BMC Urology

BioMed Central

Research article

Open Access

Stone clearance in lower pole nephrolithiasis after extra corporeal shock wave lithotripsy – the controversy continues

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Published: 21 January 2003

BMC Urology 2003, **3**:1

Received: 14 October 2002
Accepted: 21 January 2003

This article is available from: http://www.biomedcentral.com/1471-2490/3/1

Abstract

Background: To determine factors influencing the clearance of fragments after extra-corporeal shock wave lithotripsy (ESWL) for lower pole calyceal (LPC) stones.

Methods: In the period between July 1998 and Oct 2001, 100 patients with isolated lower polar calyceal calculi ≤ 20 mm, in patients aged ≥ 14 years, were included in the study. Intravenous urograms (IVU) were reviewed to define the LPC anatomy (width of the infundibulum and pelvicalyceal angle). Study end points i.e. stone free status; number of shock waves used and number of sessions were correlated with variables like LPC anatomy, body mass index and stone size.

Results: At three months follow up the clearance for stone size ≤ 10 mm, 11–15 mm and 16–20 mm were 95, 96 and 90% respectively. Patients with acute LPC (<90°) and obtuse angle (>90°) had stone clearance of 94 and 100% respectively. For the infundibular width of < 4 mm, the stone clearance was 93% were as for > 4 mm, it was 100%. For body mass index (BMI) less than and > 30 kg/m^2, the stone clearance was 92 and 95% respectively.

Conclusions: There is a trend towards more ESWL sessions and shock wave requirement in patients with acute pelvi-calyceal angle and narrow infundibulum but it is not statistically significant. Size (≤ 20 mm) and BMI has no relation with stone clearance. With modern lithotripter, stones up to 20 mm could primarily be treated by ESWL, irrespective of an un-favorable lower polar calyceal anatomy and body habitus.

Background

Since after the introduction of extra corporeal shock wave lithotripsy (ESWL) in early 1980's, stones in the lower pole calyx (LPC) have been the topic of discussion. Observation in a Meta analysis by Lingeman et al [1] and further supported by other reports subsequently published [2,3] showed lower stone free rate of ESWL for LPC, when compared to results of stones in other calyces. Similarly, compared to percutaneous extraction, the overall stone clearance of LPC by ESWL is also considerably lower [4].

ESWL has an inherent advantage of being minimally invasive, there is often no need for anesthesia, it is an out patient treatment, and there is no loss of working time as patient can even work on the day of treatment compared to percutaneous surgery (PCNL). The morbidity of PCNL has decreased considerably over the years but is still not comparable to ESWL. However, the stone clearance of PCNL is much better than ESWL with a considerably less need for repeat treatment.

The effects of various factors such as LPC anatomy, body habitus, stone burden and type of lithotripter have been analyzed to predict stone clearance. There is dearth of convincing data to suggest that the stone clearance is influenced by the factors so far studied. In the present study, besides LPC anatomy and stone size, influence of body mass index (BMI) has also been studied.

Methods

In the period between July 1998 and Oct 2001, 100 patients with isolated lower polar calyceal calculi ≤ 20 mm, aged ≥ 14 years, were retrospectively reviewed. All patients had an intravenous urogram performed. Patients with distorted pelvi-calyceal anatomy congenitally or by previous surgery, history of ancillary procedures performed for the LPC stone were excluded. Patient related data i.e. demographics, body mass index, stone related data (i.e. side and size), details of lower pole calyceal anatomy (width of the infundibulum and pelvicalyceal angle) and treatment related data i.e. number of sessions, total number of shock wave used, were collected. Patients were divided into two groups based on their body mass index i.e. > or < 30 Kg/m^2.

X-rays were used to determine the lower infundibulo-pelvic angle and infundibular width, as described previously [5]. Briefly, the infundibular width is measured as the narrowest point of the infundibulum. The infundibulo-pelvic angle was determined in two axes, the ureteropelvic axis and the infundibulo-pelvic axis. Former is an axis connecting the central point of the pelvis opposite the margins of superior and inferior renal sinuses to the central point of ureter opposite the lower pole of the kidney. Latter is the central axis of the lower pole infundibulum.

All patients were treated on a second generation, Dornier MPL 9000™ echo-guided lithotripter. All patients were treated by one of the two ESWL residents under the supervision of the admitting staff member. The residents made the decision about number of shock waves and energy setting. Treatment was started at 14 Kv and gradually increased to 20 Kv based upon patient tolerance; all treatments were done under sedoanalgesia. Therapy was terminated at 100% electrode consumption or earlier if the patient could not tolerate it. Post treatment evaluation was by plain X-ray or/and ultrasound by a radiologist. The admitting urologist then reviewed these and a decision for further management was made. All patients with radioopaque stones were followed with plain x-rays; ultrasound was used for patients with radiolucent stones. Patients were declared stone free if there was no radiological evidence of stone or in asymptomatic patients with sterile urine if they had ≤ 3 mm fragments at 3 months follow up. Patients were divided into two groups, those who became stone free at 3 months follow up (group A) and the group who had residual fragments (group B).

Study end points were stone free status, number of shock waves used and number of sessions.

Results

During the period, 100 patients were treated. Ninety patients were stone free at 3-month follow up (group A). The age ranged from 15–69 years with a median of 35.5 years. There were 76 males and 24 females. The mean stone length was 9 ± 4 mm (range 5 mm to 20 mm).

The overall stone free rate was 90%. Eighty-one patients had no radiological evidence of stones while 9 asymtomatic patients had ≤ 3 mm fragments with sterile urine. The mean number of sessions per patient was 1.85 (± 0.88). Seventy-eight percent-required 1–2 sessions and only 5% needed 4 sessions. The mean number of shock waves was 2879 (± 1415; median of 3000; range of 900–5600).

The stone free rate in patients with stones less than 10 mm was 95%, for stones between 11–15 mm, it was 96% and for 16–20 mm stone 90%. The stone clearance in the patients with pelvi-calyceal angle < 90° was 94% while for patients with > 90° it was 100%. The impact of infundibular width on stone clearance, showed a difference of 7% (93 versus 100%) when 4 mm was used as the dividing line.

The impact of BMI was studied in relation to stone clearance. Seventy-six patients were eutrophic (BMI < 30 kg/m^2), whereas 24 patients were considered overweight (BMI > 30 kg/m^2). The stone clearance in the former group was 95% compared to the latter, which was 92%. The pelvi-calyceal angle (PCA) and number of shock waves were also correlated. Patients with acute and obtuse PCA required 3243 and 2500 shock waves respectively (p 0.69). Similarly patients with infundibular width of > and < 4 mm were compared, the shock waves requirement increased from 2500 to 3200 for the two groups respectively but it did not reach statistical significance (p0.27). No statistically significant difference (p 0.97) was noted in shock wave requirement between eutrophic and overweight individuals. An unfavorable PCA (< 90°), infundibular width (< 4 mm) or high BMI did not increase significantly the number of sessions required to achieve stone clearance (p < 0.64, 0.24 and 0.65). The overall complication rate was 15%, however most were minor and did not required in patient stay or operative intervention (Figure 1).

Discussion

Work by Hubner and Porpaczy [6] reported in 1990 has shown that the lower calyceal stones are not innocuous

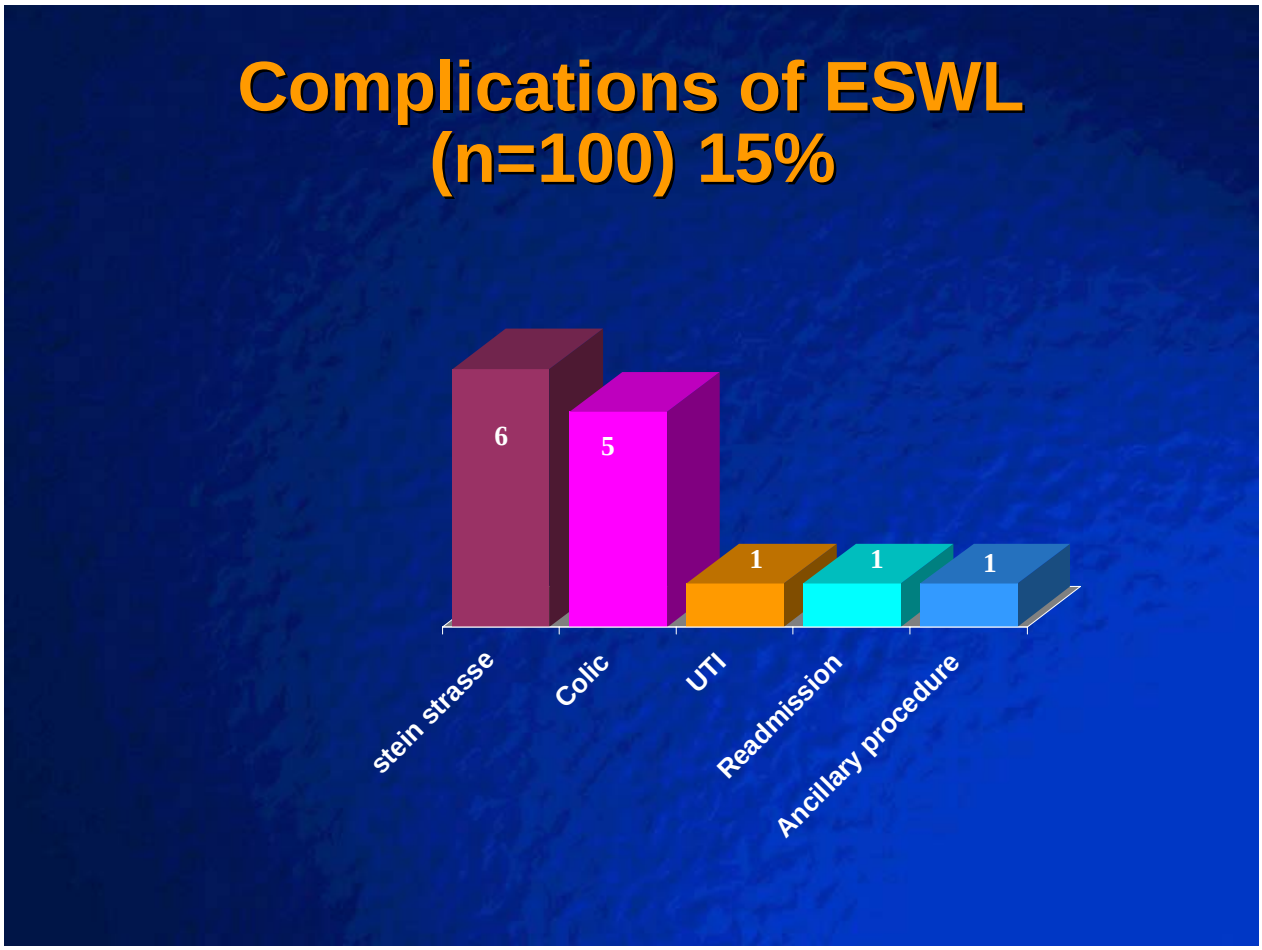

Figure 1
Complications seen, overall rate 15%.

and can lead to various complications associated with renal lithiasis. In their series, 4 out of 5 patients with LPC stone required intervention within five years of diagnosis. The management of LPC stones has always been controversial. Prior to endourology (ESWL and PCNL), open stone surgery was the only modality of treatment. Lower pole nephrectomy was a common operative procedure performed for the lower pole renal lithiasis in those days to remove poor functioning lower pole and potential source of recurrent stone disease. Since the introduction of ESWL, the management of LPC stones has changed. However, over the last one decade, literature has shown that clearance of LPC stones is much lower than that of stones in other calyces [1]. Recently, in a prospective randomized study [4] investigators have noted a very significant difference in the stone clearance rate of PCNL and ESWL, with percutaneous treatment being much more effective.

Although percutaneous surgery requires general anesthesia, occupation of operative room space, and is associated with higher morbidity than ESWL, the outcomes produced with percutaneous removal have generally being better than ESWL [7–9]. Due to advancement of technol-

ogy and greater experience with the modality over the years, complications related to PCNL have decreased [9,10].

Currently, ESWL is the initial treatment of choice for most symptomatic lower pole calyceal calculi due to its non-invasive nature, minimal anesthesia requirement and high level of patient acceptance [11]. However, several recent reports [4,12,13] have indicated a variable clearance rate using ESWL. Several investigators [3,1] have identified factors influencing clearance. These include stone burden, type of lithotripter, LPC anatomy and body habitus. For isolated LPC stones, PCA, infundibular length and width are considered as important determinants for stone clearance. Madbouly et al [14], however, refuted impact of these factors on stone clearance. Impact of body habitus has also been studied in relation to stone clearance of common bile duct stones [15]. However, in relation to LPC stones no study so far has reported the impact of obesity on clearance.

Conclusions

In the present work, we found that there is a trend towards more ESWL sessions and an increased shock wave requirement in the patients with acute pelvic calyceal angle and narrow infundibulum, but this was not statistically significant. Stone size of ≤ 20 mm does not influence stone free status. We found no relationship of stone clearance with BMI. However, due to the small number of patients in this study, we feel that a larger study should focus on the impacts of various factors influencing as for stone clearance.

Competing interests

None declared.

Authors' contribution

MHA conceived the idea, did initial pilot work, and drafted the manuscript. FA carried out the work of data collection and help in drafting the manuscript. SA helped in data collection and organizing the patients care. KK helped in data collection and organizing the patients care.

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Pre-publication history

The pre-publication history for this paper can be accessed here:

http://www.biomedcentral.com/1471-2490/3/1/prepub