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ORIGINAL ARTICLE

A supracostal approach for percutaneous nephrolithotomy of staghorn calculi: A prospective study and review of previous reports

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KEYWORDS

Staghorn calculi;
Percutaneous;
Supracostal;
Pleura

ABBREVIATION

S-PCNL, (supracostal) percutaneous nephrolithotomy

Abstract ***Objectives:*** To evaluate a supracostal approach for percutaneous nephrolithotomy (PCNL) of staghorn calculi through a prospective study and review of previously reported cases.

Methods: From June 2009 to November 2011, 40 patients with staghorn calculi were scheduled for supracostal S-PCNL in a prospective study. Of the 40 renal units, 16 (40%) had a complete staghorn and 24 (60%) had a partial staghorn calculus. Perioperative complications were stratified according to the modified Clavien system. Univariate and multiple logistic regression analyses were used to determine statistically significant variables affecting the stone-free rate and development of complications.

Results: In all, 57 tracts were established in the 40 renal units; 23 (58%) renal units were approached through one supracostal upper pole calyx, while 13 (33%) and four (10%) required a second middle- or lower-pole puncture, respectively. Overall, 78% of patients were rendered stone-free or had clinically insignificant residual fragments with PCNL monotherapy, and this increased to 88% with auxiliary procedures. In the logistic regression analysis, a complete staghorn stone was the only independent variable for residual stones ($P = 0.005$). There was an overall complication rate of 38%. Independent variables with an influence on complications were staghorn stone burden ($P = 0.007$), and operative duration ($P = 0.045$).

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Conclusion: The supracostal upper calyceal approach provides optimum access for the percutaneous removal of staghorn stones. Appropriate attention to the technique and to monitoring before and after surgery can detect thoracic complications, and these can be managed easily with intercostal chest tube drainage, with no serious morbidity.

Introduction

The AUA Nephrolithiasis Clinical Guidelines panel recommended percutaneous stone removal as the first treatment option for managing staghorn calculi patients [1]. The management strategy for treating staghorn calculi depends on the overall stone burden, location and distribution of the stones, and the anatomy of the collecting system. The success of percutaneous stone removal depends on an adequate choice of the renal calyceal approach. The lower calyx approach fails to provide optimal access to most of the collecting system, and could be traumatic to the renal parenchyma. The superior calyceal approach is considered ideal for approaching the renal system when managing staghorn stones, complex upper and lower calyceal calculi, proximal ureteric calculi, and calculi associated with primary pelvi–ureteric junction obstruction [2–4]. However, many urologists hesitate to use a supracostal approach because of the potential for intrathoracic complications.

The aim of the present study was to evaluate the status of a supracostal upper calyceal access for percutaneous nephrolithotomy (PCNL) when treating staghorn calculi, from both the initial experience and a review of previous reports.

Patients and methods

From June 2009 to November 2011, 40 consecutive patients (28 men and 12 women, mean age 43.2 years, range 16–64) with staghorn calculi were scheduled for supracostal S-PCNL in a prospective case-series study. The study was approved by the local ethics committee, and all patients signed a written informed consent before participating. During the study period, 54 patients with staghorn calculi were assessed for eligibility. The decision to use S-PCNL was based on the stone location, configuration of the intrarenal collecting system, and the likelihood of maximal clearance using a single tract. The exclusion criteria were bleeding tendency, and high-lying kidneys necessitating puncture above the 11th rib. Giant staghorn calculi requiring more than one tract in addition to the supracostal tract, and calculi associated with marked calyceal deformities, were also excluded. The preoperative assessment included routine laboratory studies, e.g., blood chemistry, complete blood count, coagulation profile, urine analysis and urine culture. A radiological evaluation was obtained with multislice non-contrast CT in all patients.

The staghorn stone could be complete (involving the renal pelvis and all calyces) or partial (with branches in two of the three calyceal groups). Of the 40 patients, 16 (40%) had a complete staghorn and 24 (60%) a partial staghorn calculus. The size of the staghorn stone was based on measuring the longest linear diameter observed on a plain film [5]. The mean (range) stone burden was 6.2 (4.5–10.5) cm.

Procedure

Prophylactic antibiotics were given before surgery in every case. All PCNL was performed as a one-stage procedure under C-arm fluoroscopic guidance. Renal access was determined before the procedure after assessing the stone configuration and intrarenal anatomy of the collecting system. The desired calyx and the upper-pole calyx were punctured and guidewires were fixed before dilatation of any tract. For supracostal upper-pole access, the intercostal space between the 11th and 12th rib was used in all cases. The puncture was made above the lateral half of the 12th rib at the mid-scapular line (Fig. 1a). The needle was advanced in the middle of the intercostal space, thus avoiding the intercostal nerve and vessels. The puncture was made during full expiration, to avoid injury to the lung or pleura. The nephrostomy tract was dilated to 30 F using Alken's coaxial telescopic dilators. A pneumatic lithotripter was used to disintegrate the stone and any stone fragments removed by grasping forceps. When additional access was required, the Amplatz sheath was left in the upper calyx while working through the second access tract, to prevent excessive extravasation from the upper calyx into the pleural cavity. A 20 or 22 F Nelaton catheter was placed as a nephrostomy tube at the end of the procedure (Fig. 1b). If there was any doubt about complete stone clearance or bleeding from the other tract, an additional nephrostomy tube was placed in that tract. All patients had a nephrostogram taken at the end of surgery, and lung fields were imaged fluoroscopically with the patient prone. A chest radiogram was taken immediately after surgery, On the second day after surgery all had a rou-