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"Multiperc" for Complete Staghorn Calculus

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Introduction

A COMPLETE STAGHORN CALCULUS typically fills the renal pelvis and branch in several and/or all calices. Complete removal of stone is crucial to eradicate infection, relieve obstruction, and prevent further stone growth. Percutaneous nephrolithotomy (PCNL) is currently the preferred first-line management option for staghorn calculi.

With increasing stone size and complexity, longer operative times for PCNL may be necessary. Various options available in this situation are single-tract PCNL with an auxiliary procedure such as shockwave lithotripsy, "sandwich therapy," single-tract PCNL with flexible nephroscopy, or multiperc PCNL. Ideally, treatments for patients with staghorn calculi should be cost-effective, safe, and achieve complete stone-free rates. We prefer managing staghorn calculi with multiple percutaneous ("multiperc") access.

Multiperc PCNL

Preoperative preparation includes adequate imaging for stone size, renal anatomy, and function. Intrarenal anatomy is assessed by anteroposterior and oblique plain radiography of kidneys, ureters, and bladder (KUB) or CT. Percutaneous nephrostomy is performed in patients with renal insufficiency and severe infection to improve drainage and renal function. Similarly, patients with severe infection are initially treated with preoperative PCN to improve drainage and function. We establish ultrasound-guided percutaneous drainage with patients under local anesthesia in a predetermined calix, which will facilitate later stone removal.

All procedures are performed with the patient under general anesthesia. A 5F ureteral catheter is placed, and the bladder is drained with a 16F Foley catheter. With the patient in the prone position, padded bolsters are used to support the chest and pelvis. Renal access is predetermined after studying the stone configuration and intrarenal anatomy of the collecting system. The numbers of calices to be approached are determined and the number of punctures ascertained. One of the punctures will be the main one, which would clear maximum stone burden. Remaining punctures are secondary, to clear the peripheral caliceal stones. We prefer multiple peripheral tracts to clear all caliceal stones that may not be cleared easily through the main tract. Initially, three or four punctures are made (Fig. 1).

All punctures are performed under ultrasound guidance. Subsequent punctures are performed with fluoroscopic guidance. Tract dilatation is achieved with a screw dilator, allowing a single-step dilatation to 14F. Thereafter, the tract is dilated with serial telescopic Alken dilators. The main tract is dilated to facilitate placement of a 26F or 28F Amplatz sheath, while additional tracts are dilated to accommodate either a 20F or 24F Amplatz sheath.

Since 1994, we have been using pneumatic lithotripsy with suction to disintegrate stone. Recently, we started using the combination of ultrasound and pneumatic lithotripsy for fragmentation, which significantly reduces nephroscopy time. We limit our nephroscopy time to 90 minutes. A 20F or 22F Nelaton catheter is placed as a nephrostomy tube, and the secondary tracts are drained by 12F or 14F nephrostomy tubes.

If necessary, a second-stage procedure is scheduled after 72 hours. If the residual stone can be approached through the existing tract, the tract is dilated. If necessary, an extra tract is created under fluoroscopic control for stones in isolated calices. Stone-free status is decided on radiographic evaluation with anteroposterior and oblique plain films (Fig 2).

We conducted a retrospective analysis at our center that included patients with staghorn calculi (684 patients, 725 renal units) who underwent PCNL as monotherapy between 1991 and April 2007. The male to female ratio was 4:1. Clearance rates and major complication rates were equivalent in both groups. The mean hemoglobin drop was not significant; the blood transfusion rates were higher in those with multiple tracts (Table 1).

Discussion

The American Urological Association Nephrolithiasis Guideline Panel on staghorn calculi suggests that percutaneous monotherapy with multiple tracts is associated with a 79% stone clearance rate, acute complication rates of 15%, and transfusion rates of 18%.[1] The perceived concerns regarding multiple tracts include greater bleeding and higher complication rates.[2]

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FIG. 1. Left complete staghorn. (**A**) KUB x-ray. (**B**) IV urogram.

Hegarty and Desai[3] noted a mean drop in hemoglobin in patients with multiple tracts that was similar to that of patients who needed a solitary tract; the use of multiple tracts did not lead to a higher incidence of complications. Complete clearance was achieved in 95% of the cases. Aron and colleagues[4] achieved complete clearance in 84% of cases with multiple tracts (2 tracts in 11, 3 tracts in 68, 4 tracts in 39, and 5 tracts in 3). Liatsikos and coworkers[5] described multiple angular punctures to approach the superior pole, central region, and lower pole of the kidney for the management of

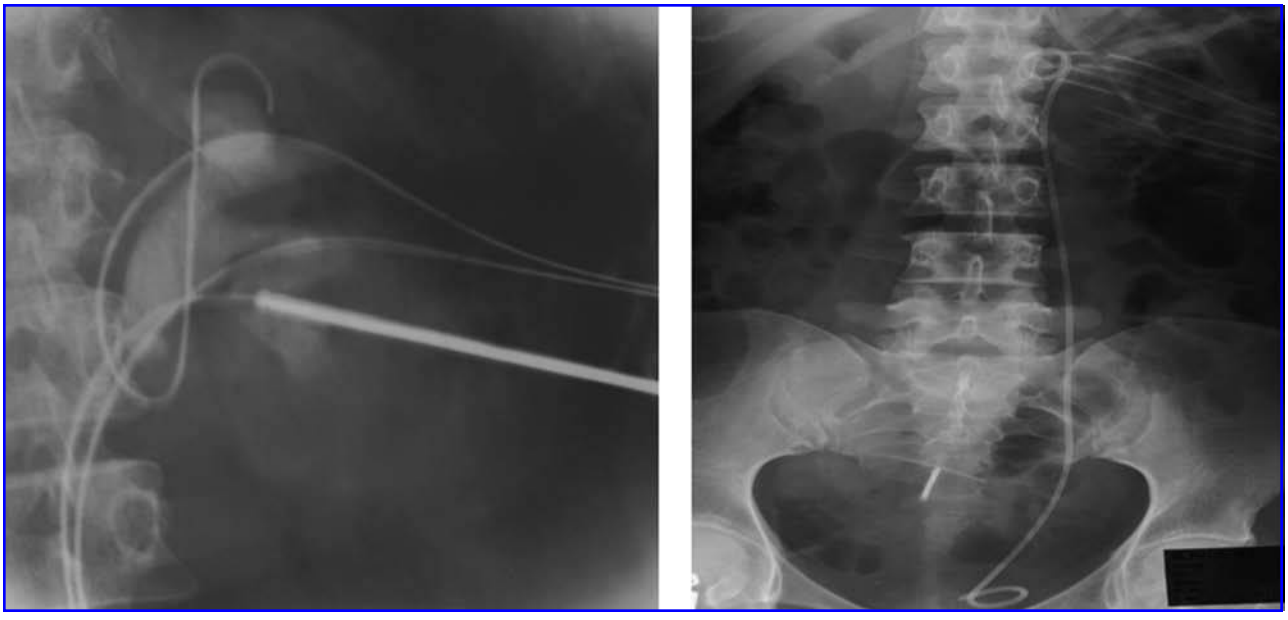

FIG. 2. Guidewires prep laced in the desired calyx, postoperative KUB showing complete clearance.

Table 1. Comparing Single and Multiple Tracts

Parameters	*Single tract (%) (n = 225)*	*Multiple tract (%) (n = 500)*	P *value*
Clearance	194 (86.4%)	420 (84.1%)	0.06
Blood transfusion	19 (8.4%)	62 (12.4%)	<0.01
Hemoglobin drop (g%)	1.4	2.1	0.06
Complications	10 (4.6%)	23 (5%)	0.92
Hospital stay (days) (mean)	7.4	11.1	<0.001
Leak (days) (mean)	1.3	1.5	<0.01

staghorn calculi with 87% stone clearance rates in a single session. Auge and associates[6] found no significant difference in blood loss, transfusions, complications, or length of surgery as the number of tracts increases.

In our series, the overall hemoglobin drop was 2.1 g%; in patients with a single tract, the drop was 1.4 g% and in multiple tracts, 2.1 g%. Although this is not statistically significant, it reflects the associated comorbidities in patients with multiple tracts, such as anemia and renal insufficiency. In our series, there were no major complications in patients with multiple tracts.

Surgical points that merit mention are that all percutaneous accesses in our center were achieved by a urologist with ultrasound guidance, and at the outset, all guidewires were positioned in the desired calices, because we believe this becomes increasingly difficult as the procedure proceeds. We restricted our nephroscopy time to 90 minutes and staged the procedure if vision was poor. Complete clearance was ensured intraoperatively by fluoroscopy and also with plain KUB radiography 48 hours postoperatively before removing the tubes.

The policy of multiperc PCNL has enabled us to achieve complete clearance in 84.1% of patients in a single hospital stay (average 11.1 days) with minimal morbidity. The approach of multiperc is also cost effective because it does not necessitate additional equipment.

Conclusion

Staghorn stones can be completely cleared with a multiperc approach. While comparing morbidity among single and multiple tracts, the blood transfusion rate is higher in patients with multiple tracts, but the major complications are similar and not significantly different in either group. More punctures are needed for complete clearance and more stages are needed for the safety of the patient. The morbidity associated with the multiperc approach is bleeding, which most of the time is managed conservatively. Complete clearance of staghorn calculi with a multiperc approach is safe, effective, and cost-effective.

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Abbreviations Used

CT = computed tomography
KUB = kidneys, ureters, bladder
PCNL = percutaneous nephrolithotomy

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