ORIGINAL RESEARCH PAPER
Volume-6 | Issue-12 | December-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 93.98
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MINI PCNL – NEW ASPECTS OF KIDNEY STONE TREATMENT

Urology

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ABSTRACT

Background: Percutaneous nephrolithotomy is the treatment of choice in larger kidney stones, which employs a percutaneous tract size of 20-34 French. Modification of the technique, mini PCNL has been developed by reducing the nephrostomy tract size and has shown many advantages over the standard technique.
Aims and objective: The objective of this study was to compare mini PCNL with standard PCNL.
Materials and Methods: Total 372 cases of PCNL since 2011 under gone PCNL. These were treated by either standard PCNL or mini PCNL techniques or both techniques were employed in same patient
Results: High stone free rate was found. Low morbidity with low% of complications especially in smaller calculi comparable to complications in larger calculi. Minimally invasive, short treatment course, less expensive and can be used for 2nd or 3rd tract for lesser morbidity.
Conclusion: Mini PCNL is safer, cause less bleeding, shorter hospitalization, less bleeding, effective modality and less complicated method.

KEYWORDS

PCNL, Percutaneous nephrolithotomy, Stone

Introduction

Kidney stone disease has affected humankind since antiquity. Additionally, the incidence of kidney stones has been increased in western societies in the last eras in connotation with economic development.[1]

Management of patients suffering from urinary tract calculi is considered to be a health care problem because of its incidence and relapse. Renal stone treatment has considerably progressed from open surgery to minimal invasive surgical procedures, such as extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL) and laparoscopic ureterolithotomy, have now largely replaced open surgery.[1,2]

Since discovering of percutaneous nephrolithotomy (PCNL) into clinical practice in 1941, when Rupel and Brown performed the first nephroscopy, application of this method has undergone steady advance, with the number of PCNLs performed annually in the USA increasing by 47%, between 1999 and 2009.[4]

According to the updated European Association of Urology (EAU) guidelines, PCNL is recommended as the therapy of choice for large renal calculi (>20 mm) and also for smaller stones (10–20 mm) of the lower renal pole when unfavorable factors for ESWL exist. Excellent stone-free rates (SFR) following PCNL have been reported, which range from 76% to 98%.[1]

The usual signs for PCNL are stones larger than 20 mm, staghorn, partial staghorn calculi. PCNL has been contraindicated for pregnancy, bleeding disorders, uncontrolled urinary tract infections. PCNL is considered as the treatment of choice for large stone. PCNL manages stone free rates of upto 95%. AUA guidelines recommend PCNL as a treatment of choice for staghorn calculi. Larger stones in the lower pole are best accomplished by PCNL as the first treatment option. Data from metaanalysis suggests that larger lower polar stones have lower clearance rates and higher retreatment rates. PCNL is considered to be a gold standard in management of calyceal diverticular stones. In comparison to ESWL, PCNL has higher stone free rates with similar recurrence rates and complication rates.[3]

Percutaneous nephrolithotomy is a suitable and safe procedure in children including pre-school age group for both simple and complex stones.[5]

PCNL which is based on the conception of a suitable percutaneous renal access, dilation of this tract, and fragmentation and elimination of the stone fragments using the nephroscope through an access sheath, is a well-established technique for the treatment of urinary stone in all age groups. Firstly, Goodwin et al. described the use of a needle to decompress a hydronephrotic kidney.[7]

Although different sized nephroscopes have been used according to the tract size, a 26–30 Fr access tract can be big enough for standard PCNL. In parallel with the development of technology, reducing the nephroscope diameter became the main goal of minimising the surgical morbidity of PCNL. Thus, mini-PCNL and micro-PCNL have been developed.[7]

The percutaneous tract is successively dilated to 16-20 Fr in mini-PCNL. Nowadays, mini-PCNL is usually defined for PCNL procedure performed through the access tract of 18 Fr. Previously, this has been used in paediatric cases, but it has also been shown to be highly efficient and safe in adults.[7]

The aim of mini-PCNL procedure is to decrease the size of nephrostomy tract. Although, there was no substantial difference in the loss of functional tissue and postoperative renal scarring between standard PCNL and mini-PCNL. A new technique ultra-mini PCNL (UMP) in which the renal tract was dilated to 11-13 Fr. and any expensive stone retrieval instruments such as baskets and graspers were not required. UMP had a minimal complication rate, a high rate of stone-free and a very low rate of auxiliary procedures; however, it can be useful for the stones. As in micro-PCNL, the stone fragments were extracted via vacuum cleaner effect without requirement for any extraction instrument; however, Ho:YAG laser was required for ICL in this type of PCNL.[7]

Features required in the technique for the treatment of urinary stone:

- Low pressure irrigation
- Stone retraction with irrigation current
- Without nephrostomy
- Sealed

- Fast

Complications due to PCNL include:
- the overall major complications rates: 4-8%
- transfusion: 2-23% (major vascular injury: 2-3%)
- pulmonary & colon injury: rare
- medical complication: postoperative fever (22-25%), urosepsis (1-2%)

Expectation for technique use for treatment of Urinary stone:
- Increase stone free rate
- Decrease morbidity
- Decrease invasiveness
- Less treatment time
- Low cost

Table 1: Classification of surgical complications based on the modified Clavien system:[8]

Grade	Subgrade	Definition
I		Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside
II		Complications requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included
III		Complications requiring surgical, endoscopic or radiological intervention
	A	Intervention not under general anesthesia
	b	Intervention under general anesthesia
IV		Life-threatening complications (including CNS complications) requiring IC/ICU management
	a	Single organ dysfunction (including dialysis)
	b	Multiorgan dysfunction
V		Death
Suffix "d"	If the patient suffers from a complication at the time of discharge, the suffix "d" (for disability) is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.	

History of Mini PCNL method:
Jackman et al. in 1997 described "miniperc technique" using 11 fr. Peel away vascular sheath in 7 children of 5 to 24 kg. Stone free rates was 85% with no complications related to procedure.

Jackman et al. subsequently employed this with 13 fr ureteral access sheath in adult patients with 2 cm and greater calculi with 89% success rate.

Sung et al. in 2006 used 14 fr. peel away sheath. Success rate was 97.8% with stone<2.5 cm and 51.9% in large calculi>2.5 cm.

Materials and Methods
The objective of this study was to compare mini PCNL with other PCNL methods.

We have performed all procedures in Sanwal Hospital & Research Centre, Kanpur Road, Jhansi, India.

We had started doing mini PCNL since March 2011 with 11 Fr. Nephroscope and 14 & 15 french access sheath.

We have also done mini PCNL without access of laser with pneumatic lithotripsy till 2013. Whereas mini PCNL with access of combined laser and pneumatic lithotripsy was performed since March 2013.

We has performed total of 372 cases till now.

Out of 372 cases 148 cases were treated with mini PCNL having stone >2cm size since 2011.

Standard PCNL was performed using 26 French nephroscope and 28-30 Fr. access sheath of single tract in staghorn stones with hydronephrosis was used for procedure. Total 20 cases were found since March 2011.

Standard PCNL was performed using 24 french storz or wolf nephroscope employ in f 26-30 French nephrostomy sheath.

Figure 3: innovative three step dilators

Retrospective analysis of our data was done since March 2007 to Feb 2016 in Sanwal Hospital & Research Center. Operation was carried out by single experience surgeon doing PCNL surgery since 1999.

Exclusion criteria for study:
Kidneys with
- malformations,
- contracted kidney with sepsis,
- multiple calculi, and
- sepsis

All punctures require for surgery were done under fluroscopy after retrograde catheterization with end on technique.

For mini PCNL procedure ,In calculi up to 2cm,14&16 sheath has been used along with 12 Fr. nephroscope while in calculi of

>2 cm, we used 20 Fr. sheath with 18 Fr. nephroscope.

Results and Discussion

After study at Sanwal Hospital & Research Centre, following results has been found:

Table 2: Patient Data

Characteristic	Standard PCNL >2cm	Mini PCNL Stone 1-2 cm	Mini PCNL Stone >2 cm
No. of patient	64	160	148
Sex	42M, 22F	92M, 68F	80M, 68F
Side	40 RT, 24LT	83 RT, 72 LT	76 RT, 74 LT
Overall Success	92%	98-75 {n=158}	95.94 (n=142)
Operating Time	60+10mts (range45-110)	38+10mts (range30-50)	50+10 mts (range 38-76)
AVG. Fluid Consumed	15 LT. N SALINE	3LT. N SALINE	9 LT. NSALINE
Analgesic Requirements	100 mg tramadol	50 mg tramadol	50 -100 mg tramadol
Complication Grade	Gr 1—17.8% (N=11), Gr2–4.68% (N=3), Gr31.56% (N=1)	Gri- 5, Gr2- 3	Gri- 15, Gr2--5
Overall Complication Rate (%)	23.43%	5%(n==8)	12.5%(N=20)
Time of Nephrostomy Tubes	2-3 DAYS, 2ND OR 3RD TUBELESS	Mostly tubeless	60% TUBELESS
Hospital Stay	3-4 DAYS	2 days	2-3 days
Time of Recovery To Go To Work	7+4	7 days	Majority in 7 days (138 OUT OF 148 PTS)

As per Sajid S. et al.,[5] M:F ratio was found 2.3:1 which indicates that urinary stone found in male more than in female. Similar results were also observed by Dr. Sanwal and team as per table 1 data.

According to summary found in Nikolaos F. et al., operation time was vary from 27.4 mint to 155.5 mint. In this study also operation time was vary from 30 to 110 mints. It was also observed from Table 1 that with mini PCNL technique time of operation was found to be decreased than by standard PCNL technique. Similar results were also found by Ahmed S. et al.[9]

In this study, half amount of analgesics required in mini PCNL than standard PCNL. Similar results were found by Ahmed S. et al.[9]

According to Ahmed S. et al.[9], hospitalization stay was not having any change from standard PCNL to mini PCNL however in this study, hospitalization stay was found to be less in mini PCNL than that of standard PCNL.

Moreover following advances were found in mini PCNL compared to standard PCNL in this study:

- Increase of overall success rate,
- Fluid consumed (Saline) is less,
- Less complications grade,
- Less complication rate,
- Less recovery time.

According to Guohua Z. et al.[10] mini PCNL is a safe and effective modality for the treatment of complex stones. Similar results were also observed during this study.

According to Gao N. et al.[11] mini PCNL is effective and causes less trauma for un-hydronephrotic cata-staghorn ranal calculi. As per Sabnis RB et al.,[12] heamorrhagic complications of mini PCNL are significantly less compared to standard PCNL techniques. Similar types of results were also observed in this study by Dr. Sanwal and team.

Conclusion

Mini PCNL has similar clearance rate compared to standard PCNL for sizes 1 to 2cm. Mini PCNL cause longer operative time but ends more frequently in tubeless procedure. With mini PCNL technique it causes significantly less bleeding. Similar safety profile was found with mini as well as standard PCNL but mini PCNL results in shorter hospital stay.

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