

# Management of Single Large Nonstaghorn Renal Stones in the CROES PCNL Global Study

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**Purpose:** We compared stone characteristics and outcomes in patients with a single large nonstaghorn renal calculus treated with percutaneous nephrolithotomy in the Clinical Research Office of Endourological Society global study.

**Materials and Methods:** Two statistical analyses were done, including one comparing renal stone size (20 to 30, 31 to 40 and 41 to 60 mm) and the other comparing renal stone site (pelvis, or upper, mid or lower calyx). Surgical outcomes, including operative time, hospital stay, stone-free rate and postoperative fever, were compared between groups. Fitness for surgery was assessed using the American Society of Anesthesiologists scoring system. Severity of postoperative complications was graded with the modified Clavien classification.

**Results:** Of 1,448 stones 1,202 (83%) were 20 to 30 mm, 202 (14%) were 31 to 40 mm and 44 (3%) were 41 to 60 mm. Of the large stones 73% were located in the renal pelvis. A statistically significantly lower stone-free rate, and higher postoperative fever and blood transfusion rates were seen with increased calculus size. With increased American Society of Anesthesiologists score the proportion of large stones in the calyces increased. At a score of III the proportion of large stones in the calyces was more than twice that of stones in the renal pelvis (13.5% vs 5.7%). Generally more patients with large calyceal than large pelvic stones had postoperative complications across the range of Clavien scores from I to IIIB.

**Conclusions:** Calyceal site was associated with decreased fitness for surgery and an increased risk of postoperative complications compared to renal site. An increase in stone size results in a lower stone-free rate, and higher rates of postoperative fever and blood transfusion.

**Key Words:** kidney; kidney pelvis; kidney calculi; nephrostomy, percutaneous; Europe

## Abbreviations and Acronyms

ASA = American Society of Anesthesiologists

CROES = Clinical Research Office of Endourological Society

PCNL = percutaneous nephrolithotomy

RIRS = retrograde intrarenal surgery

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PERCUTANEOUS nephrolithotomy is currently the preferred first line therapy for large radiopaque and large cystine renal stones not amenable to extracorporeal shock wave lithotripsy.<sup>1,2</sup> PCNL is thought to not provoke significant nephron damage and im-

provements in renal function after PCNL were noted in some patients.<sup>3,4</sup> Nevertheless, the risks associated with an invasive procedure such as PCNL should not be underestimated. The PCNL Global Study was performed by CROES to generate a global database

on the usefulness of the technique, principally by assessing morbidity and factors that influence outcome.

This study is the latest in the series to be published. We compared outcomes in patients presenting with a single nonstaghorn renal calculus greater than 20 mm in diameter by stone size and site in the kidney, which are recognized risk factors for increased intraoperative and postoperative complications.<sup>5</sup>

## MATERIALS AND METHODS

The CROES PCNL Global Study is a prospective observational study of consecutive patients treated at each participating center during a single year. Details of organization and methods, including imaging techniques, were previously published.<sup>6</sup> Briefly, 96 centers worldwide contributed study data on patients who underwent PCNL as primary or secondary treatment of renal stones. Local guidelines and practices for PCNL were adhered to. There were no study exclusion criteria.

Upper tract access was guided by ultrasound and/or x-ray combined with fluoroscopy. After calyceal puncture of the collecting system a guidewire was inserted and maneuvered toward the ureter. Tract dilation allowed placement of an Amplatz sheath and passage of a rigid nephroscope was facilitated with balloon, telescopic or serial dilators. After inspection complete stones were removed with graspers. As needed, laser, ultrasound or ballistic lithotripsy was done to fragment larger stones. The procedure was considered complete when all removable stones were extracted and patients were stone free for 30 days.

Stone-free status was confirmed according to the local protocol using computerized tomography, abdominal ultrasound and plain abdominal x-ray or perioperative flexible endoscopy. Bleeding severity was judged by the treating physician and transfusion was given according to local practice guidelines.

Large renal stones were defined as renal stones with a longest dimension of 20 mm or greater. Only patients with a single large renal stone per kidney were included in study. Patients with multiple stones and staghorn stones were excluded, the latter since the stone shape made determining stone size problematic.

Large renal stones were arbitrarily categorized into 3 classes based on size, including 20 to 30, 31 to 40 mm and 41 to 60 mm. Surgical outcomes were compared among the 3 categories, including operative time, length of stay, stone-free rate and postoperative fever. Depending on the site in the kidney large renal stones were classified as pelvic or calyceal. Calyceal stones were further classified as upper, mid or lower calyceal depending on the anatomical position in the calyceal system.

Patient fitness to undergo surgery was assessed using the ASA score. The severity of postoperative complications among the groups was graded with the modified Clavien classification, which stratifies postoperative complications into 5 grades.<sup>7,8</sup>

Two statistical analyses were performed, including one based on classifying large renal stones by size and the other based on renal site. SPSS®, version 16.0 was used to analyze collected data. All data are descriptive and based on frequency. Continuous variables were analyzed for statistically significant differences between the classes using 1-way ANOVA with the Pearson chi-square test used to compare categorical variables.

## RESULTS

A total of 1,448 single large renal stones were included in analysis, of which 1,202 (83%) were 20 to 30 mm, 202 (14%) were 31 to 40 mm and 44 (3%) were 41 to 60 mm. Thus, most large renal stones were 20 to 30 mm and frequency decreased with increasing size. Table 1 lists the number of large stones by site and mean size. Of the large stones 73.5% were in the renal pelvis and the proportion decreased with superior calyceal location in the kidney. While puncture for the stone bearing calyx was directly to the specified calyx, various calyces were used to access large single pelvic stones. The lower calyceal system was used in 799 patients (75.1%), followed by the middle calyx in 195 (18.3%) and the upper calyx in 55 (5.2%). Multiple punctures were done in 15 patients (1.4%). The mean size of large stones treated with PCNL was broadly similar regardless of renal site.

Table 2 lists surgical outcomes with stones categorized by size. One-way ANOVA suggested that increased renal stone size was statistically significantly associated with increased mean operative time ( $p < 0.001$ ) but not with increased hospitalization. A lower stone-free rate, and higher postoperative fever and blood transfusion rates were noted with increasing calculous size, particularly when stones were 41 mm or greater. They attained statistical significance when assessed by the chi-square test.

Table 3 lists ASA scores, and calyceal and pelvic renal sites. Regardless of location most large renal stones were associated with the lowest ASA score (I), indicating an otherwise healthy patient. At this level of preoperative risk a slightly greater proportion of large stones were located in the renal pelvis (59.7%) compared with the calyces (50.1%). As ASA

**Table 1.** Large renal stone site and size

| Calyceal Site | No. Pts (%)  | Mean $\pm$ SD Stone Size (mm) |
|---------------|--------------|-------------------------------|
| Renal:        |              |                               |
| Upper         | 93 (6.4)     | 27.0 $\pm$ 7.5                |
| Mid           | 39 (2.7)     | 27.5 $\pm$ 9.0                |
| Lower         | 252 (17.4)   | 24.8 $\pm$ 6.4                |
| Pelvic        | 1,064 (73.5) | 26.8 $\pm$ 6.9                |

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