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ORIGINAL ARTICLE

# Does the presence of a percutaneous renal access influence fluoroscopy time during percutaneous nephrolithotomy?



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## KEYWORDS

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**Abstract** *Objective:* The aim of this study was to assess whether the presence of a pre-formed percutaneous renal access (PCA) had any effects on fluoroscopy time (FT) during percutaneous nephrolithotomy (PCNL).

*Methods:* After ethics approval was obtained, medical records of all patients who underwent PCNL between 2009 and 2013 at a tertiary stone referral centre were retrospectively reviewed. Patients with and without pre-formed PCA undergoing PCNL were compared. Patients who underwent second-look PCNL and those who had their access inserted by interventional radiology constituted the group with pre-formed PCA.

*Results:* A total of 185 PCNLs were reviewed. The mean patient age was  $55.2 \pm 1.0$  years with mean body mass index (BMI) of  $27.8 \pm 0.5$  kg/m<sup>2</sup> and male gender of 63.8%. The mean stone size was  $618.4 \pm 47.0$  mm<sup>2</sup> with mean Guy's grade of  $2.3 \pm 0.7$  and mean S.T.O.N.E. score of  $7.6 \pm 0.1$ . The mean operative time was  $98.7 \pm 2.6$  min with mean FT of  $113.4 \pm 4.5$  s. The overall stone-free rate was 71.9% with complication rate of 16.2%. When compared with PCNLs without pre-formed PCA, PCNLs with pre-formed PCA were associated with significantly shorter FT ( $120.6 \pm 5.1$  vs.  $77.5 \pm 6.7$  s;  $p < 0.001$ ) and significantly lower estimated blood loss (EBL) ( $p = 0.01$ ). On multivariate analysis, PCNLs with pre-formed PCA were associated with significantly shorter FT (B. coefficient =  $-43.2$  (95%CI:  $-66.4$  to  $-20$ );  $p < 0.001$ ) and lower EBL ( $p = 0.02$ ).

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*Conclusion:* PCNLs with pre-formed PCA were associated with significantly lower FT and EBL when compared with PCNLs without pre-formed PCA.

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## 1. Introduction

According to the latest American Urological Association guidelines on staghorn stones, fluoroscopically-guided percutaneous nephrolithotomy (PCNL) is still the cornerstone of treatment of large renal stones [1]. However, it is associated with the highest radiation exposure compared with other endourological procedures [2,3]. Although ionizing radiation offers advantages over other imaging modalities, patients and medical personnel may be exposed to significant levels of radiation. Some authors have even reported potential oncologic consequences from exposure to excessive ionizing radiation [4–6]. Thus, the need for following radiation safety measures including minimizing amount of fluoroscopy during PCNL and wearing appropriate radiation protective gear [3,7].

Several studies have already determined factors associated with increased radiation exposure during PCNL [8–10]. However, there is a paucity of literature regarding the effect of presence or absence of percutaneous renal access (PCA) on fluoroscopy time during PCNL. Therefore, the aim of this study was to assess whether PCNLs with pre-formed PCA are associated with significantly shorter fluoroscopy time (FT) when compared with PCNLs without pre-formed PCA.

## 2. Patients and methods

### 2.1. Study design

This study was conducted in concordance with the declaration of Helsinki 2013 and after approvals from the Director of Professional Services and Ethics Board of McGill University Health Centre (No. 14-050-GEN) were obtained. A retrospective review of all consecutive PCNLs between 2009 and 2013 was performed. Both Guy's and S.T.O.N.E. nephrolithometry scores were calculated. All PCNLs were performed by a single fellowship-trained endourologist (SA) under general anesthesia. Except for seven PCNLs performed in the supine position, all PCNLs were performed in the prone position according to what has been previously published [11,12]. At the end of the procedure, an antegrade indwelling 6F double-pigtail ureteral stent was inserted. In addition, a 20F council-tip Foley catheter was used as a nephrostomy tube for standard PCNL cases. For tubeless PCNL cases, the skin was closed with 4-0 absorbable suture. Immediately post-operatively, the attending endourologist filled out PCNL datasheets containing patients' pre-operative information and intra-operative procedural details. All of the PCNL datasheets and patients' medical charts were reviewed. Patients were followed up

with plain radiographs (kidney-ureter-bladder) at 1 and 3 months. Non-contrast computed tomography (NCCT) scans were obtained for patients with radiolucent stones. Stone-free was considered in cases with absence of any stones or presence of clinically insignificant residual fragments (<4 mm) at follow-up. The intra-operative estimated blood loss (EBL) was categorized as <250 mL or ≥250 mL. FT was calculated from the beginning till the end of the case including cystoscopy and retrograde pyelography. The calculation method for the FT has been previously reported [10]. Post-operative complications were reported according to the modified Clavien classification system [13]. PCNLs were categorized into two groups according to the presence or absence of pre-formed PCA. Therefore, the first group included PCNLs without pre-formed PCA, where the PCA was performed using fluoroscopic-guidance by the attending endourologist at the time of PCNL. The second group included PCNLs with pre-formed PCA, where the PCA had been inserted prior to the PCNL during either a previous PCNL procedure for patients undergoing second-look PCNLs or the PCA was inserted by an interventional radiologist (IR) under ultrasound- or CT-guidance. There were several indications for patients having their PCA by an IR prior to PCNL. These indications included patients with: renal transplant stones; severe scoliosis; ankylosing spondylitis; encrusted indwelling ureteral stents with renal, ureteral and bladder stones; quadriplegia and spinal fixation with metal rods overlying the kidneys; urinary diversions; pelvic kidneys; and patients with retro-renal colons.

### 2.2. Statistical analysis

Both groups were compared in terms of baseline demographics and peri-operative outcomes. FT and continuous variables were compared between the two groups using the Mann Whitney-*U* test. Categorical variables were compared using Fisher's exact test or Chi-square test. Two tailed *p*-values <0.05 were considered statistically significant. Multivariate logistic regression analysis and general linear models were performed to estimate the effect size and correct for any possible confounders. SPSS for Windows version 20 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

## 3. Results

A total of 185 PCNLs were identified and reviewed. The mean patient age was  $55.2 \pm 1.0$  years with a mean body mass index (BMI) of  $27.8 \pm 0.5$  kg/m<sup>2</sup> and male gender of 63.8% (118/185). The mean stone size was  $618.4 \pm 47.0$  mm<sup>2</sup> with mean Guy's grade of  $2.3 \pm 0.7$  and

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