# HOW I DO IT

# Percutaneous nephrolithotomy under conscious sedation in morbidly obese patients

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Two morbidly obese males weighing 159 kg and 184 kg underwent percutaneous nephrolithotomy (PCNL) for large, symptomatic renal stones. To avoid anesthetic

## Introduction

The morbidly obese are a surgical and anesthetic challenge in any setting, particularly during percutaneous nephrolithotomy (PCNL). This procedure is classically performed under general anesthesia with the patient positioned prone. For an obese patient, this position, especially while paralyzed, may cause severe cardiorespiratory compromise from abdominal compression.

Some reports claim that the usual prone position is safe in moderately obese patients, and outcomes are comparable to their slimmer counterparts. Other reports recognize the risks and describe modified PCNL equipment, techniques, and patient positioning.<sup>1,2</sup> In fact, many of these modifications would become redundant, and many of the risks would diminish if general anesthesia could be circumvented.

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Address correspondence to Dr. H. Razvi, St. Joseph's Health Care, 268 Grosvenor, London, Ontario N6A 4V2 Canada complications and cardiorespiratory compromise in the prone position, the procedures were performed under IV sedation with local anesthesia. The risks of PCNL in this patient population are reviewed, and the technique employed to mitigate the risks in these two cases is described.

**Key Words:** obesity, percutaneous nephrolithotomy, conscious sedation, anesthesia, stones

Presented here, are two cases where the risks of general anesthesia were avoided entirely by performing percutaneous nephrolithotomy under conscious sedation and local anesthesia.

#### Case one

A 54-year-old man presented with recurrent urinary tract infections, intermittent flank pain and hematuria. Noncontrast computed tomography (CT) scan confirmed a 2.5 cm stone in the right renal pelvis with moderate hydronephrosis. He was morbidly obese at 184 kg and 188 cm (body mass index/BMI >52), and smoked a pack of cigarettes per day. He had a history of multiple uric acid stones for which he was on allopurinol and sodium bicarbonate alkalinization therapy.

Given the large stone size, he was booked for PCNL, and an anesthesia consult was obtained. He had an acceptable airway, however the consultant anesthetist felt that in the prone position, the pressure of the patient's sizable abdomen would significantly compromise chest compliance and breathing. The main concerns included peri-operative hypercarbia from impaired ventilation, and decreased venous return from caval compression. Local-regional methods of anesthesia were contemplated. The decision was made to attempt to proceed with local anesthetic infiltration of the proposed percutaneous tract site supplemented as necessary by intravenous sedation while allowing the patient to breathe spontaneously.

While supine, midazolam 5 mg was administered intravenously and the patient was started on an infusion of remifentanyl at an average rate of 0.0375 µg/kg/min. Oxygen was provided by mask at 8 L/min. Flexible cystoscopy was performed and a Bentson guide wire, followed by a 6 Fr. ureteral catheter were advanced into the renal pelvis fluoroscopically. The patient then turned himself into the prone position. Additional midazolam was given for a total of 9 mg during the entire case. Local infiltration of the proposed tract was performed using a 15 cm long, 18 gauge trocar needle(Cook Inc, Bloomington, IN, US) and 20 ml of 2% xylocaine. Percutaneous access was gained using the 18-gauge needle and an angled hydrophilic guidewire. Tract dilation was performed using a balloon dilation catheter to 30 Fr. allowing placement of a 30 Fr. working sheath. Ultrasonic lithotripsy and fragment extraction were then performed. A 16 Fr. Councill catheter was left at the completion of the procedure. He remained hemodynamically stable with minimal discomfort in the consciously sedated state. His oxygen saturation remained above 92% throughout the procedure. His respiratory rate varied between 12-21 breaths/minute. The operating time was 2 hours.

Flexible nephroscopy was successfully performed, employing 2% topical xylocaine instillation along the access tract, 3 days later to remove four small residual fragments. At his 6-week follow up appointment, he remained clinically well and radiographically stone free.

## Case two

This 62-year-old man weighing over 158 kg (BMI >52) presented with right flank pain and hematuria secondary to a large right sided ureteropelvic junction (UPJ) stone on KUB. CT scan confirmed a 2.3 cm right renal UPJ stone with moderate hydronephrosis and perinephric fluid. Due to his significant comorbidities, including aortic stenosis, sleep apnea, hypertension, type 2 diabetes, and ulcerative colitis, ureteroscopy and laser lithotripsy was first attempted. Due to purulent urine within the kidney, visibility was impaired and the stone could not be fragmented in its entirety.

PCNL was then discussed with the patient and consultations with his cardiologist and anesthesia were obtained. There was considerable concern about his aortic stenosis and obesity and both general and spinal anesthesia were considered risky. The decision was then made to proceed with PCNL under IV sedation and local anesthesia.

Flexible cystoscopy and ureteral catheter insertion were performed using 2% intraurethral xylocaine gel with the patient in the cystolithotomy position. He then positioned himself prone, and pressure points were appropriately padded with his guidance. Intravenous midazolam (2 mg), remifentanyl at  $0.15 \ \mu g/kg/min$  and 2 mg of ketoralac were administered. Oxygen was administered by nasal prongs at 4 L/min. Employing the 18 gauge, 15 cm long trocar needle, 15 ml of 2% xylocaine was infiltrated into the perinephric tissues along the proposed tract. Of note, due to the patient's body habitus, the needle could not reach the renal capsule. A scalpel blade was then used to cut down around the needle, and with aid of a Kelly clamp we were then able to direct the hub of the needle beneath the skin surface to reach the kidney. Percutaneous access was gained employing a subcostal tract, with dilation to 30 Fr. allowing placement of a 30 Fr. working sheath. The ultrasonic lithotripter was used to fragment and aspirate the stone, and a 20 Fr. Councill catheter was placed to serve as the nephrostomy tube at the termination of the procedure. His respiratory rate ranged from 14-24 breaths/minute and his oxygen saturation was above 93% throughout the procedure. The operating time was 2 hours. On his second postoperative day, a nephrostogram confirmed the absence of stones, and he was discharged the next day. Four weeks later, he remained asymptomatic and radiographically stone free.

## Discussion

Performing PCNL in the morbidly obese (BMI >40) creates several anesthetic and cardiorespiratory challenges. Due to chronically elevated intraabdominal pressure, their functional residual capacity (FRC) and total lung capacity (TLC) are decreased.<sup>3,4</sup> Add muscle paralysis from general anesthesia, and even higher intra-abdominal pressure in the prone position, and cardiorespiratory complications are imminent. Specifically, caval compression decreases preload, thereby decreasing oxygenation capacity; diaphragmatic pressure decreases chest compliance and ventilation capacity.<sup>5,6</sup> Moreover, obese patients are more likely to have altered upper airway morphology and rapid desaturation times, making tracheal intubation a challenge.<sup>3</sup> When the patient can offer no feedback, soft tissue injury and nerve compression from unprotected pressure points are more likely.<sup>7</sup>

There have been multiple reports of PCNL outcomes in the obese population. Pearle et al reviewed 57 patients with BMI >30 and found comparable stone free, complication, transfusion and hospital stay rates to those with a lower BMI.<sup>8</sup> In the obese group, operative times were slightly longer. Carson et al report similar rates of success, complications and morbidity in 44 obese and 226 nonobese undergoing PCNL.9 Over two-thirds of the obese group, however, weighed only 152-210 pounds. Faerber et al compared 437 non-obese and 93 patients with BMI >40.<sup>10</sup> Complications occurred at least twice as frequently in the latter group, despite similar stonefree rates and operating times. Finally, in their study of 223 procedures, Koo et al suggested that BMI is independent of procedure success; however, only 12 of their patients exceeded a BMI of 40.<sup>11</sup>

Little data exists however, regarding outcomes for those patients with BMI >50. In studies where such patients were included, the authors unanimously recommend caution. Brodsky et al describe the prone position with hips and shoulders supported in bolsters, thereby allowing the patient's pannus to hang more freely.<sup>5</sup> Of note, 12 people were required to maneuver the patient into the appropriate position. Kerbl et al and Ofer et al describe the lateral decubitus position, which allows the abdomen to fall aside and relieve compression of other structures. Percutaneous access employing this position, however, can be technically difficult.<sup>6,12</sup>

Spinal or epidural anesthesia can be considered, bearing in mind that the usual bony landmarks become virtually unidentifiable in the morbidly obese, making this technically challenging. Some propose that obese patients also have smaller epidural space volumes due to both fatty infiltration and increased blood volume from abdominal compression.<sup>13</sup> Spread of the local anesthetic solution becomes less predictable, and if the block height ascends beyond T5, respiratory and cardiovascular failure occurs.<sup>14</sup> One must also consider comorbidities, such as the aortic stenosis in our second patient, where sympathetic blockade may precipitate hypotension and cardiac ischemia.

Under conscious sedation, the patient breathes spontaneously, maintains some muscle tone, can offer feedback for protection of pressure points, and can maneuver himself into the appropriate position. The risks of the procedure are substantially fewer, and both of our patients had favorable outcomes. This approach may be equally valuable for treating patients with other comorbidities, such as marginal heart and lung function, or with previous adverse reactions to general anesthetic agents.

#### Conclusion

PCNL remains the procedure of choice for large volume and complex upper urinary tract stone problems. While PCNL is technically more demanding and has greater potential anesthetic implications in the morbidly obese, employing IV sedation with local anesthesia can reduce cardiorespiratory risks while maintaining treatment efficacy in this population.

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