



PCNL monotherapy for staghorn stones: Sohag faculty of medicine experience.

Hosny Fathalla, Atef Galal, Essam Salem, Ahmed Mamdoh Abdelhamied

Department of Urology, Sohag Faculty of Medicine, Sohag University

Abstract

Background: PCNL as monotherapy for renal staghorn stones is challenging for urologists to attain complete clearance of all calculi. The purpose of this study is to evaluate the efficacy and safety of PCNL for renal staghorn stones.

Methods: Study was initiated on June 2017 - June 2018 by recording the data of 32 patients with staghorn stones to do PCNL as a single or multiple sessions till complete clearance of the stones was achieved (20 males, 12 females), age range of 15-63 years, Right-sided stones were in 18 cases and left-sided stones in 14 cases. Recurrent stones were in 12 patients. Intraoperative and early postoperative complications, blood transfusion and hospital stay were recorded. The data were analyzed SPSS for Windows version 20.

Results: The mean age was 39.88 ± 13.5 years. The mean operative time was 58.75 ± 24.8 minutes. The range of hospital stay was 1-10 days. Bleeding was the most common complication (25%) of cases. The stone clearance status of percutaneous nephrolithotomy monotherapy after only one session was achieved in 22 cases (68.75%). The second session was needed in 6 cases to achieve complete clearance. Other auxiliary measures needed in 4 cases.

Conclusions: Percutaneous nephrolithotomy for the treatment of renal staghorn stones is a safe and effective choice to achieve a reasonable Stone free rate with minimal morbidity.

Keywords: PCNL, Staghorn, Stone free rate, Bleeding, Sohag university

INTRODUCTION

Staghorn stones are branched stones that occupy much of the renal collecting system. Most staghorn stones occupy the renal pelvis and extend to one or more of the surrounding calyces. Treatment of staghorn stones now changed from exploratory big incisions to minimally invasive methods such as combinations of PCNL and ESWL, percutaneous nephrolithotomy (PCNL) monotherapy, or ESWL monotherapy [1]. When staghorn stones are discovered, active stone removal should be achieved unless the patient cannot safely withstand the surgery [1]. Stone clearance is higher with PCNL

(78%) than with open surgery (71%) or ESWL (22% to 54%). PCNL has a shorter length of hospital stay, lower morbidity, shorter operating time, and a faster return to work than open surgery [1]. Both AUA Nephrolithiasis Guideline Panel and the EAU urolithiasis guidelines are recommending PCNL as the first-line to treat staghorn stones in most patients [2]. Being a high skill-demanding surgical procedure. In the study, we evaluated the experience of the Sohag urology department intreating staghorn stones with PCNL as regard safety and efficacy. Sohag university hospital, Upper Egypt.

METHODS

From June 2017 to June 2018, the data of 32 patients with staghorn stones-ideal for the study inclusion criteria-presented to the urology department of Sohag University Hospital were recorded. This study included both complete and partial staghorn calculi with no distinction. Patients with raised serum creatinine, active infection, coagulopathy, pregnancy, pulmonary or cardiac disease, and morbid obesity were excluded. The study protocol was approved by the Ethical Committee of Faculty of Medicine, Sohag University. The patient evaluation by history taking, examination, and investigations with imaging in the form of abdominal ultrasound, Computed tomography, and in recurrent cases and malrotated kidneys Intravenous urography (IVU) was done. Preoperative lab. investigations included urinalysis, creatinine, CBC, liver function and prothrombin time and concentration (PC). All patients were fasting 8 hours preoperatively and intravenous (IV) cephalosporins two hours before the surgery.

Surgical technique

With endotracheal intubation, all patients were operated under general anesthesia. An ipsilateral ureteric catheter was inserted with the patient in a lithotomy position. Percutaneous access was made after fixation of the ureteric catheter in the prone position with flank is slightly elevated by a small pillow under the upper abdomen to make the back flat, using multidirectional C-arm fluoroscopy guidance after opacification of the renal pelvicalyceal system by Iodinated contrast in a retrograde fashion. The surgeon, assistant, nurse, and the lithoclast stand at the side of the stone, looking at the C-arm monitor and Endoscopic monitor on the other side of the table.

The skin puncture was done using an 18-gauge coaxial ship needle at the posterior axillary line towards the posterior lower calyx. All tracts were made and guidewires were secured inside the calyceal system before dilatation of either tract. We performed dilatation with Amplatz dilators up to 30 French for the main preferred tract where a rigid nephroscope of 26F (WOLF) was used through an Amplatz sheath. In some cases, the dilatation of secondary tracts was done according to the shape of the stone. Stone disintegration with pneumatic lithotripters and extracted through the nephroscope using forceps and mechanical suction. Confirmation of stone-free status virtually and under fluoroscopy. Ureteric catheter left as a stent when the session was finished, but -if indicated- a ureteric catheter is replaced with a DJ stent inserted in an antegrade fashion. 22 French nephrostomy tube was placed in the main track while 20 French nephrostomy tubes were placed in any further tracts and all the tubes were closed till the next morning. Intraoperative procedure time, the number of access tracts, access calyces, need for blood transfusion and any intraoperative complications were recorded. Operative time was defined as the time from the introduction of the ship needle into the skin of the patient to the placement of the nephrostomy tube.

Post-operative evaluation

The patients were allowed to resume oral feeding 4 hours postoperatively. The closed nephrostomy tube was opened 24 hours postoperatively, PUT or non-contrast CTU was then performed. Nephrostomy tubes were removed routinely after confirmation of a stone-free state. The ureteric catheter was removed on the second day postoperatively. DJ was removed

after 1 month postoperatively. In patients with residual stones that needed second look PCNL, Ureteric catheter and nephrostomy tube were left till the second look which was done 1 week later. The postoperative Hemoglobin level was evaluated. The length of hospital stay, postoperative transfusion, and any early or late complications was recorded.

Data analysis:

Data analysis was accomplished using the Chi-Square test and IBM Statistical Package for the Social Sciences Statistical Software (SPSS) for windows version 20. Significant results when the P-value is <0.05.

RESULTS

In our study 32 cases (20 males, 12 females) staghorn stones, underwent PCNL, with a mean age of (39.88 years \pm 13.58 SD). 18 cases were on the left side and 14 were on the right side, In 12 PCNLs (37.5%) previous open nephrolithotomies were encountered. Radiolucent calculi were present in 6 cases (18.8%). The stone size varies from 2.5 cm to 6 cm. Stone density was variable with a mean of (980 \pm 295 SD) HFU.

Staghorn stones of the study were viewed and they were as follows: Nineteen cases (59.4 %) stones were classified as partial staghorn stones and thirteen cases (40.6%) as complete staghorn. Ten Stones were branched through the renal pelvis and one major calyx (lower calyceal group). Nine Stones were occupying renal pelvis and 2 major calyces (lower & middle calyceal group). Thirteen Stones were occupying renal pelvis and > two major calyces (lower, middle and upper calyceal group).

Surgical outcomes were as following; Operative time 58.75 \pm 24.8 minutes, the Subcostal approach was used in 30 cases, the Supracostal approach was used with the subcostal approach in 2

cases, as regards a number of tracts, single track in 23 cases, 2 tracts in 8 cases, 3 tracts in one case, Postoperative Haemoglobin drop was 2.66 \pm 1.3 gm/dl. Perioperative and postoperative complications were as following; Intraoperative bleeding in 8 cases that required blood transfusion, 1 case had colonic injury and intraperitoneal collection, Postoperative complications were bleeding in 6 cases; 4 of them also had intraoperative bleeding, 3 cases managed with clamping of the nephrostomy tube, the other 3 cases needed blood transfusion.

In 22 cases (68.75%) one session of PCNL was needed with complete clearance of the stones. In 6 cases (18.75%) 2 PCNL sessions needed to render patients stone free. Secondary measures were needed in 4 cases, 2 of them had undergone ureteroscopy for migrating ureteric stones, 1 had ESWL, and the last patient who had an intraoperative colonic injury and intraperitoneal collection managed by the termination of the procedure, JJ stent insertion, intraperitoneal drain, and ileostomy did after 1 week. Ileostomy closed after 1 month, and after the improvement of his general condition, stone clearance had been completed with open surgery. At 3 months of follow up, all patients became free from stones after PCNL and other secondary measures.

The range of hospital stay was 1-10 days; 23 cases spent 1 day postoperative, 8 cases spent 3 days postoperative, 1 case which had Intraoperative colonic injury spent 10 days in the hospital.

The success after a single session of PCNL achieved in 68.75%, after the second session it increased to (87.5%).

DISCUSSION

The aim of treatment of staghorn stone with percutaneous nephrolithotomy to

achieve the best Stone clearance rate with minimal morbidity, fewer complications, shorter hospital stay & lower blood transfusion requirements. Clayman et al in 1983 reported the safety & feasibility of percutaneous nephrolithotomy for staghorn stone treatment [3]. Currently, PCNL is a proper choice for staghorn renal stones [4].

Stone clearance rates after percutaneous nephrolithotomy for staghorn stones were reported by Al-Kohlany being 49% [5] - 78% reported by Soucy [6]. In this series, the stone clearance was 68.75%. The stone clearance rate of 49% was reported by Al-Kohlany because they were treating complete staghorn stones, while we included complete and partial staghorn stones. Stone free rate in the current study is higher than that by Maghraby et al, Lam and associates, V. Ambert and El-Nahas et al, which was (52%, 54%, 58%, 56.6%) respectively. [7, 8, 9, 10]. It is nearly like the results of Weiwen Yu et al 2016 which was 68.9% [11]. However, the result of the current study was less than the 78% reported by Soucy. 2009 who included stones branching into only one calyx in 70% of their patients [6]. Stone clearance rate after three months follow up with PCNL monotherapy (87.5%) is comparable with that in the last AUA guidelines which were (66%) [1], and that of El-Nahas et al. 2012 which was (72.7%) [8]. It is also higher than that of Desai M et al which was 86% [4]. It was reported to be 53% in the study done by John Withington et al for the treatment of staghorn stones by PCNL in the supine position [13].

The mean operative time in current study is (58.75 minutes \pm 24.8 SD) which is shorter than that by Kurtulus et al, Sarhad Khan et al, Weiwen Yu et al, and Nguyen Phuc Cam H who reported mean operative time of (130

minutes, 80 minutes, 73.2 \pm 11.4 minutes and 102 minutes) respectively [13, 14, 11, 15]. Recurrent stones (37.5%) after open renal surgery were an important cause of the prolonged time of PCNL due to difficulties in tract dilation in scarred perinephric spaces and collecting system and cautious fixation of kidney in the retroperitoneum. All recurrent cases in the study especially those with higher stone burdens were operated by experienced senior endocrinologists who are operating more than 20 cases per month. Multiple tracts were used in these cases.

It is an important point to make a good Patient explanation before Percutaneous nephrolithotomy as there is a 19% another session PCNL and 12.5% auxiliary procedures were needed in this series which is comparable with El-Nahas et al 2012 who reported 30% another session PCNL and 21% auxiliary procedures, and it was also comparable with the rate of secondary procedures done by Duvdevani et al, 2007 which was 24.7% [16]. It is the same as reported in the study done by Nguyen Phuc Cam H in 2010 [15]. The patients must be informed that the chance of needing multiple interventions to become stone-free might be up to 50%.

Potentially significant morbidity or death was reported with PCNL in large scale series [17]. Fortunately, no deaths occurred in this series. The hospital stay in this series was (1-10 days) which is within the range of others.

A staghorn stone was identified to be a risk factor for severe bleeding after percutaneous nephrolithotomy [18], and multiple tracts were also detected as a risk factor for bleeding during PCNL. Bleeding is the most frequent complication of PCNL. Excessive bleeding can occur during any step of the procedure like needle passage and

tract dilatation [19]. Intraoperative bleeding that require blood transfusion has been reported in 3% to 12% of cases [20], and 0.8%-30.9% [1]. Transfusion in the current study was 25%, the same rate reported by Nguyen Phuc Cam H [17]. It was 30% in the study done by Manish [21]. In this study, no selective embolization required or nephrectomy. The most often injured organs during PCNL and stone removal are the lungs and pleura, with possible hydrothorax or pneumothorax. There was no such incidence despite the use of the supracostal approach in 2 cases (6%). Bowel perforation occurred in one patient (3%) in this study and ileostomy done for the patient after one week postoperative. In 1983, Vallancien et al. reported 2 cases with perforation of the left colon among a series of two hundred and fifty percutaneous nephrolithotomies, these two patients were treated surgically [23]. El-Nahas et al. retrospectively reviewed 5039 PCNLs (from 1985 to 2004) and reported 15 (0.3%) colonic perforations [24].

A staghorn guidelines panel reported complication rates of 7–27% and a postoperative transfusion rate of 18% [12]. The complication rate of 21%, postoperative transfusion rate of 9% were the results in this study. Angiographic embolization was not needed; it was encountered in 3.4% of patients in El-Nahas et al. 2012.

Stone position and stone branches in collecting system were evaluated using Non-contrast CTU or Intravenous Urography (IVU). Non-contrast CTU is important in planning the PCNL access [4]. Complete clearance of the stone is a must to eradicate any causative organisms, to relieve obstruction, and to prevent further stone growth [25]. This would be achieved by using multi-tract PCNL [26], flexible nephroscopy during the

first or second session PCNL [4], or ESWL to treat residual stones.

The limitation of this study was that we didn't have the data of stone constituent, which had a role in the curative effect, especially for the residual stones, and there was no standard method for reporting the burden of staghorn stones.

Conclusion

PCNL is the method of choice for treating staghorn stones, It should be done in a specialized center with facilities for the management of stones and treatment of any consequences. The patients should be informed about the stone-free rates, possible complications, and the possibility of multiple sessions or auxiliary procedures. PCNL is a safe and effective choice for the treatment of staghorn stones with high stone-free rates and minimal morbidity.

REFERENCES

- 1- **Preminger GM**, Segura JW, Assimos DG, et al. Nephrolithiasis Clinical Guidelines Panel summary report on the management of staghorn calculi. The American Urological Association Nephrolithiasis Clinical Guidelines Panel. *J Urol* 1994, 151:1648–51. , 2005, Chapter, P: 1.
- 2- **Turk C**, Knoll T, Petrik A, et al; European Association of Urology (EAU) Guidelines Office. European Association of Urology guidelines on urolithiasis. 28th ed. Milan: EAU Annual Congress; 2013.
- 3- **Clayman RV**, Surya V, Miller RP, Castaneda Zunega WR, Amplatz PH, Lange PH. Percutaneous nephrolithotomy; an approach to branched and staghorn renal calculi. *JAMA* 1983; 250:73–5.
- 4- **Desai M**, Jain P, Ganpule A, Sabnis R, Patel S, Shervastav P. Developments in technique and technology: the effect on the results of percutaneous nephrolithotomy for staghorn calculi. *BJU Int* 2009; 104:542–8.

- 5- **Al-Kohlany KM**, Shokeir AA, Mosbah A, Mohsen T, Shoma I, Eraky I, et al. Treatment of complete staghorn stones: a prospective randomized comparison of open surgery versus percutaneous nephrolithotomy. *J Urol* 2005; 173:469–73.
- 6- **Soucy F**, Ko R, Duvdechai M, Nott L, Denstedt JD, Razvi H. Percutaneous nephrolithotomy for staghorn calculi. A single-center experience of 15 years. *J Endourol* 2009; 10:1–5.
- 7- **Maghraby HA**, Hofstetter AG, Shalaby MA, Al-Akkad MA, Tawfeek W: Experience in techniques of percutaneous nephrolithotomy. M. D. Thesis. 1990, Department of Urology, Assiut University.
- 8- **El-Nahas** et al, Percutaneous nephrolithotomy for treating staghorn stones: 10 years of experience of a tertiary-care centre *Arab Journal of Urology* (2012) 10, 324–329.
- 9- **Lam HS**, Lingeman JE, Russo R, GT C. Stone surface area determination techniques: A unifying concept of staghorn stone burden assessment. *Journal Urology*. 1992; 148(3):1026-9.
- 10- **V. Ambert**, M.T. Radu, B. Braticevici, Y. Sallahedin, V. Voinescu, T.V. Constantin. **PNL in the treatment of staghorn calculi – a 15 years' experience** *Prof. Dr. Th. Burghley Clinical Hospital, Dept. of Urology, Bucharest, Romania*, 2008
- 11- **Weiwen Yu**, Jiong Yao, Dahong Zhang, Xiang He, Clinical factors of stone-free rates after percutaneous nephrolithotomy for staghorn calculi, *Int J ClinExp Med* 2016;9(4):7289-7296 2016.
- 12- **John Withington**, David Curry, Sarah Tang, Asheesh Kaul, Helena Gresty, Anthony Goode, Nick Woodward, Dominic Yu, Anuj Goyal, Rajesh Kucheria, Darrell Allen, Leye Ajayi, London, United Kingdom supine percutaneous nephrolithotomy for staghorn calculi e prospectively recorded experience in a single tertiary endourology unit ,the journal of urology 2017.
- 13- **Kurtulus FO**, Fazlioglu A, Tandogdu Z, Aydin M, Karaca S, Cek M: Percutaneous nephrolithotomy: primary patients versus patients with a history of open renal surgery. *J Endourol*. 2008, 22 (12): 2671-5. 10.1089/end.2007.0431.
- 14- **Sarhad Khan**, Muhammad Asif, Khalid Farooq, Bilal Ahmad, Sajid Rehman: an initial single-center experience of percutaneous nephrolithotomy for renal stones larger than 2.5 cm, *KJMS May-August, 2016*, Vol.9, No.2
- 15- **Nguyen Phuc Cam H**, Vu Le C, Le Anh T, Chung Tuan K, Nguyen Viet C *Dept. of Urology, Binh Dan Hospital, Hoshi Minh City, Vietnam Percutaneous Nephrolithotomy or Staghorn Calculi, 2010*
- 16- **Duvdevani M**, Razvi H, Sofer M, Beiko DT, Nott L, Chew BH, et al. Third prize: contemporary percutaneous nephrolithotripsy: 1585 procedures in 1338 consecutive patients. *J Endourol* 2007; 21:824–9.
- 17- **Michel MS**, Trojan L, Rassweiler JJ. Complications in percutaneous nephrolithotomy. *Eur Urol* 2007; 51:899–906.
- 18- **El-Nahas AR**, Shokeir AA, El-Assmy AM, Mohsen T, Shoma I, Eraky I, et al. Post-percutaneous nephrolithotomy extensive hemorrhage. A study of risk factors. *J Urol* 2007; 177:576–9.
- 19- **Kukreja R**, Desai M, Patel S et al (2004) Factors affecting blood loss during percutaneous nephrolithotomy: a prospective study. *J Endourol* 18:715–722
- 20- **El-Kenawy MR**, el-Kappany HA, el-Diasty TA, Ghoneim MA. Percutaneous nephrolithotripsy for renal stones in over 1000 patients. *Br J Urol* 1992; 69:470 - 5.22.
- 21- **Singla M**, Srivastava A, Kapoor R, Gupta N, Ansari MS, Dubey D, Kumar A: Aggressive approach to staghorn calculi-safety and efficacy of multiple tracts percutaneous nephrolithotomy. *Urology*. 2008, 71 (6): 1039-42. 10.1016/j.urology.2007.11.072.
- 22- **Juan YS**, Huang CH, Chuang SM, Shen JT, Li CC, Wang CJ, et al. Colon perforation: a rare complication during percutaneous nephrolithotomy. *Kaohsiung J Med Sci*. 2006; 22: 99–102.

- 23- **Vallancien**, G., Capdeville, R., Veillon, B. et al. Colonic perforation during percutaneous nephrolithotomy. *J Urol* 1985; 134:1185–1187.
- 24- **El-Nahas**, A.R., Shokeir, A.A., El-Assmy, A.M. *et al.* Colonic perforation during nephrolithotomy: Study of risk factors. *Urology* 2006; 67:937–941.
- 25- **El-Nahas AR**, Eraky I, Shokeir AA, Shoma AM, El-Assmy AM, El-Tabey NA, et al. Long-term results of percutaneous nephrolithotomy for treatment of staghorn stones. *BJU Int* 2011.
- 26- **Ganpule AP**, Desai M. Management of the staghorn calculus: multiple-tract versus single-tract percutaneous nephrolithotomy. *Curr Opin Urol* 2008; 18:220–3.