

# Enhancing Percutaneous Access: The «GENOA» Prone Modified Position

Guglielmo Mantica<sup>1,2</sup>, Marco Martiriggiano<sup>1,2</sup>, Raquel Diaz<sup>2,3</sup>, Enrico Vecchio<sup>1,2</sup>, Lorenzo Lo Monaco<sup>1,2</sup>, Giorgia Granelli<sup>1,2</sup>, Benedetta Col<sup>1,2</sup>, Francesca Ambrosini<sup>1</sup>, Federica Balzarini<sup>1</sup>, Rafaela Malinaric<sup>1</sup>, Daniele Panarello<sup>1</sup>, Carlo Terrone<sup>1,2</sup>

<sup>1</sup>Department of Urology, IRCCS Ospedale Policlinico San Martino, University of Genova, Genova, Italy; <sup>2</sup>Department of Surgical and Diagnostic Integrated Sciences (DISC), University of Genova, Genova, Italy; <sup>3</sup>Department of General Surgery, IRCCS Ospedale Policlinico San Martino, University of Genova, Genova, Italy

Correspondence: Guglielmo Mantica, Department of Surgical and Diagnostic Integrated Sciences (DISC), University of Genova, Largo Rosanna Benzi 10, Genova, 16132, Italy, Email [guglielmo.mantica@gmail.com](mailto:guglielmo.mantica@gmail.com)



**Abstract:** Percutaneous nephrolithotomy (PCNL) is the preferred treatment for large or complex renal stones, but the optimal patient positioning remains debated. While the traditional prone position offers excellent access to posterior calyces, it can limit ventilation and increase anesthetic complexity. Supine modifications improve airway management but may reduce access efficacy. We propose the “GENOA” Prone Modified Position, a novel setup combining the advantages of both approaches. In this preliminary study, three patients underwent PCNL using this technique, which involves prone positioning with a ~30-45° rotation obtained by placing gel pads under the thoracic and abdominal regions contralateral to the affected kidney. This alignment brings the renal axis parallel to the floor, facilitating a safer and more ergonomic puncture. All punctures were performed below the costal margin, accessing the lower calyces in four of six renal units. Mean operative time was 72.2 minutes, and two patients achieved complete stone clearance. No complications or opioid use were recorded, and the average hospital stay was 4.3 days. The GENOA Prone Modified Position appears to be a feasible and effective solution that enhances access to posterior calyces while minimizing ventilatory risk. Further studies are needed to validate its reproducibility and long-term benefits in larger cohorts.

**Keywords:** PCNL, urolithiasis, prone PCN, kidney stones, staghorn stones

## Introduction

Urolithiasis represents a common and increasingly prevalent disease worldwide, leading to a significant clinical and economic burden on national healthcare systems.<sup>1-3</sup> Its incidence has been rising steadily over the past decades, partly due to changes in diet, lifestyle, and climate, affecting both adult and pediatric populations.<sup>4-7</sup> Percutaneous nephrolithotomy (PCNL) represent one of the treatments of choice for large or complex renal stones.<sup>8,9</sup> Among the critical aspects of this procedure, patient positioning plays a pivotal role in determining the success of renal access and the overall safety of the intervention.<sup>10</sup> The traditional prone position provides optimal access to posterior calyces but may be associated with respiratory compromise and logistical difficulties.<sup>10</sup> Conversely, modified supine positions have improved anesthetic management and reduced operative time in selected cases but may limit access to certain calyces and complicate tract dilation. In light of these limitations, we developed the “GENOA” Prone Modified Position, aiming to preserve the anatomical advantages of the prone setup while improving ergonomics, patient safety, and access precision. The aim of this preliminary study is to describe the technical features of the GENOA Prone Modified Position and to report the initial surgical and clinical outcomes in a small cohort of patients undergoing PCNL.



## Materials and Methods

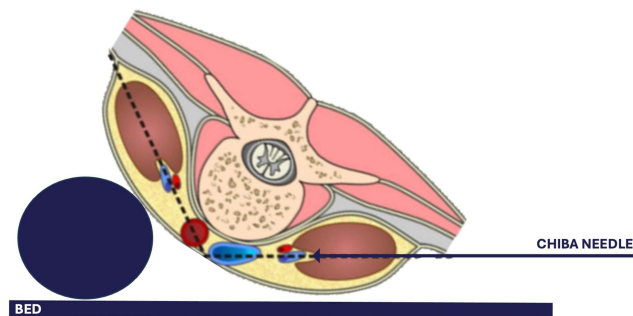
Three consecutive patients scheduled for PCNL at our Institution were selected to undergo PCNL using the GENOA Prone Modified Position. The indications for performing PCNL at our center are in accordance with the current European Association of Urology (EAU) Guidelines<sup>11</sup> and include the presence of kidney stones larger than 20 mm, staghorn calculi, lower pole stones larger than 10 mm with unfavorable anatomy, failed prior extracorporeal shock wave lithotripsy (ESWL), or stones resistant to other minimally invasive treatments. PCNL are performed in general anesthesia. Standard Antimicrobial prophylaxis according to EAU guidelines.<sup>12</sup> All procedures were performed using a 24 Ch nephroscope (model WA22367A, Olympus®, Tokyo, Japan) in combination with a lithotripter (Trilogy®, Electro Medical Systems S. A., Nyon, Switzerland), which integrates ultrasonic, ballistic, and suction functionalities. All procedures have been performed by a single surgeon (G.M.) experienced in endourology (> 250 PCNL both with supine and prone approach).

This novel setup involves placing the patient in a prone position with the body rotated approximately 30–45° compared to the operating table, achieved through the strategic placement of gel pads under the thoracic and abdominal regions on the contralateral side of the target kidney (Figures 1 and 2). This rotation results in partial lateral decubitus while maintaining prone exposure, aligning the renal axis parallel to the floor and improving access to the posterior calyces. Standard anatomical landmarks are identified and marked preoperatively. Puncture is performed under fluoroscopic guidance, targeting the lower calyces with a subcostal approach. Ultrasound imaging may be used intraoperatively.

Intraoperative parameters, stone characteristics, access success, operative time, complications, analgesia requirements, and hospital stay were recorded.

## Results

The cohort included three patients (two males, one female), with a mean BMI of 23.8 kg/m<sup>2</sup>. One patient presented with a horseshoe kidney. All stones were located in the renal pelvis or lower calyces, with a mean stone volume of 3.5 cm<sup>3</sup>. No patients had hydronephrosis, and none had a prior history of renal surgery. Access was achieved below the costal margin in all cases. The lower calyx was successfully punctured in four of the six kidney units (bilateral stone disease in



**Figure 1** Novel setup involves placing the patient in a prone position with the body rotated approximately 30° compared to the operating table.



**Figure 2** Gel pads placement under the thoracic and abdominal regions on the contralateral side of the target kidney.

one patient). All punctures were completed in three or fewer attempts. The mean operative time was 72.2 minutes. Stone-free status was achieved in two out of three patients, with the third patient presenting minor residual fragments not requiring re-intervention. All patients received postoperative analgesia, limited to non-opioid medications. No intraoperative or postoperative complications were recorded. The mean length of hospital stay was 4.3 days. Importantly, the tilted prone position facilitated thoracic expansion on the non-operative side, potentially improving ventilatory dynamics and reducing anesthetic risks often associated with conventional prone setups.

## Discussion

The PCNL GENOA Prone Modified Position represents an innovative variation of the traditional prone positioning, rather than a supine alternative. From our perspective, standard prone PCNL remains the preferred approach in most patients due to its well-established safety and effectiveness. However, from our point of view, the GENOA modification introduces specific ergonomic and physiological advantages that may offer clinical benefits in selected cases. Compared to the classic prone position, the GENOA PCNL allows for partial thoracic decompression, as the chest does not completely lay on the operating table. This configuration facilitates better respiratory mechanics and may reduce anesthesiological issues and complications, especially in patients with borderline pulmonary function.<sup>13–16</sup> The ~30–45° rotation of the body, achieved through targeted support with gel pads, results in a partial lateral decubitus which promotes thoracic expansion on the contralateral side.

Another key advantage is the orientation of the working sheath, which lies parallel to the floor, similar to what is observed in supine PCNL. This positioning potentially improves the evacuation of stone fragments by gravity, potentially increasing stone clearance rates. Furthermore, the surgeon can operate in a seated position, which may enhance comfort and precision during longer procedures, again echoing the ergonomic benefits of the supine approach. Theoretically, the GENOA position may also carry a reduced risk of accidental colonic puncture. As showed in our video, the combination of lateral tilt and reduced abdominal pressure appears to favor displacement of the colon toward the contralateral side, thereby increasing the safety margin during percutaneous access. Taken together, these features suggest that the GENOA Prone Modified Position may offer a viable alternative to standard prone PCNL, particularly in patients with increased anesthesiological risk or in settings where improved ergonomics and fragment evacuation are desired. Nonetheless, the introduction of the GENOA Prone Modified Position requires dedicated training before clinical implementation. Given the altered anatomical orientation and access angles, we recommend that surgeons undergo simulation-based or cadaveric training to become familiar with the positioning technique feasibility.<sup>8,17</sup> Mastery of standard prone PCNL remains essential before attempting this variant, particularly to ensure safe and effective renal access.

This study presents several limitations: the technique has so far been applied in only three patients as the primary aim of the present video and description is to demonstrate the feasibility of the GENOA PCNL, rather than to provide comparative data on outcomes. No formal comparison with standard prone or supine approaches has yet been conducted, and no conclusions regarding superiority or equivalence should be drawn at this stage. At this stage, we could only provide a potential new position for prone PCNL. Further prospective studies involving larger cohorts and standardized outcome measures are required to evaluate the reproducibility, safety profile, and potential advantages of this technique in comparison to traditional PCNL approaches.

## Conclusions

Our initial experience suggests that the GENOA Prone Modified Position may be feasible, safe, and potentially an option for PCNL. It allows for effective percutaneous access while possibly reducing respiratory compromise and hopefully minimizing the risk of intra-abdominal injury compared to standard prone PCNL. Despite the limited sample size, the present findings point toward the possible integration of this technique into clinical practice. Further studies with larger cohorts and comparative analyses are needed to confirm its reproducibility and to better define its role in the armamentarium of endourological procedures.

## Ethical Statement

This approach represents a minor modification of a standard technique widely adopted in clinical practice, both in general and within our Institution. Therefore, no specific approval from the Ethics Committee was required. Moreover, our

Institution is a Scientific Institute for Research, Hospitalization and Healthcare (IRCCS), and all patients undergoing surgery routinely provide informed consent at admission, including consent for the anonymous use of their data for scientific and publication purposes. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Regarding the ethics requirements, we confirm that the completed document CONSAZHQA\_0001 fulfills our Institution's ethics policy requirements for this type of study, and therefore appropriately covers the ethical aspects related to data use and publication.

## Disclosure

The authors report no conflicts of interest in this work.

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