half of them were male (51.9% and 57.7% of group A and group B respectively) (p=0.3).

Residual stone (i.e. fragments more than 4 mm in size) was more frequently reported among cases of Group B (63.5%) in comparison to cases of Group A (15.4%) (p=0.000). Figure 1 Table 2 displays the intra-operative indicators that were reported among the studied sample. Using ureteroscopy with stone-cone significantly decreases the mean time that consumed for completing the surgery from 35.8 minutes to 18.2 minutes (p<0.0001).

The stone size parameters for the Group A ranged 7-16 mm with the mean size 10.5 mm ±1.92, while the size of the stones for the Group B ranged between 8-17 and the mean size equals to 11.8 mm ±2.7 (p<0.05).

Retropulsion of stones during lithotripsy was recorded among 7.7% of cases in group A in comparison with 42.3% of cases in Group B (p<0.0001). In addition, none of cases of group A had uretric injury during surgery.

Table 1: Demographic characteristics of studied sample.

Demographic characteristics	Group A (n=52)		Group B (n=52)		p-vlaue
	no.	%	no.	%	
Age (year)					
Range	13-72		16-72		0.8*
Mean	36.4		36.2		
Gender					
Male	30	57.7	27	51.9	0.3**
Female	22	42.3	25	48.1	

*By using T-test of two samples
**By using chi^2 test

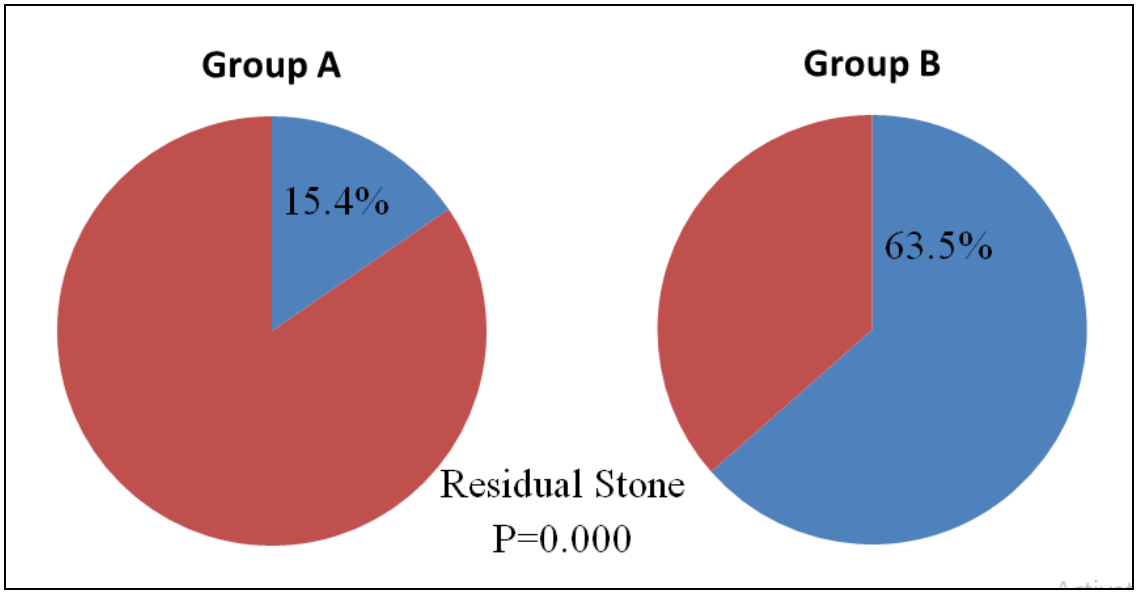

Figure 1: Event of intra-operative residual stone among studied sample.

Table 2: Intra-operative indicators among studied sample.

Intra-operative indicators	Group A (n=52)		Group B (n=52)		p-vlaue
	no.	%	no.	%	
Time consuming (min)					
Range	9-35		15-60		0.000*
Mean	18.2		35.8		
Stone size					
Range	8-17		7-16		0.005*
Mean	11.86		10.5		
Retropulsion					
Present	4	7.7	30	57.7	0.000**
Absent	48	92.3	22	42.3	
JJ insertion					
Present	41	87.8	49	94.2	0.02**
Absent	11	21.2	3	5.8	
Ureteric injury					
Present	0	0	3	5.8	NA
Absent	52	100	49	94.2	

*By using T-test of two samples
**By using chi^2 test
NA= Not Applicable

DISCUSSION

Ureteroscopic lithotripy is an important and the most successful urological procedure for the management of ureteric stones. It is routinely performed by the urologists for the management of ureteric stones with an increasing experience and excellent results reaching up to 90% stone free in some literatures. Hence rapidly removing the stone and alleviating the symptoms of ureteric colic.[4,5]

However, two important problems can occur during the procedure namely the proximal migration of the stone i.e. retropulsion and significant stone residuals as defined to be the presence of more than 2 mm stone fragment at the termination of the procedure.[6,7]

These complications resulted in an increased chance of conversion to other endoscopic modalities such as flexible ueteroscope, PCNL, at the same procedure or a second procedure or to shift to ESWL. Such issues resulted in an increased morbidity, increased risk of second anesthesia and increased economic burden on the patient with low overall satisfaction.[8,10]

In the urology center, since its establishment in 2017 we have an experience of managing ureteric stones successfully using the 7F Storz rigid ueteroscope and utilizing LASER lithotripsy for the vast majority of our

patients owing to its effectiveness and feasibility and to less extent the pneumatic lithotripsy.

In the current study, authors took upon in a consideration all the evaluation parameters and comparing such for patients in group A to whom stone cone was applied and two cases in group B the duration of the procedure was shorter for the cases in group A than for the group B with a high significance. It was observed significant decrease in the mean time of the ureteroscopy from 35.8 minutes to 18.2 minutes with a high significance ($p<0.0001$) when using the stone cone. This observation matches the observations obtained in various studies.[11,12] In our experience, the stone cone acts to occlude the proximal ureter and therefore decrease the time required to fragment the stone.

It was found that only one study that contradicts other studies. A study conducted by Ding et.al(13) in 2012 they observed no significant difference between the cases underwent Ureteroscopic Laser lithotripsy with the aid of N-trap stent as a stone occlusion device and the control group to whom Ureteroscopic Laser lithotripy was conducted without using a stone occlusion device. This could be due to the type and the technical differences between of the occlusion devices utilized by his study and us.

In study locality, the retrograde migration of ureteric stones constituted a great struggle for us before the utilization of the stone occlusion device namely the stone cone. The incidence of retropulsion is well documented during Ureteroscopic lithotripsy. The percentage of success of retropulsion in various related studies range from 90% up to 100%.[11-14]

Eisner et al[1] conducted a study on 131 cases in 2009 for evaluating the efficacy of ureteral occlusion device during Holmium LASER lithotripsy and found a 100% success rate when using stone cone regarding prevention of retropulsion. While Gupta et.al[12] reported only a 3.3% failure rate due to retropulsion, during holmium laser lithotripsy.

Complete fragmentation or the absence of significant gravels decrease the need for JJ stent placement and hence he need of a second procedure which was observed significantly in our study and matches observations observed by other similar studies.[15-17]

Ureteric injuries can occur during ureteroscopy. Such lesions vary from minor mucosal abrasions to mucosal to complete ureteric tear.[18,19] However, ureteric lesions were minimum in studied sample and even absent among cases of group A

Stenting is not routinely recommended in Ureteroscopic lithotripsy. Stenting is indicated in cases of hydronephrosis, significant residuals more than 3 mm, ureteric injury and ureteric stricture.[20] Hence, it is usually not recommended in Ureteroscopic lithotripsy with the aid of ureteric occlusion device due to its safety and feasibility. In our study, the incidence of JJ stenting is significantly lower for group A than for cases in group B.[21]

The incidence of stone retropulsion and presence of significant stone residuals of more than 3 mm is of high importance as it reflects the need for a second adjunctive procedure such as shock wave lithotripsy, ureteroscopy whether rigid or flexible or PCNL with all subsequent prolonged morbidity. The need for a second anesthesia and the patient's satisfaction regarding the ureteroscopy protocol. Literatures revealed that the incidence is low when using ureteric occlusion device and hence Ureteroscopic lithotripsy with the aid of ureter occlusion device is cost effective.[21,22]

Tamsim et.al in a study published in 2017 the Ureteroscopic lithotripsy is generally associated with lower indications for adjunctive procedures during the management of ureteric stones compared to other proccedures. In our study 44 patients in case group A needed no further adjunctive procedure compared to 30 cases in group B. the significance is high P=0.002. this reflects the high efficacy of stone cone in completing stone lithotripsy.[23]

CONCLUSION

Using stone cone with ureteroscopy in management of uretric stones minimizes consumed for surgery as well as occurrence of residual fragments and their related sequales.

Recommendations

The current study recommends that introduction of stone cone within ureteroscopy procedure is required to be routine. In addition, a good training is mandatory for the working staff.

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