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Totally Tubeless Percutaneous Nephrolithotomy for Upper Pole Renal Stone Using Subcostal Access

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Abstract

Purpose: To assess the outcome and safety of the totally tubeless percutaneous nephrolithotomy (PCNL) from subcostal access in patients with renal stone in the upper pole of the kidney.

Patients and Methods: Seventy patients with upper pole renal stones were enrolled in a randomized clinical trial from April 2003 to November 2008. The inclusion criteria were the existence of solely upper pole stones, stone size >1.5 cm, extracorporeal shockwave lithotripsy failure or stone in closed calix and diverticulum, and successful subcostal access for reaching the stone. The exclusion criteria were unsuccessful subcostal access, more than two percutaneous accesses, prominent collecting system perforation, intraoperative significant bleeding, ureteral obstruction, and renal anomaly. The totally tubeless procedure was performed on 35 patients (group A); another 35 patients (group B) underwent standard PCNL. The incidence of complications, hospital stay, transfusion rate, stone-free rate, and analgesics use as well as return to normal activity were compared during a 1-month study period.

Results: The mean stone burden was 2.81 (standard deviation [SD] = 0.59) in group A *vs* 2.87 (SD = 0.62) cm^2 in group B. Hospitalization averaged 1.49 (SD = 0.7) *vs* 2.89 (SD = 0.99) days ($P < 0.001$), and the average analgesics use was 8.2 (SD = 3.59) mg *vs* 14.3 (SD = 5.99) mg of morphine, respectively ($P < 0.001$). The patients returned to normal activity in 11 (SD = 4.2) days in group A *vs* 17.6 (SD = 4) days in group B ($P < 0.001$). Operative time, transfusion rate, complications, re-treatment, and the overall stone-free rate were not different significantly, and no major complication was seen in the study as well.

Conclusion: Totally tubeless PCNL for the upper pole renal stone from subcostal access is accompanied by decreased hospital stay and analgesics use and a rapid return to normal activity. It can be considered as an accepted and cost-beneficial procedure for upper pole renal stones.

Introduction

The placement of a percutaneous nephrostomy tube and an internal ureteral stent after the completion of percutaneous renal surgery is a standard practice; in recent years, however, the literature has gradually suggested that total tubeless percutaneous nephrolithotomy (PCNL) is presumably a better practice[1–6] and that it may replace the standard practice in the future. For instance, totally tubeless PCNL is a preferred approach in cases of uncomplicated PCNL, lack of significant perforation of the collecting system and bleeding, no more than two accesses, and even in the case of renal anomalies.[1–3]

To the best of our knowledge, subcostal totally tubeless PCNL for solely upper pole renal stones has not been studied previously. Thus, we designed this study to evaluate totally tubeless PCNL for this case in comparison with standard practice.

Patients and Methods

We used a randomized trial study design, after receiving the approval from the ethical committee of Tehran University of Medical Sciences. Between April 2003 and November 2008, informed consent was obtained from all 87 eligible patients at the time of admission. Then patients underwent subcostal PCNL for upper pole renal stones. The inclusion criteria were the existence of solely upper pole stones, stone size >1.5 cm, extracorporeal shockwave lithotripsy (SWL) failure or stone in closed calix and diverticulum, and successful subcostal access for reaching the stone. The exclusion criteria were unsuccessful subcostal access for reaching the stone, more than two percutaneous accesses, significant perforation of the collecting system, intraoperative significant bleeding, ureteral obstruction in addition to renal anomaly. By using exclusion criteria, 17 patients were excluded and 70 patients were enrolled to the study.

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All procedures were performed by one expert endourologist. One or two accesses were created under fluoroscopic guidance with the patient in the prone position. We used a triangulation technique to create upper pole access. We used a Shibe needle to entered the upper calices directly from the subcostal area. Then a guidewire was placed, and we performed dilation and placed an Amplatz sheath. The tract was dilated to 30F using Amplatz dilators to allow the passage of a 30F working sheath. The stone was disintegrated by ballistic lithotripsy and then extracted. After completion of stone removal, a ureteral stent and Amplatz sheath were drawn, and pressure dressing with multiple gauzes was applied. The Foley catheter was removed after 12 or 24 hours.

The patients were then randomly assigned into two groups. Selection for removal of the stent and nephrostomy tube were done by a preprepared paper by an independent observer in the recovery room. There, the nephrostomy tube and ureteral stent were pulled out in the tubeless group but remained in the standard nephrostomy group. Thus, a totally tubeless subcostal PCNL was performed in 35 patients and the standard subcostal PCNL was performed in the other 35 patients.

Hemodynamically stable patients and those whose pain was controllable with oral narcotic medications were considered for hospital discharge after 24 hours. One week later, the discharged patients were followed up with renal ultrasonograpy and radiography of the kidneys, ureters, and bladder to rule out urinoma or any residual stones. In addition, 1 month later, they were asked by telephone about return to normal activity. Then, the two groups were compared with regard to the operative time, duration of hospital stay, postoperative analgesics requirement, complications, transfusion rate, preoperative and postoperative hemoglobin values, and the time of returning to normal activities.

The data were gathered and analyzed by Student *t* test and chi-square test. *P* value <0.05 was considered to indicate statistical significance.

Results

The totally tubeless PCNL group (group A) comprised 35 patients—23 (65.7%) males and 12 (34.3%) females with a mean age of 38.46 (SD = 11.7) years (range 17–66 y). No intraoperative transfusion was given, but two (5.7%) patients needed postoperative transfusions. There was no significant complication in this group. After PCNL, 30 (86%) patients were stone free, 5 (14.3%) patients had significant residual stones, 3 (8.6%) patients were successfully treated with SWL, and 2 patients needed a treatment other than SWL (second PCNL). Other baseline characteristics and operative outcomes of the two groups are shown in Table 1.

The standard PCNL group (group B) comprised 35 patients—21 (60%) males and 14 40%) females, and their mean age was 40 (SD = 11.9) years (range 16–70 y). No intraoperative transfusion was given, but three (8.57%) patients needed postoperative transfusions. There was no significant complication in this group. After PCNL, 29 (83%) patients were completely stone free, 6 (17%) patients had significant residual stones, 3 (8.6%) patients were successfully treated with SWL, and 3 patients needed a treatment other than SWL (second PCNL).

Generally, patient age, sex, body mass index, stone burden, stone location, operative time, hemoglobin drop, transfusion rates, complications, and stone-free rates were not statistically different between the two groups, whereas hospital stay, need for analgesics, and time to return to normal activity were significantly lower in the totally tubeless PCNL group ($P < 0.05$).

Discussion

Because the percutaneous approach to stone removal is superior to the open approach in terms of morbidity, convalescence, and cost, many reports have established PCNL as a routinely used technique that has replaced open surgical removal of large or complex calculi.[7] While upper pole access can be achieved by a supracostal, intercostal, or infracostal approach, supracostal access to the upper pole carries a risk of potential pleural or parenchymal lung injury. Experience could minimize the rate of such complications, but it is still up to 10% in large series.[8–14]

There are many studies showing the safety of supracostal access, but it should be a concern that the supracostal approach has some complications with little importance that there are not in the subcostal access, such as plural effusion and perforation, lung injury, and chest tube placement. There is some concern about probably more bleeding in the subcostal access and theoretically it seems true, but we have not found any proof of it yet; further studies are needed on this subject.

Thus, we perform the subcostal approach for almost all cases of just upper pole renal stones. In some cases, when

Table 1. Patient Characteristics and Operative Outcomes

Parameters, mean (SD)	*Totally tubeless PCNL (group A)*	*Standard PCNL (group B)*	P *value*
Age, years	38.4 (11.7)	40 (11.95)	0.58
BMI, kg/m^2	22.5 (3.2)	21.8 (3.1)	0.35
Stone burden, cm^2	2.81 (0.59)	2.87 (0.62)	0.66
Operative time, min	59.8 (19.4)	68 (18.9)	0.08
Hemoglobin drop, mg/dL	2.04 (0.75)	2.03 (0.72)	0.97
Analgesics, mg of morphine	8.2 (3.59)	14.3 (5.99)	0.000
Hospital stay, days	1.49 (0.7)	2.89 (0.99)	0.000
Return to normal activity, days	11.03 (4.2)	17.6 (4)	0.000

PCNL = percutaneous nephrolithotomy; SD = standard deviation; BMI = body mass index.

subcostal access was not successful, we used supracostal access to reach the stone; these patients were excluded from the study. In the current study, we do not want to suggest subcostal access as the choice procedure. Furthermore, the goal of this study is not a comparison between the subcostal and supracostal approaches for PCNL in the case of superior calices stones. Our goal was to suggest that endourologists who prefer to use the subcostal access and a triangulation technique to reach the superior calices could perform surgery by a totally tubeless method. In summary, totally tubeless PCNL for the upper pole renal stone using subcostal access is a safe and effective method that has not been studied before.

In addition, a nephrostomy tube and ureteral stent after PCNL cause pain and discomfort for the patients.[3,4] Therefore, many urologists have tried to remove the nephrostomy tube and ureteral stent at the end of the procedure as totally tubeless PCNL. Tubeless PCNL was promoted by Bellman and associates[15] in 1997, and now there are many studies that have demonstrated total tubeless percutaneous renal surgery as a safe and effective procedure and the option of choice in suitable cases.[5,6,16] These cases involve patients with a solitary kidney, previous ipsilateral open surgery, raised serum creatinine level, as well as presence of three renal accesses or supracostal accesses, and in patients undergoing bilateral synchronous PCNL or contralatral endourologic stone treatment.[1]

In a study by Mishra and colleagues,[17] early tube removal in PCNL was compared with tube PCNL. They found no difference in analgesics use, hemoglobin drop, and hospital stay between those two groups. Conversely, there was significantly lower early hematuria to save the option of check nephroscopy in early tube removal. They suggested that early tube removal is an accepted standard of care. In a study by Shah and coworkers,[1] these investigators showed that tubeless PCNL has a favorable outcome. Not only is there not any increase in complications but also there are advantages such as decreased postoperative pain and analgesics use and hospital stay duration. This is also compatible with our previous experiences.[2]

In addition, subcostal access for upper pole renal stone has a longer course through the kidney than the supracostal approach, and this seems to cause more damage to the renal parenchyma. Furthermore, subcostal access may traumatize the subcostal artery and cause more bleeding; however, this study did not confirm this hypothesis. Thus, safety and supremacy of the tubeless approach are questionable in such conditions.

To our knowledge, up to now, the role of totally tubeless subcostal PCNL in patients with only upper pole renal stone has not been evaluated, so we decided to perform a study to evaluate this procedure in those patients. We found that there were no significant differences in hemoglobin drop, transfusion rate, and complications between the two groups, although postoperative pain, hospital stay, duration of return to normal function, and analgesics use in the tubeless approach were significantly lower than that of standard practice.

In previous studies, it was suggested that a postoperative nephrostomy tube provides homeostasis and allows the renal puncture to heal while permitting proper drainage of the collecting system.[18] We demonstrated in our study that this idea does not seem true and postoperative hemorrhage and access tract recovery are not related to the existence or removal of the nephrostomy tube.

Conclusion

Totally tubeless PCNL for upper pole renal stone using subcostal access could be a safe and effective procedure. In addition, removal of the nephrostomy tube is safe, has cost benefits, and provides less morbidity, postoperative pain, and hospitalization duration.

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Disclosure Statement

No competing financial interests exist.

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Abbreviations Used

PCNL = percutaneous nephrolithotomy
SD = standard deviation
SWL = shockwave lithotripsy