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Research Article

Comparison Of Chiba And Intracath Needle Techniques For Percutaneous Access In Percutaneous Nephrolithotomy: A Retrospective Analysis Of Success Rates And Complication Profiles.

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Abstract

Objective: To compare the efficacy and safety of Chiba and Intracath needles in achieving percutaneous renal access during percutaneous nephrolithotomy (PCNL).

Methods: This retrospective study included 1,731 PCNL procedures performed between 2010 and 2020. Patients were categorized into Chiba (n=840) and Intracath (n=891) groups. Outcomes assessed included access success rate, access time, fluoroscopy time, estimated blood loss, and complications classified by the Clavien-Dindo system.

Results: Access success rates were similar (Chiba: 95.2%, Intracath: 95.6%; p>0.05). Intracath needle use resulted in significantly shorter access time (5.2 ± 1.8 min vs. 6.8 ± 2.1 min, p<0.05) and reduced fluoroscopy duration (48.1 ± 12.7 sec vs. 65.4 ± 14.2 sec, p<0.05). Estimated blood loss and complication rates were comparable.

Conclusion: Both needle types are effective and safe for PCNL access. The Intracath needle offers efficiency advantages without increased complication risk.

Keywords: percutaneous nephrolithotomy, PCNL, Chiba needle, Intracath needle, renal access, complications.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the gold standard treatment for large and complex renal stones, offering superior stone-free rates compared to alternative methods such as shock wave lithotripsy and ureteroscopy (1). As the demand for minimally invasive techniques grows, optimizing the efficiency and safety of PCNL remains a priority. The success of the procedure largely depends on obtaining accurate and efficient percutaneous renal access, as prolonged access time can increase radiation exposure, procedural duration, and complication risks (2,3).

Various techniques for percutaneous renal access have been introduced, with selection often influenced by factors such as stone size, location, patient anatomy, and surgeon experience (4). The Chiba and Intracath needles are among the most commonly used instruments for access. The Chiba needle, a fine-gauge needle (18–21G), allows for easy identification of the collecting system due to immediate urine return upon entry, aiding in precise calyceal puncture. In contrast, the Intracath needle (14G) has a larger bore, facilitating smoother guidewire insertion but requiring additional fluoroscopic verification since urine return may not be immediate (5).

Previous studies have explored various access techniques, including ultrasound-guided methods and modifications in needle design, aiming to improve procedural safety and efficiency (6,7). However, direct comparisons between different needle types in PCNL remain limited. This study aims to compare the success rates and complication profiles of the Chiba and Intracath needles in a large patient cohort. The primary endpoints include access success rate, access time, fluoroscopy time, blood loss, and complications classified according to the Clavien-Dindo system.

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MATERIALS AND METHODS

Study Design and Patient Selection: This retrospective study included 1,731 patients who underwent PCNL between 2010 and 2020. Ethical approval was obtained from the institutional review board (Ethics Committee No: 2010/1234). Patients were categorized into two groups based on the percutaneous access needle used:

- Chiba Group (n = 840)
- Intracath Group (n = 891)

Baseline demographic and clinical characteristics were recorded, including age, gender, body mass index (BMI), stone size, and stone location. The primary outcome was access success rate, defined as the ability to enter the collecting system and successfully advance a working sheath without requiring an alternative puncture. Secondary outcomes included access time, fluoroscopy duration, estimated blood loss, and complications.

Surgical Technique: All procedures were performed under general anesthesia in the prone position. Retrograde pyelography was conducted using a ureteral catheter to outline the renal collecting system. Percutaneous renal puncture was performed using either a Chiba needle (18-21G) or an Intracath needle (14G) under fluoroscopic guidance.

In the Chiba group, urine return was immediately visible upon successful puncture, allowing for precise calyceal entry with minimal fluoroscopic guidance. This advantage facilitated direct guidewire placement and reduced the need for multiple adjustments.

In the Intracath group, due to the larger needle bore, urine return was often delayed, necessitating additional fluoroscopic confirmation before guidewire advancement. However, once access was achieved, the wider needle lumen allowed for smoother guidewire insertion and faster tract dilation.

After successful puncture, a guidewire was inserted into the collecting system, followed by serial dilation using Amplatz dilators (up to 24–30 Fr) to create a working tract. A nephroscope was introduced, and stone fragmentation was performed using ultrasonic, pneumatic, or laser lithotripsy. Nephrostomy tubes were placed selectively based on intraoperative findings.

Outcome Measures and Statistical Analysis

Primary and secondary outcomes included:

1. Access success rate
2. Access time (time from initial puncture to successful renal entry)
3. Fluoroscopy time (radiation exposure during access phase)
4. Estimated blood loss
5. Complication rates (classified using the Clavien-Dindo system)

Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The Student's t-test and Mann-Whitney U test were used for continuous variables, while the chi-square test was applied to categorical variables. A p-value of <0.05 was considered statistically significant.

Table 1. Baseline Demographic and Clinical Characteristics.

Characteristic	Chiba Group (n=840)	Intracath Group (n=891)	p-value
Age (years, mean ± SD)	52.3 ± 11.4	52.8 ± 10.9	NS
Gender (Male/Female)	480 / 360	510 / 381	NS
BMI (kg/m², mean ± SD)	27.1 ± 3.2	27.0 ± 3.1	NS
Stone Size (mm, mean ± SD)	24.5 ± 6.2	24.3 ± 6.0	NS

Table 2. Procedural and Postoperative Outcomes

Parameter	Chiba Group	Intracath Group	p-value
Access Success Rate (%)	95.2%	95.6%	NS
Access Time (min, mean ± SD)	6.8 ± 2.1	5.2 ± 1.8	<0.05
Fluoroscopy Time (sec, mean ± SD)	65.4 ± 14.2	48.1 ± 12.7	<0.05
Estimated Blood Loss (mL, mean ± SD)	150 ± 45	148 ± 50	NS

DISCUSSION

PCNL remains the preferred treatment modality for managing large renal calculi due to its high stone-free rates (1). The cornerstone of PCNL success lies in obtaining effective and safe percutaneous renal access, as improper or delayed access can prolong operative time and increase the risk of complications, including bleeding and injury to surrounding structures (2,3).

In our study, we compared two commonly used access needles—Chiba and Intracath—and found comparable access success rates. The results confirm earlier reports indicating that both needle types are reliable for initial entry into the collecting system (4). However, the Intracath needle demonstrated a statistically significant advantage in terms of access time and fluoroscopy duration. These findings support prior evidence that larger-bore needles can facilitate faster guidewire placement and tract dilation (5).

Importantly, the larger caliber of the Intracath needle did

not result in higher estimated blood loss or complication rates. This finding contrasts with theoretical assumptions and some earlier studies suggesting an increased bleeding risk with larger puncture needles (6). Our findings align with reports that appropriate dilation techniques and controlled tract formation can mitigate trauma irrespective of needle diameter (7).

Radiation exposure remains a key concern in PCNL, both for patients and healthcare providers. The shorter fluoroscopy times observed in the Intracath group are noteworthy, particularly in light of recommendations aimed at minimizing radiation use in endourological procedures (8,9). This benefit, when combined with reduced access time, presents a strong argument for the Intracath needle in high-volume centers.

Additionally, no significant difference in the rate of vascular complications, including arteriovenous fistula formation, was detected between groups. This observation supports prior research highlighting that vascular injury risk is more closely related to patient-specific anatomical variables than needle type alone (10).

While the Chiba needle remains a valuable tool due to its tactile feedback and immediate urine return, the Intracath needle may offer time-saving benefits without compromising safety. Given the equivalency in complication rates and the improvement in access-related efficiency, needle selection can be individualized based on surgeon familiarity, patient anatomy, and procedural context.

Our study's retrospective nature and single-center design are notable limitations. The results may not fully generalize across institutions with different patient populations or surgical protocols. Furthermore, we did not analyze outcomes based on surgeon experience or learning curve, which could influence performance metrics. Nonetheless, this study represents one of the larger comparative evaluations of access needles in PCNL and provides meaningful insights for clinical practice.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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