A NOVEL TECHNIQUE SINGLE SITE MULTIPUNCTURES SUPINE PCNL: CASE SERIES REPORT

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ABSTRACT

Objective: *To presents a case series of three patients who received PCNL during 2020 and 2021.* ***Case(s) Presentation:*** *We reported three cases of two females and one male, aged 54, 63, and 48. All patients were diagnosed for having the staghorn stones in the kidney. We performed the "Single Site Multipuncture Supine (SMS) PCNL" technique on these patients.* ***Discussion:*** *Percutaneous Nephrolithotripsy (PCNL) is the preferred surgical technique for treating staghorn or other complicated kidney stones. There are many techniques and modified positions available for PCNL. This technique removes complex kidney stones by making a one cm skin incision to accommodate multiple punctures to access all kidney poles. The highest reduction in hemoglobin was only 1.54 g/dL in the patient who got four punctures, no blood transfusion was needed during post-operative recovery, and no complications occurred during the follow-up period. All patients were stone-free post-operatively without any need for additional procedures. The mean time of overall surgery was 130 minutes.* ***Conclusion:*** *This single-site multi-punctures supine PCNL technique could give the advantage to cosmetics due to less tissue injury.*

Keywords: *Multi punctures, PCNL, staghorn stones.*

ABSTRAK

Tujuan: *Memaparkan kasus series tiga pasien yang mendapatkan tindakan PCNL selama tahun 2020 hingga tahun 2021.* ***Presentasi kasus:*** *Kami melaporkan tiga kasus dari dua perempuan dan satu laki- laki, berusia 54, 63, dan 48. Semua pasien didiagnosis dengan batu staghorn di ginjal. Kami melakukan teknik PCNL "Single Site Multipuncture Supine (SMS)" pada pasien ini.* ***Diskusi:*** *Percutaneous Nephrolithotripsy (PCNL) adalah teknik bedah yang lebih disukai untuk mengobati staghorn atau batu ginjal rumit lainnya. Ada banyak teknik dan modifikasi posisi yang tersedia untuk PCNL. Teknik ini menghilangkan batu ginjal yang kompleks dengan membuat sayatan kulit satu cm untuk menampung banyak tusukan untuk mengakses semua kutub ginjal. Penurunan hemoglobin tertinggi hanya 1.54 g/dL pada pasien yang mendapat empat tusukan, tidak diperlukan transfusi darah selama pemulihan pasca operasi, dan tidak terjadi komplikasi selama masa tindak lanjut. Semua pasien bebas batu pasca operasi tanpa perlu prosedur tambahan. Waktu rata-rata operasi keseluruhan adalah 130 menit.* ***Simpulan:*** *Teknik PCNL telentang tusukan berulang satu tempat ini dapat memberikan keuntungan bagi kosmetik karena cedera jaringan yang lebih sedikit.*

Kata kunci: *Tusukan berulang, PCNL, batu staghorn.*

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INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the preferred therapeutic approach for managing renal calculi exceeding a diameter of 2 cm. It also treats smaller stones with adverse characteristics for effective management through retrograde intrarenal surgery or shock-wave lithotripsy. Percutaneous nephrolithotomy (PCNL) can be conducted in prone or supine postures.[1] PCNL is procedure is commonly conducted with the patient in the prone position. This particular approach has certain limitations, including patient discomfort with circulatory and ventilatory difficulties, which are particularly pronounced in individuals with obesity. The supine posture for patients undergoing PCNL is a secure, efficient, and appropriate method. Utilizing a modified prone position in urological procedures offers several advantages over the conventional prone position and performing percutaneous nephrolithotomy (PCNL) with the surgeon seated. These advantages include enhanced urethral access, minimized patient

manipulation, simultaneously performing PCNL and ureteroscopic procedures, and improved airway management during the surgical intervention. Collectively, these benefits contribute to a notable reduction in the total duration of the operative procedure. The consideration of percutaneous nephrolithotomy (PCNL) may apply to most patients.[2]

Assert that using PCNL as a monotherapy, employing numerous percutaneous tracts is effective in treating staghorn and other kidney stones of substantial volume. The blood loss and complication rates exhibit similarity to those observed in PCNL procedures with a solitary percutaneous route, specifically in cases involving calculi of lesser complexity. Elawady et al. also substantiated the validity of numerous punctures to clear difficult kidney stones. The present study has revealed a novel approach that effectively minimizes the requirement for supplementary interventions while ensuring both safety and efficiency while maintaining an acceptable level of complications. The utilization of multiple tracts PCNL has been demonstrated as a secure and efficient operation, yielding a notable stone clearance rate while minimizing blood loss and the necessity for blood transfusions. In this particular scenario, the primary therapeutic approach is the utilization of multi-punctures percutaneous nephrolithotomy (PCNL).[3–5]

The single-site multi-punctures supine (SMS) percutaneous nephrolithotomy (PCNL) approach is a variation of the renal displacement technique proposed by M. Lezrek in 2011. This technique uses an 18-gauge needle to access the superior calyx, easily accessible between the 11th and 12th ribs or even below the 12th rib. The optimal approach for addressing staghorn and numerous kidney stones involves a single cutaneous incision, allowing for improved visualization and management of the kidney's lower, middle, and upper poles.[6] It is anticipated that this technique will exhibit a reduced or equivalent duration of operation in comparison to the multi-site multi-punctures technique.

Moreover, a notable advantage of single incision surgery is its undeniable beauty benefit. Implementing a single-centimeter skin incision during PCNL procedures for complicated stones, there is a concurrent reduction in scar tissue formation. This study describes a case series comprising three patients with single-site multi-punctures supine PCNL procedure at a single-center teaching hospital between 2020 and 2021.

CASE(S) PRESENTATION

The procedure is conducted with either general or regional anesthesia, with the patient positioned in the supine modified Bart's flank-free posture. The entry point of the puncture needle is positioned perpendicularly to the axis of the X-ray beam along the posterior axillary line. This orientation of the tract results in a relatively horizontal pathway, facilitating the achievement of low intrarenal pressures and promoting efficient removal of the pieces through easy washout. The C-arm is positioned vertically. The lower or middle pole was accessed using percutaneous puncture under fluoroscopy guidance with a previously inserted ureteral catheter, utilizing an 18-gauge needle. Under continuous fluoroscopic surveillance, the proximal end of the needle was deliberately advanced in the cranial direction. A J-Tip super-stiff guidewire with a rigid shaft was inserted to safeguard the urothelium from the needle's distal end during the bending process. The caudal displacement of the kidney occurred due to the lever movement. The superior pole calyx has been perforated, resulting in the creation of a tract. Subsequently, a small inversion of the normal axis of the kidney was seen, with the lower pole exhibiting a medial tilt and the upper pole displaying a lateral orientation.

Consequently, the upper calyx exhibited a downward orientation close to the cutaneous entry point. As a result, the calyx that was the focus of attention became more evident. The further punctures required to access the stone are made through the initial incision, and dilatation is performed with an Alken dilator until a size of 30 Fr is reached. Subsequently, an Amplatz 30 Fr is introduced. This is followed by inserting a regular size 26 Fr nephroscope or a 12 Fr nephroscope (tiny PCNL). A lithotripsy procedure was performed after the evacuation of the fragment. The surgical procedures were concluded by inserting a 20-Fr nephrostomy tube or a 12-Fr Naso-Gastric tube into the tract. This study focuses on the procedure that involves performing many punctures of percutaneous nephrolithotomy (PCNL) with a single skin incision.[6-7]

A 48 years old male with chief complaint of

pain in right flank and history of extracorporeal shock wave lithotripsy (ESWL) 2 years prior the surgery. The patient has controlled hypertension and overweight. Non-contrast computed tomography (NCCT) of the abdomen showed right staghorn stone with middle-lower pole involvement and mild hydronephrosis with the stone size 4 cm x 1.4 cm. The preoperative laboratory showed normal hemoglobin (16.5 g/dL), leucocyte (8.300/µL) and creatinine of 1.13 mg/dL.

The patient underwent a normal PCNL procedure utilizing the supine modified Valdivia position, followed by a double-J (DJ) stent placement. The SMS-PCNL procedure involved the implementation of two punctures on the middle and lower poles inside a single incision. The overall surgery took 115 minutes to finish. The post-operative laboratory showed a hemoglobin level of 16.3 g/dL, leucocyte of 12.500/µL, and creatinine of 0.97 mg/dL. Plain X-Ray KUB in the next day showing DJ Stent inserted properly and there is no visible radiopaque shadow. The patient was being discharged 2 days after surgery.

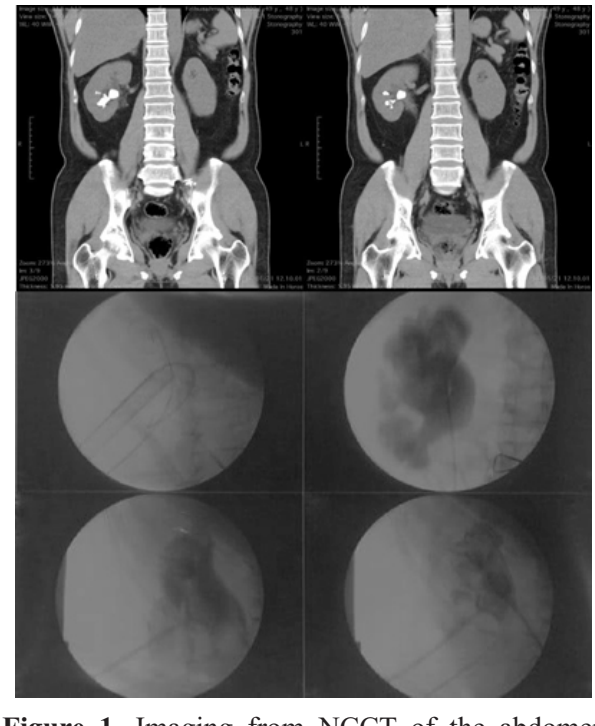

Figure 1. Imaging from NCCT of the abdomen showed right staghorn stone with middle-lower pole involvement and mild hydronephrosis, and imaging from right retrograde pyelography showed two punctures to reach the middle and lower poles of staghorn stone involvement.

Figure 2. Post-operative view of two nephrostomies in the single incision.

A 54 years old female with a chief complaint of pain in the right flank. The patient was class I obesity and had no other comorbidities. Non-contrast computed tomography (NCCT) of the abdomen showed a right staghorn stone with upper-middle-lower pole involvement and severe hydronephrosis with the size of the stone 5 cm x 2 cm. The preoperative laboratory showed the concentration of hemoglobin of 14.2 g/dL, leucocyte of 8.400/µL, creatinine 0.81 mg/dL.

The patient underwent a normal PCNL procedure utilizing the stone management system (SMS) approach, followed by the placement of a double-J (DJ) stent. The SMS-PCNL was conducted with three punctures. Start on the lower pole, following middle and upper pole. The overall surgery took 135 minutes to finish, and no significant bleeding was detected during the surgery. The post-operative laboratory showed hemoglobin and leucocyte of 13,5 g/dL and 8.800/µL, while the creatinine level was 0.73. Plain X-Ray KUB in the next day showing DJ Stent inserted properly and there is no visible radiopaque shadow. The patient was being discharged 2 days after surgery.

Figure 3. Imaging from NCCT of the abdomen with a staghorn stone in the right kidney and right severe hydronephrosis, and imaging of right retrograde pyelography showed three punctures to reach the upper, middle, and lower pole of the kidney.

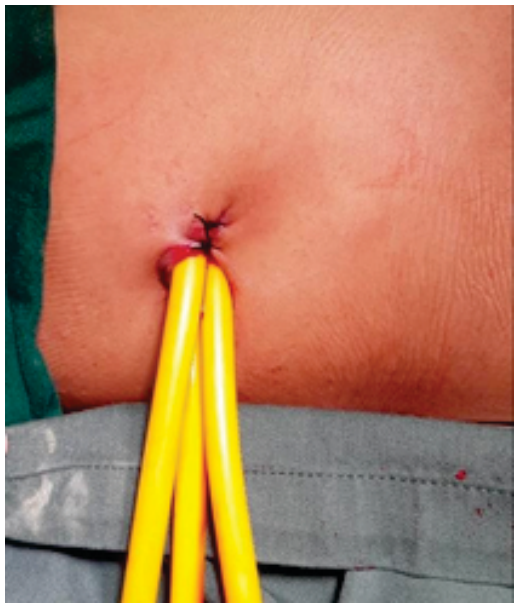

Figure 4. Post-operative view of three nephrostomy in single incision.

A 63-year-old female patient presents with a primary concern of experiencing pain in the right flank region. The patient has diabetes with a history of open right renal surgery. The patient also had hypertensive heart disease and was class I obesity. NCCT of the abdomen revealed a right staghorn stone with upper-middle-lower pole involvement and mild hydronephrosis with the size of the stone 6,5 cm x 2.3 cm. The preoperative laboratory showed the concentration of hemoglobin was 15.4 g/dL, leucocyte of 12.600/µL and creatinine level was 0.68 mg/dL.

The patient had treatment involving using both Standard PCNL and Mini PCNL techniques, employing the Stone Management System (SMS) approach. Subsequently, a Double-J (DJ) stent was inserted. The SMS-PCNL procedure was performed utilizing a total of four punctures. The initial puncture was made on the lower pole, followed by another puncture on the upper pole using the regular PCNL technique. Subsequently, two additional punctures were made on the middle pole employing the small PCNL approach. The overall surgery took 140 minutes to finish.

Post-operative complete blood count examination showed hemoglobin and leucocyte concentrations of 13.9 g/dL and 13.70000/µL, respectively with creatinine levels of 0.58 mg/dL. Plain X-Ray KUB in the next day showing DJ Stent inserted properly and and there is no visible radiopaque shadow. The patient was being discharged 3 days after surgery.

Our patient consisted of two females aged 54 and 63 years old and one male aged 48 years old. Two out of three patients were obese I and the other was overweight as defined by the World Health Organization (WHO) Asian BMI Classification system. The mean operating room (OR) time was 130 min. The longest OR time was in percutaneous nephrolithotripsy performing four punctures and four tracts in 1 incision, while the shortest duration was in percutaneous nephrolithotripsy performing two punctures and two tracts in 1 incision.

All of the patients had staghorn stones with 2 or even 3 pole involvement. All of the patients presented with normal preoperative hemoglobin concentrations. The mean concentration of their preoperative hemoglobin is 15 g/dL. All of the patients had some drop of hemoglobin postoperatively. One patient who underwent PCNL with two punctures and two tracts in 1 incision had a hemoglobin reduction of 0,2 g/dL. The patient who got three punctures in 1 incision had a hemoglobin reduction of 0,8 g/dL. The patient who underwent four punctures and four tracts in 1 incision had a more significant hemoglobin reduction of 1,5 g/dL. While the surgery itself causes some hemoglobin decrease, all of the patients do not need any blood transfusion as the postoperative hemoglobin concentration was still in the normal range.

On the other hand, not similar to hemoglobin, all three patients had some increase in leucocyte pre- and postoperative. The mean increase in leucocytes was 1900/µL. The highest rise in leucocytes was 4200 µ/L in PCNL with two punctures and two tracts in 1 incision surgery. Regarding creatinine level, all of the patients had some reduction in creatinine. The mean decrease of creatinine was 0,11 mg/dL. In these case series were assesed using Clavien-Dindo classification and showed no complication.

The mean length of stay after the surgery was 2,3 days, with the most extended duration being 3 days after surgery in a patient who had PCNL with four punctures in 1 incision. The shortest hospital length of stay was 2 days after surgery in a patient who had PCNL with two punctures and three punctures in 1 incision. After follow-up for months, we found no complications occurred.

Figure 5. Non-contrast computed tomography (NCCT) of the abdomen with a staghorn stone in the right kidney and mild hydronephrosis, and imaging of right retrograde pyelography showed four punctures to reach upper, middle and lower pole of the kidney.

Figure 6. Post-operative view of four nephrostomy in single incision.

DISCUSSION

The purpose of this study was to introduce a modified technique for removing kidney stones and highlight its ease of performance. Percutaneous nephrolithotomy (PCNL) is crucial in managing staghorn and large-volume kidney stones. According to the updated guidelines of the American Urological Association Nephrolithiasis Guidelines Panel on Staghorn Calculi, there is a current inclination towards employing percutaneous monotherapy with multiple tracts as the favored treatment approach for the majority of staghorn calculi. The ultimate treatment objective for each patient undergoing percutaneous nephrolithotomy (PCNL) is the thorough removal of all calculi using percutaneous means. Utilizing multiple percutaneous tracts during a single session of percutaneous nephrolithotomy has been determined to be a safe, viable, and effective approach for treating complicated stones in specific situations. This method has demonstrated acceptable morbidity rates and has successfully obtained enhanced stone clearance, thanks to advancements in tools and accumulated expertise in the field.[8]

To the best of our knowledge, we are the first to modified this technique we called single-site multipuncture supine PCNL, and we shortened it as SMS PCNL. This technique is performed to access the lower, middle, and upper pole of the kidney to treat staghorn and multiple kidney stones through a single skin incision. Our technique is performed with the supine modified Bart's flank free position. This position has advantages, including optimal cardiovascular and respiratory control, especially in obese patients, better stone fragment washout and low intrapelvic pressure, horizontal dorsal tract sheath angle that results in decreasing postoperative UTI, fewer colon injuries and less radiation exposure to the surgeon's hands, easy percutaneous acces under fluoroscopy, more space for placing and dilating the tract.[9]

Different from the existing multiple puncture PCNL, we performed multiple puncture PCNL in just one entry so that it causes less amount of tissue injury. The technique used in previous multiple puncture PCNL is by using multi site multi puncture and is expected to create more tissue injury than it is compared to single site multipunctures in one site. Based on a comprehensive meta-analysis, the utilization of several tracts was associated with a significant increase in hemoglobin reduction and a greater incidence of transfusions. Hemorrhage typically arises from the initial puncture of the blood arteries within the kidney and the adjacent organs. Including supplementary tracts during PCNL has been associated with an elevated likelihood of significant blood vessel damage and may impede recovery following puncture injuries. Furthermore, this complication could also increase the risk of blood transfusion.[10]

From these three cases, the highest reduction in hemoglobin was only 1.54 g/dL was found in single site multipuncture PCNL performing four punctures and four tracts in 1 incision. No blood transfusion was needed during post-operative recovery, and all of the 3 cases have been assessed using the Clavien-Dindo classification indicate there are no significant complications occurred. All patients are stone free post operatively without any need for additional procedure had been done due to the appearance of residual stones. The mean time of overall surgery was around 115 to 140 minutes. Although this operative time is considered longer than the usual PCNL technique because of the complexity of the stone. The one undeniable advantage of single incision surgery is cosmetic. By creating just one site of an incision during PCNL in complex stones, we also reduce the amount of scar tissue.

Finally, despite the advantages of this technique, we still do need more throughout comparison between this single site multipuncture technique of supine PCNL with the classic multi site multipuncture technique.

CONCLUSION

The demand and interest in "scarless" surgery are undeniable. Besides that, we attempted to modified a technique that creates less tissue injury that would benefit to cosmetic, shorter treatment time and hospital stay that we called SMS PCNL. SMS PCNL is safe, effective and gives a better cosmeticlooks. This technique still needs more comprehensive and expanded studies to be compared to the conventional multi site multi puncture PCNL techniques.

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