 Prague Medical Report / Vol. 122 (2021) No. 4, p. 294–299

Supine Percutaneous Nephrolithotomy in a Patient with Solitary Lung: A Case Report and Literature Review

Yavuz Onur Danacıoğlu[1], Yusuf Arıkan[1], Fatih Akkaş[1], Emre Şam[1], Deniz Noyan Özlü[1], Nalan Saygı Emir[2], Feyzi Arda Atar[1]

[1]Department of Urology, Istanbul Bakirkoy Dr. Sadi Konuk Training and Research Hospital, University of Health Sciences, Istanbul, Turkey;
[2]Department of Anesthesiology and Reanimation, Istanbul Bakirkoy Dr. Sadi Konuk Training and Research Hospital, University of Health Sciences, Istanbul, Turkey

Received July 4, 2020; Accepted October 20, 2021.

Key words: Endourology – Percutaneous nephrolithotomy – Solitary lung – Supine

Abstract: Percutaneous nephrolithotomy (PNL) surgeries are performed with different patient positions, anesthesia methods and different-sized access sheaths in order to reduce the complication rates. Supine positioned PNL can be performed safely in the high-risk group patients with comorbidities. Herein, we present a patient who had a past surgical history of right pneumonectomy and underwent a supine PNL procedure under regional anesthesia for a staghorn renal stone in the right kidney.

Mailing Address: Deniz Noyan Özlü, MD., Department of Urology, Istanbul Bakirkoy Dr. Sadi Konuk Training and Research Hospital, University of Health Sciences, Tevfik Saglam Caddesi No:11 Zuhuratbaba/Bakirkoy, Istanbul 34147, Turkey; Phone: +90 535 233 64 40; e-mail: noyanozlu@hotmail.com

https://doi.org/10.14712/23362936.2021.27

Introduction

Percutaneous nephrolithotomy (PNL) is the gold standard treatment method for renal stones larger than 2 cm. It has been made possible to perform this surgery in patients from all age groups by means of the technological developments in the field of endourology (Fernström and Johansson, 1976). Despite these developments, PNL surgeries are performed with different patient positions (i.e. prone, supine, flank), anesthesia methods (regional, general) and different-sized access sheaths in order to reduce the complication rates (Basiri et al., 2010; Nouralizadeh et al., 2013). Thus, with the help of these flexibilities, PNL can be performed safely in the high-risk group patients with comorbidities. Supine PNL which became popular during the last two decades was defined by Valdivia Uría in 1987. It has been shown by subsequent studies that, this position had several advantages when compared with the prone PNL (Proietti et al., 2019). Lesser exposure of the surgeons to radiation, shorter surgical time, rendering simultaneous endoscopic intrarenal surgery possible and most importantly, reduction of the risks associated with anesthesia in high-risk patients who have respiratory compromise are the main advantages of this approach (Curry et al., 2017; Proietti et al., 2019). There are case reports published in the literature regarding supine PNL surgeries performed in nephrolithiasis patients with high anesthesia-related risks (ASA ≥ 3) and comorbidities (Manohar et al., 2007). In this report, we are presenting a patient who had a past surgical history of right pneumonectomy and underwent a supine PNL procedure under regional anesthesia for a staghorn renal stone in the right kidney.

Case report

A 58-year-old male patient presented to our outpatient clinic with the complaint of right-sided flank pain. His past medical history was significant for a history of lung cancer for which he underwent right pneumonectomy and received adjuvant chemotherapy in 2013. No cancer recurrence or metastasis was detected during

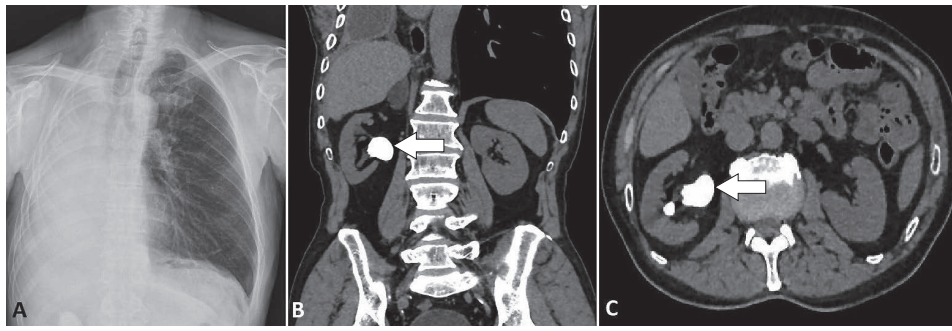

Figure 1 – Preoperative radiological imaging. A) Preoperative chest X-ray of the patient. B) Coronal view of the staghorn calculi filling his right kidney pelvis and lower pole. C) Axial view of the staghorn calculi filling his right kidney pelvis and lower pole.

his 5-year follow-up (Figure 1A). Physical examination, blood biochemistry and urinalysis findings were all unremarkable. Ultrasonography showed a staghorn renal stone and grade 2 pelvicalyceal dilatation in the right kidney. Non-contrast computerized tomography (NCCT) and intravenous urography were performed for more thorough investigation of renal anatomy, localization of the stone and assessment of the renal function. These investigations revealed that both kidneys were functional and there was a 45×40×35 mm staghorn stone in the right renal pelvis (Figure 1B and C). The stone volume was calculated by the formula: π×1/6×length×width×height, as 315 mm^3. The maximum stone density was calculated as 940 Hounsfield unit (HU). Right-sided PNL surgery was planned. Pre-operative workup included pulmonary function tests which revealed a forced expiratory volume in 1 second (FEV1) and a forced vital capacity (FVC) of 25% and 24%, respectively.

An epidural catheter was introduced to the intervertebral space between T12 and L1 by an 18-G needle in order to provide sensitive anesthesia between the segments T6 and S4 (from the level of kidneys to the level of the penile urethra). Adrenalin (1:200,000) and 3 ml of lidocaine were administered. Subsequently, the solution

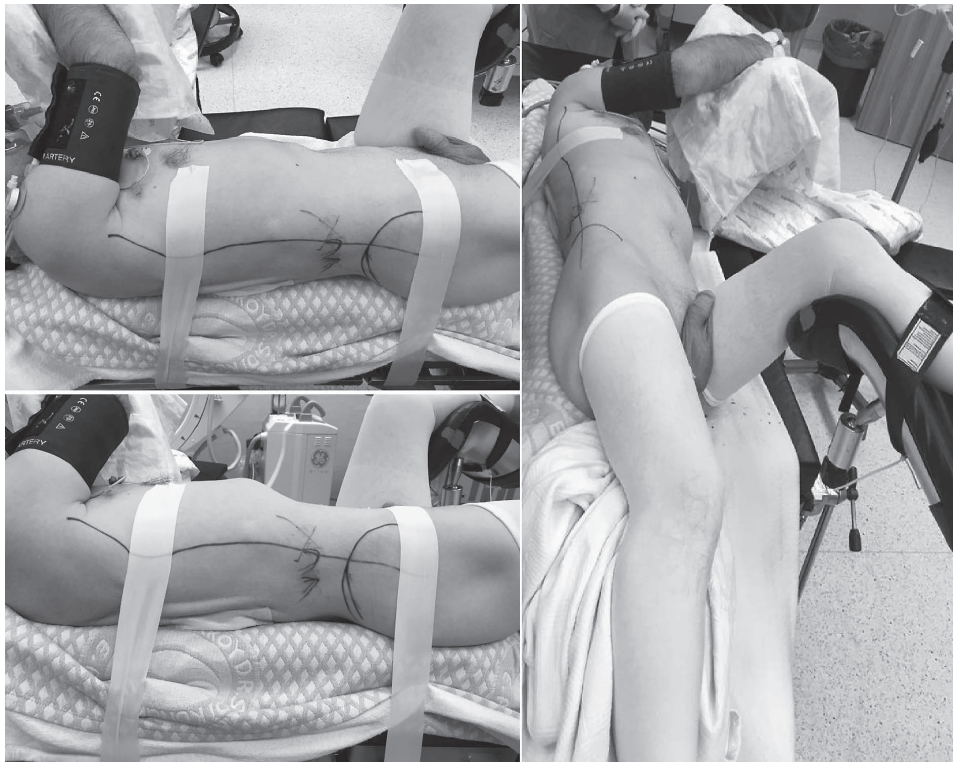

Figure 2 – The Galdakao-modified Valdivia supine position.

including 5 mg 0.5% bupivacaine and 20 ml of 0.05 mg/ml fentanyl was injected through the epidural catheter and sensitive anesthesia was provided. Anesthesia maintenance was obtained by administration of 10 ml from this solution every hour. Sensitive anesthesia was obtained without motor blockade by means of the selected drug concentration.

Galdakao-modified Valdivia supine position was given to the patient and the right flank was elevated by the help of a surgical gel positioning pad. Posterior axillary line, iliac crest and 12th rib were marked with a pen (Figure 2). A 5-F ureteral catheter was advanced through the right ureteral orifice by means of a 7-F semirigid ureteroscope (Karl Storz®, Tuttlingen, Germany). An 18-G Chiba needle (Cook Medical, Bloomington, IN, USA) was introduced to the lower pole and a 0.038-inch guidewire (Sensor guidewire, Boston Scientific®, US) was advanced through the needle under fluoroscopy and ultrasound (Logic3, GE Healthcare, US) guidance. The tract was dilated over the guidewire by a 9-F coaxial. Further dilatation was achieved over the 9-F coaxial by dilatators (Amplatz Type Renal Dilators Set, Boston Scientific®, US) ranging from 16-F to 24-F. Subsequently, a 24-F access sheath (Amplatz sheath, Boston Scientific®, US) was placed into the tract. A 19-F nephroscope (Karl Storz®, Tuttlingen, Germany) was introduced through the access sheath. The stone was visualized and subsequently fragmented by a pneumatic lithotripter (EMS, LithoClast Master, Switzerland). Stone fragments were removed by using a stone grasper (Grasping Forceps, Karl Storz®, Tuttlingen, Germany). No residual stones were identified during fluoroscopic imaging. A 14-F nephrostomy tube was inserted into the renal pelvis after fragmentation of the stones. Duration of surgery and total blood loss were determined as 63 minutes and 130 milliliters, respectively. There were no intraoperative and postoperative complications. The

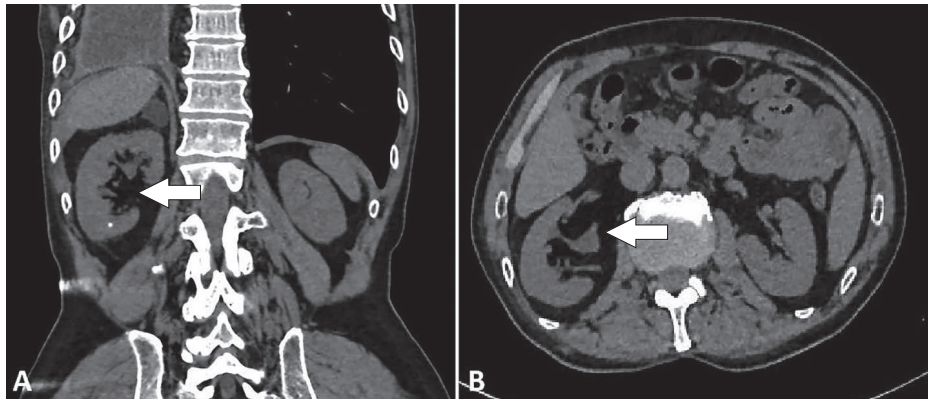

Figure 3 – Postoperative radiological imaging. A) Coronal imaging in non-contrast computed tomography after the operation. No residual stone in the right kidney. B) Axial imaging in non-contrast computed tomography after the operation. No residual stone in the right kidney.

patient was discharged on the 2nd postoperative day following the removal of the nephrostomy tube. The patient did not have any complaints in the first follow-up visit one month after the surgery and the NCCT scan did not reveal any residual stones (Figure 3).

Discussion

Despite the fact that switching from the conventional prone approach to the supine approach did not have any impact on the success rates, supine PNL is still less frequently preferred by the endourologists (Sofer et al., 2017). As a matter of fact, supine PNL has several advantages over prone PNL. Shorter surgical time, less intrarenal pressure increase, less radiation exposure and rendering simultaneous retrograde intrarenal surgery possible for the endourologist represent its surgical advantages. Since there is no need for intraoperative position change, the procedure lasts shorter (Proietti et al., 2019). Easier exposure for respiratory and cardiac interventions, absence of inferior caval vein compression and less risk for thromboembolism with the help of more favourable ventilator parameters constitute the anesthesia-related benefits of this approach (Proietti et al., 2019).

Although PNL is considered as a safe procedure especially inexperienced hands, complications may still occur. Complication rates are similar between supine and prone-positioned PNL procedures (Baard et al., 2014). Furthermore, most of the perioperative complications in the prone PNL are anesthesia-related and pulmonary problems arising from position change can lead to these complications (Kyriazis et al., 2015). Advanced patient age, obesity and the presence of a lung disease are the major risk factors for pulmonary complications. Despite the fact that pain management can be suboptimal; spinal, epidural and intrapleural anesthesia methods can be implemented for patients who have a high risk for surgery (Mehrabi et al., 2013).

To the best of our knowledge, this report is the first in the literature to present a case of supine PNL performed under regional anesthesia in a patient with one lung. In this case, we performed supine PNL under regional anesthesia in order to reduce the risk of anesthesia-related complications since our patient had a history of right pneumonectomy which lowered the functional lung capacity. The supine approach led to lower intrarenal pressure with subsequent less fluid absorption, less perirenal fluid extravasation and cardiac preload while regional anesthesia led to easier patient management. One of the reasons for choosing supine PNL is that it allows general anesthesia to be applied if regional anesthesia is not provided with sufficient anesthesia. General anesthesia was not required in our patient to the end of the operation.

Conclusion

Peri-operative management of high-risk patients is challenging both for the surgeon and anesthesiologist. The surgical approach should be individualized in order to

reduce complication rates. In line with this approach, supine PNL can be preferred to prone PNL in for the patients who have lung disease. Case series are needed to elaborate on the safety profile of this approach in these patients as well as other high-risk patient populations.

References

Baard, J., Kamphuis, G. M., Westendarp, M., de la Rosette, J. J. (2014) How well tolerated is supine percutaneous nephrolithotomy? *Curr. Opin. Urol*. **24(2)**, 184–188.

Basiri, A., Sichani, M. M., Hosseini, S. R., Vadjargah, A. M., Shakhssalim, N., Kashi, A. H., Kamranmanesh, M., Nasseh, H. (2010) X-ray-free percutaneous nephrolithotomy in supine position with ultrasound guidance. *World J. Urol*. **28(2)**, 239–344.

Curry, D., Srinivasan, R., Kucheria, R., Goyal, A., Allen, D., Goode, A., Yu, D., Ajayi, L. (2017) Supine percutaneous nephrolithotomy in the Galdako-modified Valdivia position: A high-volume single center experience. *J. Endourol*. **31(10)**, 1001–1006.

Fernström, I., Johansson, B. (1976) Percutaneous pyelolithotomy: A new extraction technique. *Scand. J. Urol. Nephrol*. **10(3)**, 257–259.

Kyriazis, I., Panagopoulos, V., Kallidonis, P., Özsoy, M., Vasilas, M., Liatsikos, E. (2015) Complications in percutaneous nephrolithotomy. *World J. Urol*. **33(8)**, 1069–1077.

Manohar, T., Jain, P., Desai, M. (2007) Supine percutaneous nephrolithotomy: Effective approach to high-risk and morbidly obese patients. *J. Endourol*. **21(1)**, 44–49.

Mehrabi, S., Zadeh, A. M., Toori, M. A., Mehrabi, F. (2013) General versus spinal anesthesia in percutaneous nephrolithotomy. *Urol. J*. **10(1)**, 756–761.

Nouralizadeh, A., Ziaee, S. A. M., Hosseini Sharifi, S. H., Basiri, A., Tabibi, A., Sharifiaghdas, F., Kilani, H., Gharaei, B., Roodneshin, F., Soltani, M. H. (2013) Comparison of percutaneous nephrolithotomy under spinal versus general anesthesia: A randomized clinical trial. *J. Endourol*. **27(8)**, 974–978.

Proietti, S., Rodríguez-Socarrás, M. E., Eisner, B., De Coninck, V., Sofer, M., Saitta, G., Rodriguez-Monsalve, M., D'Orta, C., Bellinzoni, P., Gaboardi, F., Giusti, G. (2019) Supine percutaneous nephrolithotomy: Tips and tricks. *Transl. Androl. Urol*. **8**, S381–S388 (Suppl. 4).

Sofer, M., Tavdi, E., Levi, O., Mintz, I., Bar-Yosef, Y., Sidi, A., Matzkin, H., Tsivian, A. (2017) Implementation of supine percutaneous nephrolithotomy: A novel position for an old operation. *Cent. European J. Urol*. **70(1)**, 60.