Original Research Article

# Comparison of One Shot Tract Dilatation to Metal Telescopic Dilatation in Percutaneous Nephrolithotomy and their Effect on Various Outcomes

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## Abstract

**Background:** Tract dilatation during percutaneous nephrolithotomy (PCNL) is a crucial step. Many methods to achieve it have been advocated; however superiority of anyone is not established. We have compared two popularly used methods namely metal telescopic dilatation (MTD) and one shot dilatation (OSD) in our study. **Methods:** Retrospective observational study included 40 adult patients of renal or upper ureteric stone, underwent PCNL. Group A utilized MTD, while OSD was used in group B. Demographic features, stone parameters, access establishment time, fluoroscopy time, stone free rate and complications were compared. Chi-square and Student T-test was used for analysis.**Results:** Group A and B had 21 and 19 cases respectively. Age, BMI, stone size, stone location, past surgery status, presence of hydronephrosis was similar in both groups. Tract dilatation fluoroscopy time was significantly shorter in group B (OSD) than A (MTD) (35.1±7.6 sec v/s 53.8±13.2 sec, *p=.000*). Access establishment time was also reduced in group B than A (289.7±89.7 sec v/s 405.1±133.3 sec, *p=.003*). Operation time, blood transfusion rate, hemoglobin drop and stone free rate was not significantly different among groups. Incidences of intraoperative and postoperative complications were also similar in both groups.**Conclusion**: Both methods are safe and effective for tract dilatation. OSD however is associated with lower radiation exposure and short access establishment time.

**Keywords:** Nephrolithotomy, tract dilatation, one shot dilatation, metal telescopic dilatation.



## Introduction

Renal calculus accounts for 67.4% of upper tract stones disease in the urological practice [1].It can lead to recurrent colics, infection, hydronephrosis, pyonephrosis and renal failure [2]. Percutaneous nephrolithotomy (PCNL) is the standard of care for these renal stones as well as large upper ureteric stones. It ensures complete stone clearance along with minimal nephron loss [3]. It encompasses accurate puncture of renal calyx, tract securing, dilatation of tract and placement of sheath for nephroscope insertion followed by litho-tripsy.Recently technological advances have lead to modifications in all these steps; however superiority of one to other is a matter of debate. Dilatation of percutaneous tract is an important maneuver in PCNL. It provides adequate width to allow safe and accurate insertion of nephroscope sheath [4]. It is usually done under fluoroscopic guidance. Metal telescopic dilatation (MTD), balloon dilatation (BD), serial tract dilatation and one shot dilatation (OSD) are the different techniques of PCNL tract dilatation [5]. All of these have their advantages and drawbacks in different situations. Uniform superiority of any one technique is not yet established. We explored this issue further by comparing MTD with OSD in patients underwent PCNL surgery for renal stone disease.

**Material & methods**

**Study Design:**Retrospective observational study was conducted in the department of urology from January 2020 to January 2021.Data of all adult patients of either sex of renal or upper ureteric stone disease operated for PCNL was taken. An informed consent was taken from all patients. Ethical clearance was not sought, as it was an observational study and all routine steps of a well established surgery were performed. No separate intervention of any kind was introduced. Declarations of Helsinki and its amendments were followed. Patients with ectopic kidney, horse-shoe kidney and previous nephrostomy placement were excluded from the study.

**Study Protocol:**Patient's history, physical examination, routine blood and urine investigations were noted. Ultrasound, X-ray KUB and intravenous pyelography were performed. Stone size, location, hospital stay and presence of hydronephrosis were recorded. Anesthetically fit patients were planned for surgery. General or spinal anesthesia was given. IV antibiotic was administered. Ureteric catheter was placed into the renal pelvis in lithotomy position. Patient was turned to prone position and desired calyx was punctured with 18G needle under fluoroscopic guidance. Guidewire was placed into the renal pelvis or ureter. Puncture needle was removed. Patients were divided into two groups based on dilatation technique used. Group A patients underwent MTD, while group B underwent OSD [Figure 1]. Nephro-scope sheath was placed after successful dilatation. Stone was located and pneumatic lithotripsy was completed. All fragments were removed and routine DJ stent was placed across ureter into the bladder. Patient was turned to supine position and shifted to the ward after stabilization.

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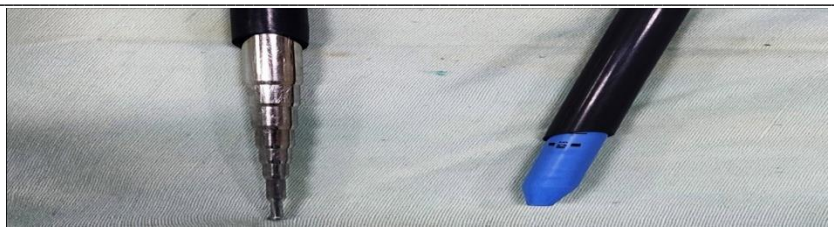

**Fig 1: Showing metal telescopic dilataor (Left) and one shot dilator (Right).**

**Outcome & Analysis:**Primary outcomes were noted in form of access established time, tract dilatation fluoroscopy time, operation time and incidence of bleeding, under-dilatation, false tract and pelvis injury. Secondary outcomes recorded were postoperative Hb drop, need for blood transfusion, stone free rate, perioperative complications and additional procedure required later.

Descriptive data was presented in form of frequency, mean, range, standard deviation and percentage. Chi-square and T-test were used for categorical and continuous variables respectively. Confidence interval was 95% and significance level was set at below .05. SPSS software (version 21.0, IBM Corp, USA) was used for analysis.

**Results**

**Baseline Characteristics:**Total 40 cases were studied. Mean age and BMI were 40.3 ± 12.6 years and 28.7 ± 3.9 respectively. Group A had 21 and group B had 19 cases. Duration of symptoms, past flank surgery and presence of hydronephrosis were similar in both groups [Table 1]. Stone was slightly bigger in group B than A (2.7±1.4 vs 2.2±0.8), but it was not statistically significant (0.151). Stone laterality and location distribution was same among groups.

**Table 1: Baseline demographical, clinical and stone characteristics of both study groups.**

| Parameter | Group A (MTD) | Group B (OSD) | *p value* |
|---|---|---|---|
| Number of cases | 21 | 19 | |
| Gender- Male/female | 11/10 | 11/8 | .488 |
| Age (years) | 40.3 ± 12.4 | 40.4 ± 13.3 | .984 |
| BMI | 29.2 ± 3.9 | 28.2 ± 3.9 | .432 |
| Presence of hydronephrosis (n/total) | 13/21 | 10/19 | .393 |
| Past flank surgery (n/total) | 0/21 | 1/19 | .475 |
| Symptom duration (months) | 7.4 ± 6.2 | 6.0 ± 4.2 | .408 |
| Stone size (cm) | 2.2 ± 0.8 | 2.7 ± 1.4 | .151 |
| Stone Location | | | |
| Calyx | 4 | 2 | |
| Pelvis | 7 | 11 | |
| Ureter | 3 | 3 | |
| Pelvis & Calyx | 2 | 3 | |
| Ureter & Pelvis | 4 | 0 | |
| Calyx & Ureter | 1 | 0 | .246 |
| Stone Laterality | | | |
| Left | 10 | 9 | |
| Right | 11 | 10 | .618 |

**Comparison of Intraoperative Events:**Lower calyx was more often chosen for puncture in both groups. Fluoroscopy time during tract dilatation was significantly higher in group A than B (53.8±13.2sec v/s 35.1±7.6sec, *p=.000*) [Table 2]. Access establishment time was also more in group A than B (405.1±133.3sec v/s 289.7±89.7sec, *p=.003*). Final operative time was same. Incidence of bleeding, under-dilatation, false tract, PCS injury was not much different in groups. Repeat dilatation was required six times in group A, while only twice in group B.

**Table 2: Comparison of intraoperative events in both study groups.**

| Parameter | Group A (MTD) | Group B (OSD) | *p value* |
|---|---|---|---|
| Calyx punctured | | | |
| Upper | 3 | 4 | |
| Middle | 5 | 6 | |
| Lower | 13 | 9 | .649 |
| Tract dilatation fluoroscopy time (sec) | 53.8 ± 13.2 | 35.1 ± 7.6 | .000 |
| Access establishment time (sec) | 405.1 ± 133.3 | 289.7 ± 89.7 | .003 |
| Operation time (min) | 56.7 ± 11.2 | 59.9 ± 13.6 | *.408* |
| Tract length (cm) | 8.7 ± 1.6 | 8.6 ± 1.9 | *.872* |
| Bleeding obscuring vision | 5/21 | 4/19 | *.569* |
| Under dilatation | 4/21 | 2/19 | *.381* |
| False tract creation | 4/21 | 4/19 | *.592* |
| Repeat dilatation | 6/21 | 2/19 | *.152* |
| PCS* injury | 1/21 | 0/19 | *.525* |

*PCS- Pelvicalyceal system

**Comparison of Postoperative Events**

Group B had slight higher hemoglobin drop after 24 hours of surgery [Table 3]. Mean hospital stay, blood transfusion rate and stone free rate was similar in both groups (*p=.360, p=.731, p=.451*). Two patients in group A and three in group B had grade 3 complications. Redo PCNL was required twice in both groups. One case in group B underwent ureteroscopic lithotripsy for stein strasse.

**Table 3: Comparison of postperative events in both study groups.**

| Parameter | Group A (MTD) | Group B (OSD) | *p value* |
|---|---|---|---|
| Hemoglobin drop (gm/dl) | 0.8 ± 0.4 | 1.2 ± 1.9 | .346 |
| Hospital stay (days) | 5.0 ± 2.1 | 5.7 ± 2.9 | .360 |
| Blood transfusion rate | 1/21 | 1/19 | .731 |
| Stone free rate | 19/21 | 16/19 | .451 |
| CDC complications | | | |
| Grade 1 | 3 | 2 | |
| Grade 2 | 1 | 0 | .534 |
| Grade 3 | 2 | 3 | |
| Grade 4 | 0 | 0 | |
| Additional procedure required | | | |
| Redo PCNL | 2 | 2 | .476 |
| URSL* | 0 | 1 | |

*URSL- Ureteroscopic lithotripsy

**Discussion**

PCNL has been a mainstay of treatment of large renal stones since its first description by fernstorm in 1976 [6]. After successful initial puncture, establishment of tract for nephroscopic intervention is the next challenging step. Amplatz K initially described use of serial fascial dilators, followed by popularization of MTD by Dr Alkem [7]. Frattini et al suggested use of OSD in his series of 78 cases in 2001 [8]. Factors such as body mass index, past surgery, hyper-mobile kidney, surgeon's expertise, presence and absence of hydronephrosis may affect the process of dilatation and subsequent outcome [9]. In our study access establishment time was significantly shorter in OSD group than MTD group by approximately 2 minutes. Studies in literature also support this finding [10, 11]. Reason may be the less number of dilators to be passed in the OSD group. Recently there has been a lot of concern raised regarding the radiation exposure sustained during use of fluoroscopy in PCNL [12]. Many practices such as use of ultrasound, radiation safety devices, still photographs in fluoroscopy and decreasing fluoroscopy time with use of OSD and BD etc, have been suggested to lessen the harm [7]. We also found the significantly decreased tract dilatation fluoroscopy time in OSD group than MTD group. Few reports have raised the concern of more trauma to the renal parenchyma in OSD due to higher axial force required for OSD [13]. However studies have allayed this concern and established the safety of OSD [14, 15]. We also found the equal incidence of bleeding, under dilatation, false tract and PCS injury in both groups. A slightly higher postoperative drop in hemoglobin in OSD group was noted in our study. It may be due to larger stone size in OSD group. On the opposite, few reports literature has found a lesser hemoglobin drop in OSD cases than others [5], however other have reported no such differenvce [15, 16]. Blood transfusion rate was same in both groups.Stone free rate in OSD and MTD group was 84.2% and 90.5% respectively (p=.451). Incidence of postoperative complications and hospital stay were also similar. Many studies comparing different techniques of tract dilatation have also reported the similar stone free rate, transfusion rate and complication occurrence [14-16]. So advantages of OSD over MTD are mainly in form of reduced radiation exposure and shortened access establishment time. Limitations of this study are small sample size, single center data, lack of randomization and exclusion of other dilatation techniques.

**Conclusion**

OSD and MTD both are safe and effective methods of tract dilatation during PCNL. OSD reduces the access establishment time and radiation exposure time during the tract dilatation as compare to MTD. Hospital stay, drop in hemoglobin, stone free rate and occurrence of complications are similar with both methods.

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