

Endourology

Ultrasound guided dual tract supine PCNL with simultaneous use of two different energy sources by two urologists working in unison-an innovative approach in staghorn calculus[☆]

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ABSTRACT

Complete staghorn renal calculi are surgical challenge requiring multi-tract or staged PCNL. We report a case of supine PCNL where complete stone clearance was achieved with dual tracts (24 Fr/lower pole and 16Fr/upper pole) through which two surgeons operated simultaneously using two different energy sources (pneumatic/ultrasound lithotripter through 24Fr and Thulium Fiber laser through 16Fr). Strong water currents generated by dual-tract irrigation augmented the mini-PCNL venturi effect facilitating stone fragment evacuation. This is first reported case of two surgeons operating simultaneously using two different energy sources, in supine position in a limited space on a complete staghorn stone.

1. Introduction

Treatment of Staghorn renal calculi are challenging, with percutaneous nephrolithotripsy (PCNL) being the most effective treatment invariably requiring either multi-tract or multistage PCNL to achieve complete clearance.¹ Multi-tract/multi-stage PCNL increases the risk of bleeding and renal function deterioration.² To improve efficiency of stone clearance while reducing operative time and perioperative complications for a complete staghorn stone a Supine ultrasound guided, dual tract PCNL (Lower-pole 24 Fr and upper-pole Mini-PCNL 16Fr) with simultaneous use of two different energy sources (Thulium fiber Laser (TFL) and ultrasonic/pneumatic lithotripsy) by two urologists was performed. This is the first reported case of this unique approach performing supine PCNL with two urologists working simultaneously in a very limited space using two different energy sources.

2. Case presentation

Patient was a 78-year-old frail woman with multiple prior admissions for urosepsis who presented with acute right flank pain. CT scan revealed 10mm right upper ureteral calculus with left renal complete staghorn calculus measuring 52mmx44mmx27mm and 1024 HU [Fig. 1]. Following right ureteroscopy with bilateral stenting a left PCNL

was scheduled 2 weeks later. Normal labs (WBC $8.4 \times 10^9/L$, Creatinine 0.8mg/dL) and sterile urine culture were ensured before PCNL.

Patient placed in Barts flank-free modified supine position.³ Two endoscope tower setups were established. While one urologist performed renal ultrasound, second urologist changed patient's stent to a 5 Fr ureteric catheter. Ultrasound revealed complete staghorn calculus without hydronephrosis. Ultrasound-guided punctures were performed in the superior and inferior posterior calyces and guidewires coiled in the system. Inferior-calyceal puncture was dilated up to 24 Fr using Balloon dilator (NephroMax™, Boston Scientific) and Superior-calyceal (Infracostal) puncture was dilated using single-step mini-PCNL dilator followed by 16Fr mini-PCNL metal Amplatz sheath (Karl Storz®) placement [Fig. 2]. Tracts were kept 4 cm apart [Fig. 3]. Two urologists operated simultaneously using two different energy sources (lithotripsy and Laser) at the same time [Fig. 4]. Through the inferior tract one surgeon utilized a 22 Fr nephroscope (OES Pro, Olympus®) with the pneumatic/ultrasonic lithotripter (Shock pulse-SE, Olympus®) to fragment the calculi, while simultaneously through the superior tract another surgeon used a 12 Fr Mini-PCNL nephroscope (Karl Storz®) with TFL (Soltive, Olympus®) fragmenting the calculi at 50W [10Hz × 5J]. Stat fluoroscopy images were taken to confirm Amplatz sheaths positions and complete clearance and stent position at the end of the procedure [Fig. 5]. Total operative time after establishing renal access was 45 minutes with estimated blood loss <25 mL and fluoroscopy time

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Abbreviations:

PCNL Percutaneous nephrolitholtripsy
 TFL Thulium Fiber Laser

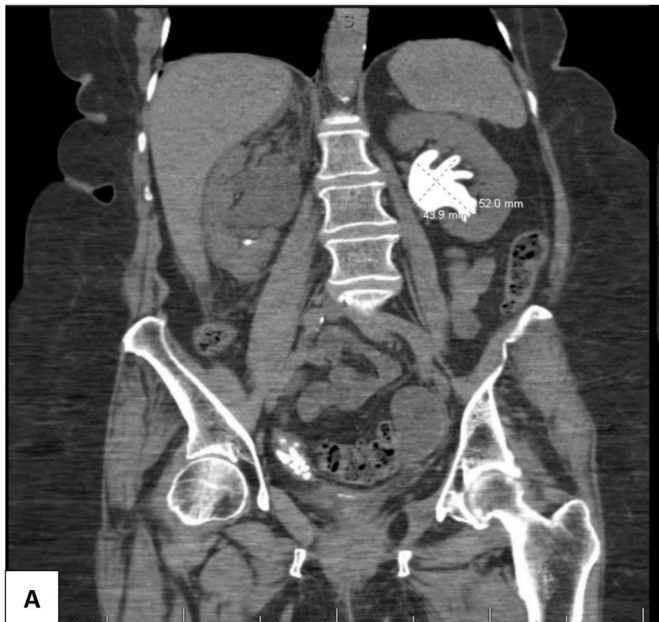


Fig. 1. CT Abdomen (Coronal View): Left complete staghorn calculus.

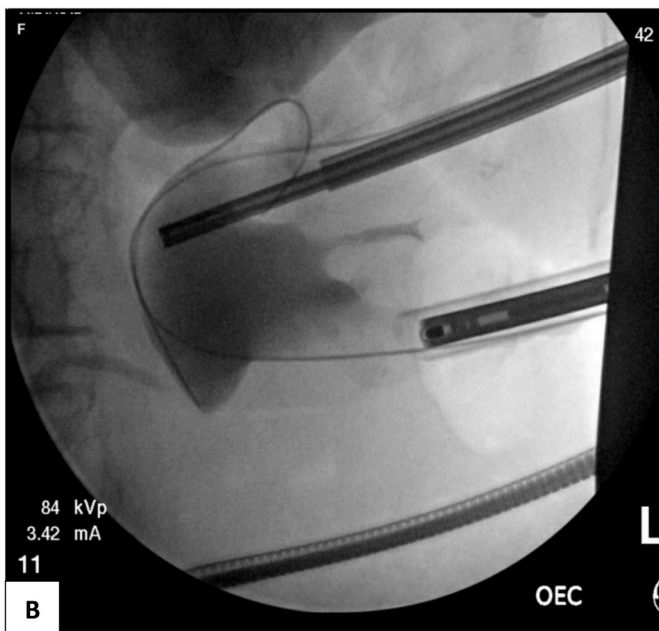


Fig. 2. Intraoperative fluoroscopy image confirming the two Amplatz sheaths with two nephroscopes in position.

of 60 seconds.

Strong water currents were generated as water was flowing through both the tracts augmenting the venturi effect through the mini-PCNL tract helping the fast and effective stone fragment evacuation while

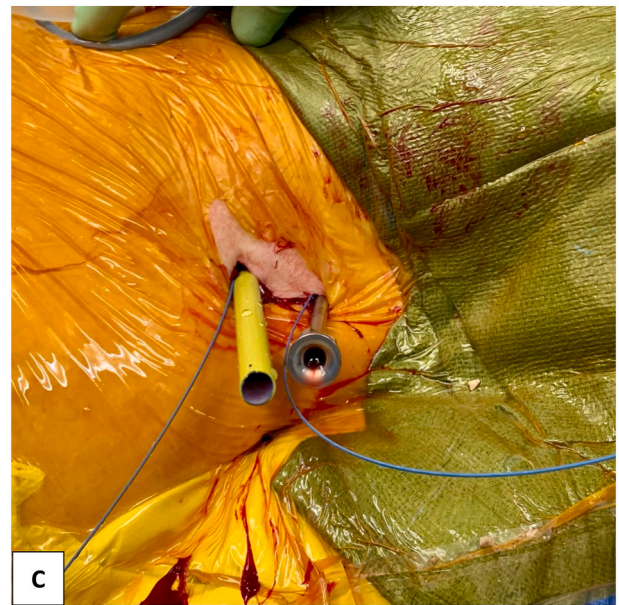


Fig. 3. Two nephrostomy tract sites 3–4 cm apart with safety wires.

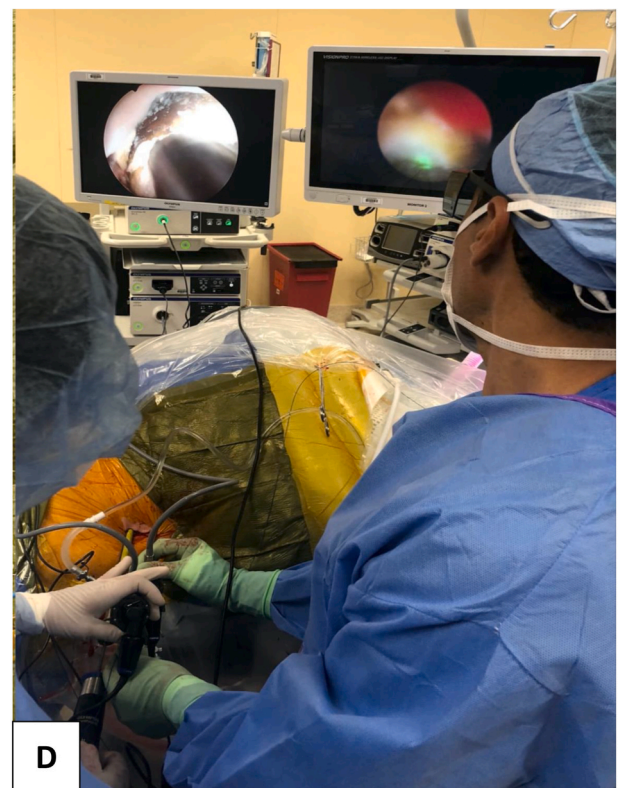


Fig. 4. Both urologists working simultaneously using lithotripter from the inferior tract (24 Fr) and laser fragmentation through the superior 16 Fr mini-perc tract. Both nephroscopes oriented parallel to each other to avoid torquing and renal injury with both urologist’s access to dual endoscopic towers.

lowering the intraplevic pressure avoiding risks of pyelovenous reflux, potential sepsis and need for graspers to retrieve fragments. Visual confirmation of complete stone clearance was confirmed from opposite nephroscopes through both the tracts inspecting the renal pelvis and calices for residual stones.

Both surgeons were careful to work in tandem maintaining well-

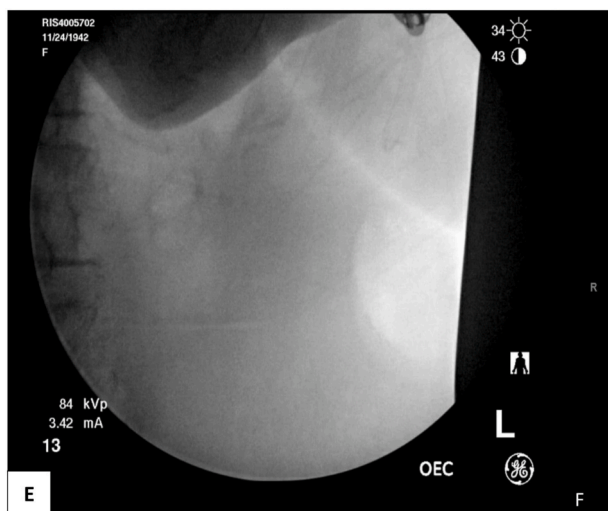


Fig. 5. Post op CT scan done next day shows complete clearance with stent in position curling in the renal pelvis.

coordinated parallel directions throughout the procedure while avoiding excessive torquing of the nephroscope to prevent renal injury. A 6Fr/26cm stent was placed at the end of the procedure. Nephrostomy tubes were not placed as stone free status and minimal extravasation was confirmed with an antegrade study. Negligible change in pre to post laboratory values were noted (Hematocrit change of 30%–29%, GFR change of 71mL/min to 76mL/min). Patient was discharged next day and postoperative day one low-contrast CT-Urogram demonstrated no postoperative collections or residual stones and adequate stent position [Fig. 6]. Stent was removed outpatient after 7 days. Stone composition was 30% struvite and 70% calcium Phosphate. Denies any abdominal pain or urinary complaints at one month follow-up.

3. Discussion

We describe a simultaneous dual approach to PCNL, where two urologists worked simultaneously in unison on a patient with complete staghorn calculus, thus improving the outcome. Staghorn renal calculi are often associated with long standing renal infections and renal function deterioration. To achieve complete clearance, staged or Multi-tract PCNL is often required which in experienced hands can achieve 79% stone free rate but are associated with 15% short-term complication rates like bleeding or bacteremia/sepsis.² Combined rigid and flexible nephroscopy through single tract has been reported but were associated with significant increase in operation and fluoroscopy times.⁴

The primary goal in our case was to achieve complete stone clearance in single setting without prolonged anesthesia time while avoiding perioperative complications. To achieve this goal, we used supine PCNL decreasing cardiorespiratory complications and reducing operative time by avoiding patient repositioning. Moreover, in supine position gravity assists in evacuating the stone fragments. We used an Ultrasound guided renal access which is safe in experienced hands avoiding prolonged radiation exposure. To further decrease our operative time, two urologists simultaneously operated through two tracts using two different energy sources. We realized that irrigation through both tracts generated strong water currents (whirlpools) guiding stone fragments towards the Mini-PCNL tract which were then evacuated spontaneously by the Venturi effect,⁵ mitigating need for stone graspers, and further reducing operating time.

Operating simultaneously in such a close space required coordination of two operating surgeons maneuvering their nephroscopes always in parallel which was critical in our case. The angle of access to each pole was intentionally acute to avoid excessive renal torquing and shearing

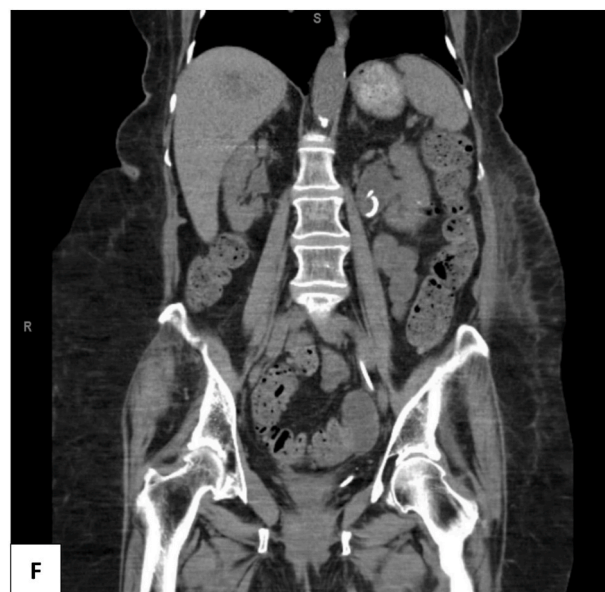


Fig. 6. Post op fluoroscopy image showing complete clearance at the end of the procedure.

injury while maintaining space between the two nephroscopes. Secondly, dual towers were utilized and positioned to be visible by both the surgeons simultaneously allowing both surgeons access to both screens allowing for coordination between movements and avoiding any inadvertent injury by the laser fibers or lithotripter to the other scope.

4. Conclusion

This dual access supine PCNL with simultaneous use of two different energy source, by two urologists working in tandem is a unique approach and to the best of our knowledge is the first report of this approach. This approach is a feasible option in complex staghorn calculi if carefully performed, but larger comparative series is required to ascertain it's benefit and safety in comparison to standard PCNL.

Consent

Written signed informed consent was taken from the patient after explaining about the surgical procedure. Patient understands that the operative images or radiologic images may be used solely for publication purposes in the journal. None of the images include patients name or any other features patient's identity in any form.

Declaration of competing interest

Ahmed Ghazi is a consultant for Olympus, this work was not funded by industry.

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References

1. Resnick MI. Evaluation and management of infection stones. *Urol Clin.* 1981;8: 265–276.
2. Hegarty NJ, Desai MM. Percutaneous nephrolithotomy requiring multiple tracts: comparison of morbidity with single-tract procedures. *J Endourol.* 2006;20:753–760.

3. Bach C, Goyal A, Kumar P, et al. The Barts 'flank-free' modified supine position for percutaneous nephrolithotomy. *Urol Int.* 2012;89(3):365–368.
4. Goktug G, Karakoyunlu N, Sener NC, et al. Standard percutaneous nephrolithotomy alone versus in combination with intraoperative anterograde flexible nephroscopy for staghorn stone: a retrospective analysis. *Kaohsiung J Med Sci.* 2015;31, 568e57.
5. Nicklas AP, Schilling David, Bader MJ, et al. The vacuum cleaner effect in minimally invasive percutaneous nephrolitholapaxy. *World J Urol.* 2015 Nov;33(11): 1847–1853.