



PERFORMING PERCUTANEOUS NEPHROLITHOTOMY WITH SINGLE STEP RENAL TRACT DILATATION METHOD : A PROSPECTIVE RANDOMISED STUDY

Urology

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ABSTRACT

Abstract Objective: To perform an economical single step renal tract dilatation (RTD) during percutaneous nephrolithotomy (PCNL), using directly a 26 Fr Amplatz dilator over the central Alken guide rod, in a trial to reduce the operative duration and radiation exposure during RTD while avoiding an exchange of dilators that might increase the risk of blood loss. Patients and methods: In a prospective randomised study including 52 patients divided into two groups, the first had RTD before PCNL using the standard serial Alkens metallic telescopic dilators, and the second had RTD using the 26Fr Amplatz dilator over the central Alkens guide rod. The operative duration, with fluoroscopy exposure, was calculated. The procedure outcome in terms of complications, stone free rates and hospital stay was evaluated statistically. Results: The tract was dilated correctly in all cases. The operative duration and fluoroscopy exposure was shorter in patients undergoing single step amplatz RTD ($P < 0.05$). There were perioperative complications, according to the Clavien grading system, in 17 (34%) patients but there was no statistically significant difference between the groups. The stone free rates were comparable in both groups.

KEYWORDS

Renal Tract Dilatation, Single Step, Amplatz Dilators, Telescopic Dilators

INTRODUCTION

Percutaneous surgery is based on needle and guidewire access to the kidney and the upper urinary tract. An important and integral step in PCNL is renal puncture and tract dilatation with insertion of the access sheath, but during these steps bleeding can occur, although it usually responds to the tamponade effect provided by the access sheath [1]. With recent advances, many invasive open urologic procedures are now performed endoscopically through small-diameter percutaneous access tracts [2]. Percutaneous nephrolithotomy (PCNL) is an effective treatment for renal stones of >2 cm. This technique is associated with high success rates, decreased morbidity and fewer complications than is conventional renal stone surgery [3]. There are currently four standard methods for renal tract dilatation (RTD) such as serial metal telescoping dilators (Alken), sequential Teflon fascial dilators, single step amplatz dilator followed by amplatz sheath and the one-step balloon dilatation.

The serial Alkens metal telescopic dilators are reusable and thus more economical, and they maintain a tamponade effect throughout the dilatation. Previous reports suggest no statistical difference between metallic and sequential teflon fascial dilatation in terms of safety and efficiency [4]. Sequential Teflon fascial dilators are disposable and it has been documented that during sequential dilator exchanges, the tamponade effect on the renal parenchymal tract is lost, which can lead to more blood loss during the sequential dilatation of tract [5]. Both metallic and sequential fascial dilators are time-consuming to use, which increases fluoroscopy time and radiation exposure, with an increased incidence of kinking of the guidewire during tract development, thus hindering adequate and safe renal tract dilatation.

To reduce the operative time and fluoroscopy exposure during tract dilatation and also increase the safety of tract dilatation one step balloon tract dilatation was used. This also reduced the blood loss as it provided a constant tamponade before sheath insertion. One step balloon dilators are very costly and are not reusable, thus limiting their usage in routine PCNL surgery [6].

Thus in this study we assessed the use of a single-step amplatz dilator which is more economical, reusable and less time consuming using directly the 26-Fr (French unit) Amplatz dilator over the central Alken guide rod in a trial to reduce the operative duration and radiation exposure during RTD, while avoiding an exchange of dilators that might increase the risk of blood loss.

PATIENTS AND METHODS

This was a prospective randomized control (RCT) study conducted between April 2017 and August 2018, including initially 62 patients with large (>2 cm) and/or multiple renal stones amenable to PCNL.

The study followed the tenets of the Declaration of Helsinki, with an informed consent signed by all the patients who were included.

Patients exclusion criteria was :

- 1) Pregnancy
- 2) Body mass index of >35 kg/m²
- 3) Recurrent renal surgery on the same side
- 4) Blood coagulopathies

Finally, 52 patients were divided into two groups, using sealed envelopes, with the first having RTD done by using serial Alkens metallic telescopic dilators, and the second having RTD using in a single step using the 26-Fr Amplatz dilator over the central Alken guide rod.

The standard technique which we followed for both the types of RTD was as follows:

- 1) Cystoscopic insertion of ureteric catheter 6 fr was done under fluoroscopy guidance.
- 2) Patient was made prone and after instilling contrast material from ureteric catheter, fluoroscopy guided puncture to desired calyx was done using initial puncture needle.
- 3) Insertion of guidewire was done through puncture needle.
- 4) Over guidewire 12 fr screw fascial dilatation was done.
- 5) Over the guidewire, Alken central guide rod was parked in the renal system.
- 6) In patients undergoing serial Alken metallic telescopic dilatation, use of serial dilators over the guide rod was done till the desired tract size was achieved which was followed by insertion of amplatz sheath over the last dilator used.
- 7) In patients undergoing single step dilatation, over the guide rod directly 26 fr amplatz dilator was inserted with graded pressure and screwing movements till it reached the collecting system and over which amplatz sheath was inserted.
- 8) In both groups pneumatic energy was used to fragment the stones.

The operative duration (calculated from the time of cystoscopy to securing the 26-Fr nephrostomy tube to the skin) and that of fluoroscopic exposure were recorded at the end of the procedure. Haemodynamic changes and any need for transfusion were evaluated and recorded during the first 24 h after surgery. Any perioperative complications were classified according to the modified Clavien grading system. The total hospital stay was evaluated for each group.

The data obtained were assessed statistically, with $P < 0.05$ considered to indicate statistical significance.

RESULTS

Patients having tract dilatation using the single-step technique were

statistically significantly older than those who underwent serial metallic Alken dilatation; otherwise there were no differences in the clinical variables between the groups (Table 1).

Table 1. Perioperative variables and outcome of the procedures.
Mean (SD), n/N or n (%) variable Alken dilator Amplatz dilator

	SERIAL METALLIC ALKEN DILATOR	SINGLE STEP AMPLATZ DILATOR
NO.OF PATIENTS	26	26
AGE	34.8	44.2
SEX M/F	15/11	17/9
STONE SITE R/L	18/8	16/10
BMI, kg/m ²	25.6	24.2
NO. OF STONES	2.0	2.2
STONE BURDEN (mm)	24.7	24.2
PREOP HEMOGLOBING LEVEL (g/dl)	13.5	13.2
OUTCOMES		
OPERATIVE DURATION (min)		
MEDIAN (range)	50-90	30-50
MEAN (SD)	64	42
FLUROSCOPY EXPOSURE (min)		
MEDIAN (range)	12	10
MEAN (SD)	11.8	10.5
FAILURE OF ACCESS	0	0
STONE CLEARANCE	25	24
POST OP HEMOGLOBIN LEVEL (g/dl)	13.	12.7
COMPLICATIONS		
GRADE 1	3	4
GRADE 2	5	3
GRADE 3	1	1
TOTAL	9	8
TRANSFUSION RATE	1	1
ORGAN INJURY	0	0
HOSPITAL STAY (days)		
MEDIAN (range)	5	4
Mean (SD)	4.4	4.2

In all patients there was renal access with correct tract dilatation, and the operative duration and that of fluoroscopy exposure was statistically significantly longer when using the serial metallic Alken dilators than with the single-step amplatz RTD (Table 1).

The stone free rate was assessed using a plain X ray KUB film on the day after surgery, with residual fragments of <5 mm considered to be clinically insignificant. There were residual fragments in three (6%) of the 52 patients. There was no clinical significant difference in stone free rates between the groups. Blood transfusion was needed to 2 patients one from each group. There was no statistically significant blood loss comparing hemoglobin levels before and after surgery in both groups, or between the postoperative values in both groups. There were complications, according to the modified Clavien grading system, in 17 (34%) patients; seven (41%) had grade 1 complications, with grade 2 and 3 complications in eight (47%) and two (12%), respectively. There was no statistically significant difference in complication rates between the groups, and no reported organ injury in any patient. There was no statistically significant difference in the duration of hospital stay between the groups (Table 1).

DISCUSSION

Renal tract dilatation is the most important part of PCNL surgery. A well-made tract is the success key to PCNL surgery. RD is classically done using metallic telescopic dilators (Alken), sequential fascial dilators, single-step balloon dilator and single step amplatz dilator. Although all three methods are usually safe, reports show a higher blood loss for metallic telescopic RD than for the Amplatz and balloon dilatation [6].

In the present study the duration of fluroscopy exposure was statistically lower for single-step Amplatz RTD than for sequential

Alken metallic dilators. A shorter fluroscopy exposure was also reported by Frattini et al. [7], who used single step amplatz dilator with to gain renal access.

In the present study the overall operative duration when using the single-step Amplatz RTD was significantly shorter than when using sequential metallic Alken dilators. [7-9].

The single-step Amplatz RTD was safe and effective [10], and in the present study the stone free rates were comparable in both groups, as were the complication rates, which also did not differ between the groups.

In conclusion, the single step Amplatz RTD is a time saving procedure, being safe, subjectively economical and an effective technique to gain renal access. We found no specific complication with this technique, and the morbidity rates were comparable with those of the classical metallic telescopic RTD. We recommend its use for patients undergoing PCNL.

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