CON

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Advocates of supine percutaneous nephrolithotomy (PCNL) consider several theoretical advantages for this procedure. Despite the potential advantages of the supine PCNL, the majority of urologists have remained reluctant to perform this technique. This reluctance may be related to successful outcomes of prone PCNL and technical difficulties associated with supine PCNL. Feasibility of supine PCNL has been shown in different series and the current evidence, although limited and not fully organized, implies the application of this technique for patients with simple stones who are at high anesthesiological risk. However, there is no convincing evidence to support performing supine PCNL in morbidly obese patients and those with complex and multiple stones. Further randomized clinical trials of large sample size with high methodological quality are required to recommend extensive application of supine PCNL as an alternative to prone PCNL.

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INTRODUCTION

Anesthesiological disadvantages associated with prone position in percutaneous nephrolithotomy (PCNL) are absent in supine position. This advantage is of particular importance in morbid obese patients and those with skeletal deformities. A comfortable sitting position is provided for the surgeons during the whole procedure with their hands outside of the fluoroscopic field. Retrograde access to the urinary tract is possible while the surgical field remains sterile and the patient position is unchanged. Since the bowels lie away from the puncture site in supine position, the risk of the bowel injury is comparable to that in prone position. Furthermore, supine position has been postulated to reduce the possibility of stone migration into the ureter due to horizontal percutaneous tract and the low intrarenal pressure.[1,2]

Percutaneous nephrolithotomy in supine position was introduced by Valdivia Uría and colleagues 12 years earlier[3] and the aforesaid advantages for this technique have been elucidated in different studies. Despite the potential advantages of the supine position, it has not become popular among urologists, and PCNL in prone position is being considered as the preferred method worldwide. Plausible explanations to this low acceptability may be fear of the colon injury and lack of experience.[4] However, supine position does not seem to increase the risk of the colon injury.[5]

In a review of supine and prone PCNLs, Duty and colleagues

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indicated that none of the 1494 patients in a total of 8 supine PCNLs experienced the colon injury.[6] This may have been related to more anterior displacement of the colon in supine position. Although the concerns regarding the risk of the colon injury have been resolved to a certain extent, the majority of urologists have remained reluctant to either utilize supine position as a safe technique with several potential advantages or improve their knowledge and experience in this regard. A possible reason may be related to the availability of highly effective and safe conventional prone PCNL.[7] Moreover, one has to consider that PCNL in supine position despite its irrefutable benefits is associated with several technical disadvantages.

Prone PCNL as a Safe and Effective Procedure

Prone PCNL has been performed successfully during the past 30 years and still represents the standard for percutaneous access to the kidney.[8] Stone-free rate in prone PCNL ranges from 76% to 91% in different large scale series and complication rates have been reported to be within the acceptable limits.[5,6,9]

Several disadvantages have been claimed for prone PCNL, including patient's discomfort, circulatory and respiratory complications, increased intraocular pressure, risk of the cervical spine injury, tracheal tube displacement, and prolonged surgical duration due to need for patient repositioning. However, the majority of these position-related complications have been reported in the neurosurgical and orthopedic literature, and in most patients who experienced adverse events attributable to the prone position, operation time has been much longer than the average time for performing prone PCNL.[6] Two large studies on PCNL, each including more than 1000 patients, reported no complications attributable to prone position during PCNL.[10,11]

Technical Difficulties of PCNL in Supine Position

Despite some technical advantages, such as spontaneous stone drainage during the procedure and more comfortable position of the surgeon, supine PCNL is associated with several important technical difficulties:

1- In case of anterior caliceal stone, lateral deflection of the rigid nephroscope into an anterior calyx is restricted by the side of the bed. In these conditions, either applying flexible nephroscope or forming a tract directly through the anterior calyx could be considered as practical alternatives. Nevertheless, applying flexible nephroscope is associated with relatively limited visual field and subsequently lower success rates.[12] Furthermore, forming a tract directly through the anterior calyx does not pass through the area of Brodel's avascular line and is associated with higher bleeding complications.[13]

2- Since the upper pole is more medial and posterior, and located deeply in the rib cage, upper pole caliceal puncture in supine position is more difficult and associated with a higher risk of hydrothorax or pulmonary injury.[14] Studying 20 patients, Falahatkar and associates performed renal displacement technique (lung inflation) to access the superior calyx subcostally.[15] Using this technique, they were able to avoid intrathoracic complications. However, this finding requires further confirmation and may not be applicable for patients with prior history of renal surgery and more superiorly located calices.

3- The distance between 12th rib and the superior edge of the iliac crest is greater in prone than supine position. Since the puncture site lies between these two landmarks, supine PCNL may be associated with a limited field, which restricts nephroscopic maneuvers and may interfere with execution of further tracts in the case of multiple-access PCNL.[6]

4- In supine position, the kidney is positioned more medially and is more floating in the retroperitoneum. In case of a floating kidney, wide kinking of the metallic guidewire may occur. Consequently, execution of the nephrostomy tract and dilator progression may be more challenging in the supine position.[13] Greater mobility of the kidney may also be associated with longer tract, which subsequently decreases nephroscope mobility. Therefore, greater force must be exerted on the renal parenchyma to maneuver the nephroscope, which

may increase the chance of parenchymal damage and bleeding.[6]

5- Supine PCNL is associated with decreased filling of the pyelocaliceal system. Collapsed collecting system restricts the surgical field and even a moderate amount of bleeding obscure vision and may lead to early termination of the surgery.

Some authors advocate supine PCNL as it provides a comfortable sitting position for the surgeons during the whole procedure with their hands outside of the fluoroscopic field. Nevertheless, surgeon's comfort is not only limited to the sitting position, but also depends on the better vision and possibility of greater maneuver of the nephroscope. Therefore, supine PCNL is not necessarily associated with surgeon's comfort. Radiation exposure in supine PCNL may also be more due to technical difficulties, ie, kinking of the guidewire may interfere with easy execution of the nephrostomy tract. However, these theoretical comparisons require confirmation by well-controlled trials.

Review of the Current Evidence

Low acceptability of the supine PCNL may be attributable to the lack of level I data. Only few studies have been performed so far to compare different positions for PCNL. Two randomized clinical trials[4,13] and two case control analyses[16,17] have evaluated PCNL in 182 and 207 patients with supine and prone positions, respectively. Stone burden was approximately similar between different study groups and all the studies revealed similar technical success and complication rates. Operation time was significantly longer in prone PCNL, which included time for repositioning. However, neither of these studies comprised morbidly obese patients and some studies have excluded patients with complex stones.

In one of the aforesaid randomized trials, De Sio and colleagues excluded patients with complex stones, ie, stones in more than one calyx or complete staghorn calculi. Furthermore, no access was performed through the upper calyx or with supracostal approach in their study.[13] Falahatkar and associates also reported few subjects with staghorn calculi.[4] Therefore, the results are not representative of the entire population with urolithiasis.

Different case series have also compared supine and prone PCNLs and revealed similar stone-free rates and slightly lower bleeding in favor of supine PCNL. However, analysis has shown larger proportion of staghorn and multiple calculi treated in prone position.[5] To address outcomes in obese patients and those with staghorn calculi in a comprehensive review, de la Rosette and coworkers compared weighted means presenting outcomes in supine and prone positions on operation time, success rate, and bleeding needing transfusion.[18] This comparison revealed significantly less operation time for the prone against supine PCNL, with similar bleeding and slightly better success rates. In the second analysis, they included studies with similar proportions of staghorn calculi to compare supine and prone PCNLs and noted that prone position provides better stone-free rates among patients with complex renal calculi. However, the number of studies meeting these criteria is very limited at present and conclusions should be carefully interpreted.

CONCLUSION

Current data support the feasibility of PCNL in supine position and this technique can be considered as a promising alternative in treating patients with uncomplicated stones and those with high anesthesiologic risk. However, there is no convincing evidence to support performing supine PCNL in patients with complex stones, staghorn calculi, multiple stones, upper caliceal stones, morbidly obese patients, and those with coexisting renal anomalies. Further randomized clinical trials with larger sample size and high methodological quality are required to add valuable information to the totality of the currently available evidence.

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CONFLICT OF INTEREST

None declared.

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