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Outcomes and Indications of Mini Percutaneous Nephrolithotomy in Zagazig University Hospitals Patients

Safwat Elsayed Abou Hashem, Hazim Mohammed El Galaly, Ahmed Mohammed Eliwa, Ahmed Ismail Abdel Rahman Kotb*
Department of Urology, Faculty of Medicine, Zagazig University.
***Corresponding author:** Ahmed Ismail Abdel Rahman Kotb, **Mobile**: (+20)01126899392, **E-mail** kotba2276@gmail.com

ABSTRACT

Background: PCNL is a well-established treatment option for patients with large and complex renal calculi. In order to decrease morbidity associated with larger instruments like blood loss, postoperative pain and potential renal damage. A modification of the technique of standard PCNL has been developed. This is performed with a miniature endoscope via a small percutaneous tract (11–20 F) and was named as minimally invasive or mini-PCNL.

Objectives: To improve medical service for patients attending for Zagazig University Hospital by determining indications and outcomes of M-PCNL when used as treatment modality for patients with renal stones.

Methods: This prospective cohort study was conducted at Urology Department Zagazig University Hospitals during the period from March to November 2019. 48 patients from those attending to Urology Outpatient Clinic. Percentage of improvement of patients M-PCNL was 94%, so sample was calculated to be 32 patients using open EPI with CI 95%.

Results: 48 patients and percentage of improvement of patients M-PCNL was 94%. Male represented 53.8% of the studied patients. Mean age was 35.10 years, ranged from 18 to 60 years. Mean body mass index was 39.56 kg/m^2, ranged from 18.60 to 63.20 kg/m^2. Mean preoperative hemoglobin was 12.56 g/dl, ranged from 11 to 14 g/dl. The most common site of stone was renal pelvis in 44.6% of the studied patients. Mean stone density was 1024.76, ranged from 220 to 1500. Mean stone size was 1.86 mm, ranged from 1.20 to 3-mm. Mean tract diameter was 16.92 mm, ranged from 14 to 18 mm.

Conclusion: Mini-PCNL was safe and efficacious in treatment of patients with renal stone disease.

Keywords: miniPCNL, Renal stones, Nephrolithiasis, Nephrostomy, Percutaneous.

INTRODUCTION

Nephrolithiasis is a common problem in our population [(1)]. When surgical care is required for this population, minimally invasive, endoscope procedures are often employed. These include extracorporeal shock wave lithotripsy (SWL), ureteroscopy (URS), and percutaneous nephrolithotomy (PCNL). The choice of which procedure to perform is based on both patient and stone characteristics [(2)].

The European Association of Urology (EAU) provides recommendations based on renal stone size and location. For stones < 2.0 cm, SWL, PCNL, or URS are options, but for stones > 2.0 cm PCNL is recommended with URS reserved as a second-line therapy. In the lower pole, both PCNL and URS are options, even for stones > 1.5 cm, given the limited efficacy of SWL in this setting [(3)]. Although effective for the clearance of large stone burdens, PCNL is associated with significant morbidity, particularly bleeding requiring a transfusion [(4)].

In an effort to reduce the morbidity of the procedure, miniaturized PCNL techniques were developed. In 1998, **Jackman *et al.*** [(5)] described a mini-PCNL (MPCNL) procedure. This was defined as any PCNL performed through a sheath too small to accommodate a standard rigid nephroscope, which at that time was a size 24 French (Fr) or larger. Although standard PCNL (SPCNL) is now routinely performed with sheath sizes 24–26 Fr or less, the term Mini-PCNL is commonly defined as a tract size less than or equal 18 Fr [(6)].

In this study, we described the equipment, indications, and efficacy of M-PCNL with particular attention to its value over traditional minimally invasive stone removal techniques.

SUBJECTS AND METHODS

Patients:

This prospective cohort study was conducted at Urology Department, Zagazig University Hospitals during the period from Mars to November 2019 with patients from those attending to Urology Outpatient Clinic.

Sample size:

Assuming that the number of patients with renal stones attending at Zagazig University Hospitals was 48 patients and percentage of improvement of patients M-PCNL was 94%, so sample was calculated to be 32 patients using open EPI with CI 95%.

Inclusion criteria: Patients scheduled for PCNL and decision of mini-PCNL is made by surgeon.

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Exclusion criteria: Bleeding tendency, pregnancy, childern and renal or ureteral anomalies.

Ethical and patients' approval:

An approval of the study was obtained from Zagazig University academic and ethical committee. Every patient signed an informed written consent for acceptance of the operation.

All patients were subjected to complete urological evaluation with special emphasis on:

A) A thorough history with special attention to: Bleeding disorders, anticoagulant, contrast medium reactions, history of urinary tract infections and history of previous renal surgery, hypertension and diabetes mellitus.

B) Physical examination with special attention to: Weight, height and measurement of body mass index [normal weight (BMI < 25), overweight (25 ≤ BMI < 30), obese (30 ≤ BMI < 40), and morbidly obese (BMI ≥ 40)] (WHO, 1997), skeletal deformities, signs of coagulopathy, anemia and uremia and scar of previous renal intervention.

Preoperative work up: **Lab:-**routine preoperative lab including CBC, urine analysis, urine culture and sensitivity, PT, PTT and INR, liver and kidney functions tests and random blood sugar

Radiological:-Plain x-ray on abdomen-pelvis (KUB), Pelvi-abdominal ultrasound, non-contrast spiral (CT) abdomen and pelvis and renal scintigraphy. Stone size was determined by measuring the longest diameter on preoperative radiologic investigation. All of the procedures were carried out by single experienced surgeon who makes the decision of Mini-PCNL after assessment of the clinical and radiologic data of the patients, stones and kidneys.

Operative technique:

- **Preoperative broad spectrum antibiotics:** were administrated
- **Operative time**: defined as total time from induction of anaesthesia till end of procedure (Fixation of nephrostomy tube)

Anaesthesia: under regional anaesthesia

Position: lithotomy position for insertion of ascending ureteric catheter for performance of retrograde pyelogram (**RPG**) under fluoroscopic guide then turned to flank free modified supine position.

Puncture: is preplanned and individualized according to maximum stone burden, patient body habitus and surgeon preference.

The skin was punctured at posterior axillary line puncture target calyx done under guide of **RPG** and C-arm under continuous fluoroscopy using primary puncture needle **(18gauge*22cm)**.successful puncture was identified by free flow of urine from puncture needle from target calyx.

Insertion of G-wire: At first, we start by floppy tip wire **(sensor wire-0.035inch from Boston scientific)**, then we manipulate the wire until reaching upper ureter or coiling into another calyx then exchanging sensor wire over 6F fascial dilator with standard Teflon wire.

- **Dilatation of tract** was done by application of central Alken followed by (16F) Amplatz sheath (**Boston scientific**) over (16F) fascial dilator with single step dilatation and advancement of dilator and sheath into calyx by rotatory movement. Another method is using conventional metal dilators by inserting central **Alken** followed by telescopic metal dilators till16/18 French).

Scopes used miniature 12 Fr nephroscope-6.7Fr working channel for up to 5Fr instruments-(**Karl stores/Germany**) or short ureteroscopy-34 cm length*9Fr tip*6Fr working channel) (**Karl stores/Germany**) especially in morbidly obese patient.

Then fragmentation of stone done by either pneumatic lithotripsy or using Holmium-YAG laser machine (**sphinx 100-Germany**) using fragmentation or dusting methods.

Extraction of stone done either by grasper of ureteroscopy or Zero-tip dormia.

Stone clearance was determined by a combination of fluoroscopy and the nephroscopy at the end of the procedure.

Termination by fixation of 14Fr nephrostomy tube and JJ stent.

Statistical analysis

Data were verified, coded by the researcher and analyzed using IBM-SPSS Statistics for windows, version 23.0 (Copyright IBM Corp., Armonk, N.Y., USA, 2015). Descriptive statistics: Means, standard deviations, medians, ranges and percentages were calculated. Test of significances: chi-square test was used to compare the difference in distribution of frequencies among different groups. For continuous variables, independent t-test analysis was carried out to compare the means of dichotomous data. There was no specific calculation of the sample size. A significant p-value was considered when it is equal or less than 0.05.

RESULT

Male represented 53.8% of the studied patients. Mean age was 35.10 years, ranged from 18 to 60 years. Mean body mass index was 39.56 kg/m2, ranged from 18.60 to 63.20 kg/m2. Mean preoperative hemoglobin was 12.56 g/dl, ranged from 11 to 14 g/dl. The most common site of stone was renal pelvis in 44.6% of the studied patients. Mean stone density

was 1024.76, ranged from 220 to 1500. Mean stone size was 1.86 mm, ranged from 1.20 to 3-mm. Mean tract diameter was 16.92 mm, ranged from 14 to 18 mm (Table 1).

Male represented 66.7%, 27.8, 60% and 52.9% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. Means of ages were 33.46, 35.83, 36 and 35.47 years in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. Means of body mass indices were 27.65, 35.75, 27.75 and 25.74 kg/m^2 in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. Means of preoperative hemoglobin values were 12.61, 12.38, 12.82 and 12.39 g/dl in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively (Table 2).

Renal pelvis stone was present in 53.3%, 61.1%, 0% and 35.3% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. Means of stone density were 1044, 776.44, 1230.70 and 1228.23 in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. Stone size was 1.78, 1.92, 1.86 and 1.79 mm in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. Means of tract diameter were 16.80, 17.44, 17 and 16.23 mm in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively (Table 3).

There was an insignificant difference between different indications of Mini-PCNL regarding puncture site where middle site represented 53.3%, 66.7%, 40% and 35.3% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding access time where means of access time were 3.26, 3.49, 2.70 and 3.11 minutes in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding fluoroscopy time where means of access time were 2.97, 3.25, 2.97 and 3.34 minutes in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding operative time where means of operative time were 67.66, 72.50, 63.60 and 71.64 minutes in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively (Table 4).

There was an insignificant difference between different indications of Mini-PCNL regarding postoperative hemoglobin where means of postoperative hemoglobin were 11.66, 11.45, 12.14 and 11.51 g/dl in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding need for blood transfusion where 6.7%, 5.6%, 0% and 5.9% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively needed blood transfusion. There was an insignificant difference between different indications of Mini-PCNL regarding postoperative VAS of pain where means of postoperative VAS of pain was 2, 3.89, 3.10 and 2.82 in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding need for narcotics where 6.7%, 27.8%, 0% and 11.8% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively needed narcotics. There was an insignificant difference between different indications of Mini-PCNL regarding hospital stay where means of hospital stay were 2.20, 2.38, 3.10 and 2.82 days in failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding hospital stay where two days stay represented 86.7%, 72.2%, 80% and 82.4% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively (Table 5).

There was an insignificant difference between different indications of Mini-PCNL regarding intraoperative complications (bleeding) where intraoperative bleeding had occurred in 6.7%, 5.6%, 0% and 5.9% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively. There was an insignificant difference between different indications of Mini-PCNL regarding postoperative complications (fever) where postoperative complications had occurred in 6.7%, 11.1%, 10% and 11.8% of failed ESWL, morbid obese, migrated stone and Mini-perc as primary treatment modality respectively (Table 6).

Table (1): Basic characteristics, Stone and tract charactertics of the studied patients (N=65)

Basic characteristics	The studied patients (N=65)	
	No.	%
Sex		
Male	35	53.8%
Female	30	46.2%
Age (years)		
Mean ± SD	35.10 ± 11.25	
Median (Range)	34 (18 – 60)	
BMI (kg/m^2)		
Mean ± SD	29.19 ± 7.29	
Median (Range)	28 (18.60 – 63.20)	
Preoperative hemoglobin (g/dl)		
Mean ± SD	12.56 ± 0.81	
Median (Range)	12.50 (11 – 14)	
Stone location		
Renal pelvis	29	44.6%
Upper calyx	1	1.5%
Middle calyx	3	4.6%
Lower calyx	22	33.8%
Upper ureter	10	15.4%
Stone density		
Mean ± SD	1024.76 ± 339.43	
Median (Range)	1100 (220 – 1500)	
Stone size (mm)		
Mean ± SD	1.86 ± 0.40	
Median (Range)	1.80 (1.20 – 3)	
Tract diameter (French)		
Median (Range)	18 (14 – 18)	

Table (2): Comparison between different indications of Mini-PCNL regarding basic characteristics

Basic characteristics	Indications of Mini-PCNL			
	Failed ESWL (N=15)	Morbid obese (N=18)	Migrated Stone (N=10)	Mini-perc as primary treatment (N=17)
	No. (%)	No. (%)	No. (%)	No. (%)
Sex				
Male	**10 (66.7%)**	**5 (27.8%)**	**6 (60%)**	**9 (52.9%)**
Female	**5 (33.3%)**	**13 (72.2%)**	**4 (40%)**	**8 (47.1%)**
Age (years)				
Mean ± SD	**33.46 ± 11.83**	**35.83 ± 10.66**	**36 ± 10.40**	**35.47 ± 12.45**
Median (Range)	**33 (18 – 55)**	**34.50 (20 – 58)**	**34.50 (21 – 60)**	**33 (18 – 58)**
BMI (kg/m^2)				
Mean ± SD	**27.65 ± 10.68**	**35.75 ± 3.79**	**27.75 ± 5.06**	**25.74 ± 3.11**
Median	**27**	**36**	**27.50**	**25.50**
Preoperative Hb (g/dl)				
Mean ± SD	**12.61 ± 0.89**	**12.38 ± 0.70**	**12.82 ± 0.99**	**12.39 ± 0.81**
Median	**12.90**	**12.20**	**12.70**	**12.50**

• Kruskal Wallis Test. ‡ Chi-square test. $p < 0.05$ is significant. Sig.: Significance.

Table (3): Comparison between different indications of Mini-PCNL regarding stone and tract charactertics

Stone and tract characteristics	Indications of Mini-PCNL			
	Failed ESWL (N=15)	Morbid Obese (N=18)	Migrated Stone (N=10)	Mini-perc as primary treatment modality (N=17)
	No. (%)	No. (%)	No. (%)	No. (%)
Stone location				
Renal pelvis	**8 (53.3%)**	**11 (61.1%)**	**0 (0%)**	**6 (35.3%)**
Upper calyx	**1 (6.7%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**
Middle calyx	**1 (6.7%)**	**2 (11.1%)**	**0 (0%)**	**0 (0%)**
Lower calyx	**5 (33.3%)**	**5 (27.8%)**	**0 (0%)**	**11 (64.7%)**
Upper ureter	**0 (0%)**	**0 (0%)**	**10 (100%)**	**0 (0%)**
Stone density				
Mean ± SD	**1044 ± 208.21**	**776.44 ± 400.15**	**1230.70 ± 98.78**	**1228.23 ± 186.89**
Median	**1000**	**758**	**1240**	**1220**
Stone size (mm)				
Mean ± SD	**1.78 ± 0.40**	**1.92 ± 0.39**	**1.86 ± 0.17**	**1.79 ± 0.49**
Median	**1.80**	**1.90**	**1.90**	**1.60**
Tract diameter (mm)				
Mean ± SD	**16.80 ± 1.26**	**17.44 ± 0.92**	**17 ± 1.05**	**16.23 ± 1.20**
Median	**16**	**18**	**17**	**16**

• Kruskal Wallis Test. ‡ Chi-square test. P < 0.05 is significant. Sig.: Significance.

Table (4): Comparison between different indications of Mini-PCNL regarding intraoperative data

Intraoperative data	Indications of Mini-PCNL				Test	p-value (Sig.)
	Failed ESWL (N=15)	Morbid obese (N=18)	Migrated Stone (N=10)	Mini-perc as primary treatment modality (N=17)		
	No. (%)	No. (%)	No. (%)	No. (%)		
Puncture site						
Upper	**1 (6.7%)**	**0 (0%)**	**3 (30%)**	**1 (5.9%)**	**11.112‡**	**0.085 (NS)**
Middle	**8 (53.3%)**	**12 (66.7%)**	**4 (40%)**	**6 (35.3%)**		
Lower	**6 (40%)**	**6 (33.3%)**	**3 (30%)**	**10 (58.8%)**		
Access time (min.)						
Mean ± SD	**3.26 ± 0.94**	**3.49 ± 0.96**	**3.10 ± 0.42**	**3.11 ± 0.76**	**35.186•**	**0.186 (NS)**
Median	**3**	**3**	**3**	**3**		
Fluoroscopy time (min.)						
Mean ± SD	**2.97 ± 0.45**	**3.25 ± 0.41**	**2.97 ± 0.28**	**3.34 ± 0.65**	**9.921•**	**0.194 (NS)**
Median	**3**	**3.25**	**3**	**3**		
Operative time (min.)						
Mean ± SD	**67.66 ± 21.94**	**72.50 ± 16.42**	**63.60 ± 9.67**	**71.64 ± 18.80**	**5.565•**	**0.135 (NS)**
Median	**60**	**70**	**62**	**68**		

• Kruskal Wallis Test. ‡ Chi-square test. P < 0.05 is significant. Sig.: Significance.

Table (5): Comparison between different indications of Mini-PCNL regarding postoperative data

Postoperative data	Indications of Mini-PCNL				Test	p-value (Sig.)
	Failed ESWL (N=15)	Morbid obese (N=18)	Migrated Stone (N=10)	Mini-perc as primary treatment modality (N=17)		
	No. (%)	No. (%)	No. (%)	No. (%)		
Postoperative HB (g/dl)						
Mean ± SD	**11.66 ± 1.13**	**11.45 ± 0.91**	**12.14 ± 0.98**	**11.51 ± 0.77**	**3.940•**	**0.268 (NS)**
Median	**12**	**11.50**	**12**	**11.50**		
Blood transfusion						
No	**14 (93.3%)**	**17 (94.4%)**	**10 (100%)**	**16 (94.1%)**	**0.654‡**	**0.884 (NS)**
Yes	**1 (6.7%)**	**1 (5.6%)**	**0 (0%)**	**1 (5.9%)**		
Postoperative VAS of pain						
Mean ± SD	**2 ± 1.36**	**3.89 ± 1.27**	**3.10 ± 0.87**	**2.82 ± 1.59**	**16.360•**	**0.025 (NS)**
Median	**1**	**4**	**3**	**2**		
Need for narcotics (pethidine 50mg/IM)						
No	**14 (93.3%)**	**13 (72.2%)**	**10 (100%)**	**15 (88.2%)**	**5.402‡**	**0.145 (NS)**
Yes	**1 (6.7%)**	**5 (27.8%)**	**0 (0%)**	**2 (11.8%)**		
Hospital stay (days)						
Mean ± SD	**2.20 ± 0.56**	**2.38 ± 0.69**	**3.10 ± 0.87**	**2.82 ± 1.59**	**1.208•**	**0.751 (NS)**
Median	**2**	**2**	**3**	**2**		
Two days	**13 (86.7%)**	**13 (72.2%)**	**8 (80%)**	**14 (82.4%)**	**5.893‡**	**0.435 (NS)**
Three days	**1 (6.7%)**	**3 (16.7%)**	**0 (0%)**	**3 (17.6%)**		
Four days	**1 (6.7%)**	**2 (11.1%)**	**2 (20%)**	**0 (0%)**		

• Kruskal Wallis Test. ‡ Chi-square test. P < 0.05 is significant. Sig.: Significance.

Table (6): Comparison between different indications of Mini-PCNL regarding complications

Complications	Indications of Mini-PCNL				Test‡	p-value (Sig.)
	Failed ESWL (N=15)	Morbid obese (N=18)	Migrated Stone (N=10)	Mini-perc as primary treatment modality (N=17)		
	No. (%)	No. (%)	No. (%)	No. (%)		
Intraoperative complications						
No	**14 (93.3%)**	**17 (94.4%)**	**10 (100%)**	**16 (94.1%)**	**0.654**	**0.884 (NS)**
Yes (bleeding)	**` 1 (6.7%)**	**1 (5.6%)**	**0 (0%)**	**1 (5.9%)**		
Postoperative complications						
No	**14 (93.3%)**	**16 (88.9%)**	**9 (90%)**	**15 (88.2%)**	**0.269**	**0.966 (NS)**
Yes (fever>38 C--Grade I according Clavien Dindo grading system of postoperative complications)	**` 1 (6.7%)**	**2 (11.1%)**	**1 (10%)**	**2 (11.8%)**		

‡Chi-square test. P < 0.05 is significant. Sig.: Significance.

DISCUSSION

Our study was done on 65 patients and revealed indications of Mini-PCNL as failed ESWL (15cases) and morbid obesity with stone disease (18 cases). Mini-PCNL as primary treatment modality for stone disease (17 cases), migrated upper ureteral stones (10 cases) and single or poor functioning kidneys (5 cases) with most detected indications among studied groups was morbid obesity with stone disease (27.7%) followed by (Mini-PCNL) as primary treatment modality for renal stone disease (26.2%).

In current literature, no studies described different indications of Mini-PCNL. However, **ElSheemy *et al.*** [7] did their study on renal stones > 2 cm, lower calyceal ones < 2 cm, stones resistant to **ESWL** and oral chemodissolution therapy (ODT), on renal stones ≥ 2cm. **Zhang *et al.*** [8] conducted their study on renal stones less than 3 cm, on patients with renal stones >2 cm, on renal stones in obese and morbidly obese patients. **Zeng *et al.*** [9] carried out his study on large impacted proximal ureteral stones and staghorn calculi. **Sung *et al.*** [10] performed their study on patients with failed (ESWL) or (URS), patients with renal stones (calyceal and renal pelvis) and stone in calyceal diverticulum. **Chan and Jarrett** [11] conducted their study on failure of (ESWL) or ureteroscopic lithotripsy, cystine calculi and anatomic abnormalities precluding retrograde access or the distal passage of stones.

Our study showed that SFR were 86.1% [56 cases, immediate stone free status were 72.3% (47 cases) and 13.8% (9 cases) had insignificant stone residual (< 4mm), 13.8% (9 cases) had significant stone residual (≥4mm) and 7.7% (5 cases) of them had (ESWL) and 6.2% (4 cases) had (ODT) as auxiliary maneuvers.

In comparison to other studies, our results are nearly similar to **ElSheemy *et al.*** [7] with (SFR) was 89.9% (340 cases), with (SFR) was 82.1% (70 cases) and **Sung *et al.*** [10] with (SFR) was 80.6% (58 cases) as immediate stone free status with total patients with residual stone fragments was 19% (14 cases). However, our study differs with (SFR) 76.5% (39 cases) mostly due to use of laser lithotripsy in all cases and larger stone burden (mm) mean 38.7±13.1. In addition, **Zhang *et al.*** [8] with (SFR) 93.3% (56 cases) with residual stones 6.6% (4cases) one of them needed 1.6% (ESWL) mostly due to smaller stone burden (all cases < 2 cm). While, smaller number of studied cases (60 cases) with (SFR) 71.4% (35 cases) with residual stones in 28.6% (14 cases) as their study performed on morbidly obese (BMI > 35) and larger stone burden (mm) mean 26.2 ± 8.6 and smaller number of studied cases.

In our opinion, the more significant stone free rate is related to fragmentation of the stones by pneumatic lithotripsy then extraction of the stone fragments by forceps than stone fragmentation done by laser lithotripsy till small size, which allow its passage spontaneously without extraction, these small fragments frequently deposited in the lower calyx which mandate auxiliary procedure**.**

Our study documented that mean operative time was 70.83 ± 18.80 min. In comparison with other studies, our results are nearly similar with **ElSheemy *et al.*** [7] with mean 68.6 ± 29.09 min. However, our results are contradictory to **Zhang *et al.*** [8] with at least 2 hours consumed in all cases mostly patients repositioning to prone position and use of laser lithotripsy in all cases with mean of 109 ± 42.0 mostly due to larger stone burden with mean 26.9 ± 8.6 mm, need for multiple punctures in 12.2% (4 cases) and use of short instruments (nephroscope 12 or 17F)**.**

On the other hand **Sung *et al.*** [10] had been got operative time shorter than our results because of routinely performed percutaneous renal access by interventional radiologist a day prior to planned (Mini-PCNL).

Our study detected complications as bleeding needing for blood transfusion, which was 4.6% (3 cases). This is nearly similar to **ElSheemy *et al.*** [7] who found bleeding in 4.2% (16 cases) that required blood transfusion in 3.7% (14 cases). **Zhang *et al.*** [8] found HB% drop in 3.3% (2 cases) that required blood transfusion and found bleeding, which required blood transfusion in 3.5% (3 cases). However, **Sung *et al.*** [10] found bleeding that required blood transfusion in 1.4 % (1 case preoperatively diagnosed as child with liver cirrhosis)

Also, our study detected fever in 10.8%, which is nearly similar to **Sung *et al.*** [10] who found fever in 9.7% (7 cases), but different with **ElSheemy *et al.*** [7] who found fever in 4% (15 cases) mostly due to larger sample size (378 cases). **Zhang *et al.*** [8] did not record fever in their study.

Our results documented hospital stay mean of 2.26 ± 0.59 days, which is nearly similar to **ElSheemy *et al.*** [7] with mean of 2.43 ± 1.46 days. But, different with **Zeng *et al.*** [9] who discharged all patients at 7th postoperative day as they put regimen of discharge as follow (Postoperative KUB on 4th day, nephrostomy tube removal in 5th day, ureteric catheter and Foley catheter on 6th day) and **Sung *et al.*** [10] with mean 3.97±2.72 days due to occurrence of serious complications.

On the other hand, the major limitation of this study was relatively small sized sample, so large randomized trials are encouraged to be designed so that the above conclusions can be verified with increased statistical power. The other limitation was the use of different size of renal access sheath

(14/16/18 F) with use of two different dilator (Amplatz fascial and Alken coaxial metal dilators) with no comparison between them. Finally, availability of equipments and need for longer duration of study, to explain more indications for mini-PCNL, are also limiting factors.

CONCLUSION

We concluded that indications of Mini-PCNL were failed (ESWL), morbid obesity with stone disease, (Mini-PCNL) as primary treatment modality for stone disease, migrated upper ureteral stones and single or poor functioning kidneys with renal stones. We also concluded that Mini-PCNL was safe and efficacious in treatment of patients with renal stone disease.

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