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ORIGINAL ARTICLE

Safety and efficacy of using the stone cone and an entrapment and extraction device in ureteroscopic lithotripsy for ureteric stones

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KEYWORDS

Stone cone;
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ABBREVIATIONS

URS, ureteroscopy;
MSL, maximum stone length

Abstract ***Objective:*** To assess the safety and efficacy of using a stone cone and an entrapment and extraction device (N-Trap®, Cook Urological, Bloomington, IN, USA) to avoid stone retropulsion during ureteroscopic lithotripsy for ureteric stones.

Patients and methods: This retrospective comparative study included 436 patients treated with ureteroscopic lithotripsy for a single ureteric stone from February 2011 to January 2014. The diagnosis of a stone was confirmed by plain spiral computed tomography in all cases. Patients were divided according to the ureteric occlusion device applied to avoid stone retropulsion during pneumatic lithotripsy into three groups; group 1 (156) had no instruments used, group 2 (140) in whom the stone cone was applied, and group 3 (140) in whom the N-Trap was used. Patient demographics, stone criteria, operative duration and complications, and success rates (complete stone disintegration with no upward migration) were reported and analysed statistically.

Results: The stone was in the lower ureter in >55% of patients in all groups. The mean (SD) of maximum stone length was 9.8 (2.5), 10.4 (2.8) and 9.7 (2.9) in groups 1–3, respectively. The use of the stone cone or N-Trap did not significantly increase

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the operative duration ($P = 0.13$) or complication rates ($P = 0.67$). There was a statistically significant difference ($P < 0.001$) favouring groups 2 and 3 for retropulsion and success rates, being 83.3% in group 1, 97.1% in group 2 and 95.7% in group 3.

Conclusion: The stone cone and N-Trap gave high success rates in preventing stone retropulsion during ureteric pneumatic lithotripsy. Both devices caused no increase in operative duration or complications when used cautiously.

Introduction

Ureteroscopy (URS) remains a less-invasive approach with high patient tolerance, even with repeated procedures, and has fewer adverse effects than other methods of treating ureteric calculi. Retrograde URS is considered the first choice of procedure for treating ureteric calculi, as it has a success rate of >90%. Many technical advances in the ureteroscope manufacture and stone-retrieval instruments have led to a widespread acceptance and prevalence of endoscopic management for ureteric calculi [1]. The high success rate of ureteroscopic stone retrieval is attributed to the development of effective semi-rigid and flexible ureteroscopes, new grasping devices as well as pneumatic and laser lithotriptors [2]. There are some minor issues limiting the success of ureteroscopic stone manipulation, such as the possible upward migration or retropulsion of the stone, because of propulsion effect of the irrigant or, more frequently, due to application of kinetic energy used for stone disintegration. The reported retropulsion rate is 2–60% [1,3], and this wide variation in migration rate is mainly related to the site of the stone, because proximal ureteric stones have a higher retropulsion rate than those located distally in the ureter. As a solution to this retropulsion, instruments such as the stone cone (Boston Scientific, Natick, USA), and N-Trap® (Cook Urological, Bloomington, IN, USA) have been developed. The stone cone and N-Trap are ureteric occlusion devices designed to hinder the retropulsion of ureteric calculi and enable the safe extraction of stone fragments. In addition, the stone cone can substitute for the ureteric guidewire, thus maintaining continuous ureteric access and minimising the use of excess disposables [4,5]. Despite the low proximal migration rate with laser lithotripsy, its limited availability in developing countries led to our evaluation of these occlusive devices. Here we present our experience with the use of the stone cone and the N-Trap during the pneumatic lithotripsy of ureteric stones, and assess their safety and efficacy.

Patients and methods

We retrospectively reviewed our database for patients who underwent ureteroscopic stone removal from February 2011 to January 2014. In all, 521 patients had ureteroscopic removal of ureteric calculi. In 34 patients there were multiple ureteric stones and hence they were excluded from the study, whilst the stones of 51 patients were totally extracted by either forceps or a Dormia basket without using the lithotripsy machine, and these patients were also excluded from the study. Intracorporeal lithotripsy was required in the remaining 436 patients and pneumatic lithotripsy was used in all cases. According to the device which was used to prevent stone upward migration or retropulsion during lithotripsy, these patients were categorised into three groups; group 1 (156) had no additional instruments used for preventing stone retropulsion, in group 2 (140) the stone cone was used, and in group 3 (140) the N-Trap was applied. Non-contrast spiral CT was used to confirm the diagnosis and determine the exact location and size of the stone. Routine laboratory testing, urine analysis, culture and sensitivity of urine were assessed before surgery and an appropriate antibiotic was given when needed. All patients had received an intravenous prophylactic antibiotic 2 h before surgery. Under fluoroscopic control, the retrograde ureteroscopic approach was used in all cases, with a semi-rigid ureteroscope. The Swiss pneumatic lithoclast was used to disintegrate the stone. A ureteric stent was placed at the end of the procedure when indicated. Retropulsion was considered when the stone or fragments of $\geqslant$5 mm migrated upwards and could not be reached by ureteroscopy. Success was defined as a safely completed procedure with no residual fragments or retropulsion, and no additional procedures, e.g., ESWL, being required. Residual stones or fragments were assessed 'on-table' by fluoroscopy and after surgery by a follow-up plain X-ray and noncontrast CT in all patients. Patient demographics, stone criteria, operative duration, perioperative complications and the success rate were reported and analysed statistically.

Data were checked, entered, and analysed using appropriate software. Data are expressed as the mean (SD) for quantitative variables, and number and/or percentage for qualitative variables. The chi-squared and anova tests were used when appropriate. In all tests, $P < 0.05$ was considered to indicate statistical significance.