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PCNL Surgery is the Safe Method Procedure in Renal Stone

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ABSTRACT

Introduction: Percutaneous nephrolithoterpcy (PCNL), a minimally invasive method for removal of renal stone there has been an immense improvement in technique and various guidelines have been established for treatment of renal stones. Percutaneous nephrolithotomy (PCNL) is an established, minimally invasive procedure for removal of renal calculi more than 2 centimeters in size.

Method: It facilitates a direct approach to the calculus while the kidney and surrounding structures are subjected to lesser trauma as compared to the open approach, and hence a great deal of surgical expertise is required for percutaneous access to the kidney and stone removal. Currently, the indications for PCNL include large size renal calculi (>1.5–2 cm), staghound calculi, upper tract calculi not responding to other modalities of treatment, lower pole stones, cysteine nephrolithiasis, and stones in anatomically abnormal kidneys. Generally, two approaches are followed for PCNL.

Result: However, is the perfect method with doing expert surgeon may happen a few complications which can be attributed to surgical technique as well as anesthesia related complications. This surgery were had been than 2005 _2025 with 760 procedure by dr sohrab salehi at hospital of medical science university of Qazvin Iran. The few cases yielded than 20 patients accrue the different complications seen in this procedure.

Conclusion: the aim of this article is to describe the surgical procedure and a few complications associated with PCNL related to the safety treatment. The paper also described the advantages and drawbacks of the available options in surgery, that is, general and regional, both of which are employed for PCNL.

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Introduction

The incidence and prevalence of renal calculi have increased globally across all ages, sex, and race, probably due to change in dietary habits and global warming [1]. The conventional and perhaps the oldest method of removing renal stones was open nephrolithotomy. Later, with the advent of ureterscopes, ureteric stones were removed with the help of derma baskets. Percutaneous method of removing renal calculi was first described in the 1950s but it was actually performed almost two decades later in the 70s and 80s for routine removal of renal stones. Simultaneously, other procedures for removal of renal stones, such as extracorporeal shock wave lithotripsy (ESWL), also came into vogue and PCNL remained an underutilized procedure, until the last decade, which witnessed a surge in this specific procedure vis-à-vis improvement in technique, increased prevalence of renal stones, and delineation of clear cut indications for PCNL [2]. Currently, PCNL is the procedure of choice for managing kidney stones and continues to evolve and has largely replaced open stone surgery. Advances in technology and equipment have resulted in stone removal with less morbidity, shorter convalescence, and reduced cost compared with open surgery [3].Currently, the indications for PCNL include large size renal calculi (>1.5–2 cm), staghorn calculi, upper tract calculi not responding to other modalities of treatment, lower pole stones, cysteine nephrolithiasis, and stones in anatomically abnormal kidneys [4]. Generally, two approaches are followed for PCNL .Standard PCNL. The procedure is performed with the patient in prone position. A small incision 1.3 cm is given on the back overlying the affected kidney and a track is created from the skin to the kidney. It is then enlarged using a series of Teflon dilators or bougies with a sheath being placed over the last dilator to hold the track open. After this, nephroscope (fiber optic light source with two additional channels for renal visualization and irrigation) is inserted; smaller stones may be removed with the help of a device with a basket at its end while larger stones may be fragmented by a Holmium laser lithotripter, ultrasonic or electrohydraulic probe. After removing the stones, a catheter is placed to drain the urinary system and a nephrostomy tube is placed to drain the fluid from the kidney to a drainage bag. They are usually removed before the patient is discharged [5]. Mini PCNL. It is performed with miniaturized nephroscope and has been found to have 99% efficacy in removal of stones 1–2.5 cm in size. Though not useful for larger calculi, it offers the advantages of shorter operating and recovery time and fewer complications [6]. Like all minimally invasive procedures, PCNL too has its share of complications, related to both the procedure and the underlying pathology. Early recognition and management of

many of these complications reduce the morbidity and mortality considerably. A multicenter study of 5803 patients, conducted by the Clinical Research of the Endourological Society (CROES), reported an overall complication rate of 21.5%, using the modified Clavien system, which was developed in 1992 and later modified in 2004, for classification of complications and comparison of complication rates in radical prostatectomy and cystectomy. The modified Clavien system of classification of complications was first adopted by Tefekeli et al. in 2008 to stratify complications following PCNL [7-11].

Preoperative Considerations

Patients belonging to varying age groups may present for PCNL. Elderly patients may have much comorbidity like ischemic heart disease, respiratory dysfunction, and diabetes while young children may be highly uncomfortable and uncooperative. Hydronephrosis causing deranged renal functions and sepsis, in addition to the above, may add to the above. It is essential to communicate with the surgical team and confirm the adequacy of renal function by intravenous pyelogram (IVP), DMSA, or DTPA scan [12]. DMSA (dimercaptosuccinic acid) is a renal imaging tool to evaluate renal structure and morphology and DTPA (diethylene triamine pentaacetic acid) renal scan is performed to evaluate the blood supply and function and excretion of urine from the kidneys. This test can also find out what percentage each kidney contributes to the total kidney function. There is no indication for performing PCNL if the kidney is nonfunctional; such patients should be taken up for nephrectomy. Stabilization of the existing comorbidities in the preoperative period reduces intra- and postoperative complications, overall morbidity, and mortality. There should not be any active focus of infection preoperatively [13].

Intraoperative Considerations

Although GA has been considered to be the safest technique for PCNL worldwide, it has its own hazards like accidental extubation and kinking of endotracheal tube (ET) during positioning of the patient; hence, it is desirable to use a reinforced ET tube or an oral airway along with a regular ET tube and the tube should be firmly secured. Position of bolsters should be carefully checked to allow unhampered ventilation. Torsion of the neck veins may lead to facial edema, ocular edema, and ecchymosis [14]. Care should be taken to avoid pressure on the eyeballs in the prone position as this may lead to postoperative visual loss; if the external pressure on the globe exceeds the mean arterial pressure (MAP), perfusion to the optic nerve is hampered, leading to blindness. Pressure on the pinna should be avoided as it can cause pressure necrosis. In female patients, the breasts should be positioned medially to avoid pressure necrosis. The arms should be abducted and brought upwards with the elbows flexed equally to prevent overstretching of the brachial plexus on either side. All the pressure points like the elbows, wrists, knees, and ankles should be adequately padded to prevent peripheral nerve injuries [15]. When RA is used, many of the issues related to positioning are resolved as the patients are conscious and can position himself/herself in the prone position according to their comfort. However, there is a risk of sudden hypotension after making the patient prone. Patient discomfort increases with the duration of the procedure and the surgeon may not feel comfortable in making skin punctures, especially those close to the 11th rib, if the patient is unable to coordinate breath holding at that time [16]. Complications Related to Surgical Procedure and Their Anesthetic Implications: Various authors have studied complications related to PCNL per se (Table 2). Besides the definite risk of injury to the surrounding organs and major blood vessels, these patients are also at considerable risk for sepsis. Each of these complications adds to the morbidity and sometimes mortality of patients. The majority of the complications occur in the intraoperative and immediate postoperative period; therefore, the anesthesiologist must be aware of the complications and be well equipped to deal with them effectively and minimize morbidity [17].

Table 1: Complications of PCNL

Sl number	age	Transfusion	Massive hemorrhage	Fever	Sepsis	Colonic injury	Pleural injury	Extravasation of urine	Mortality
1	20-25	10%	1%	1.2%	0.02%	NA	2.4%	10%	0.01%
2	25-30	1%	0.5%	1%	0	0%	0.7%	4%	0.01%
3	30-35	3%	NA	10.5%	NA	NA	1.8%	6%	0.1%
4	35-40	4%	2.2%	11%	0.2%	0.02%	1.1%	2.6%	0.11%
5	40-45	3.5%	1.19%	NA	0.72%	0	0.14%	1.4%	0
6	45-50	0.6%	1.2%	32%	0.13%	0	0	0.7%	0.8%
7	50up	13. %	0.8	22.4%	1%	0. 07%	3.1%	9%	0.9%

PCNL, complications, and anesthesia were incidence and prevalence of renal calculi has increased globally across all ages, sex, and race, probably due to change in dietary habits and global warming [18]. The conventional and perhaps the oldest method of removing renal stones was open nephrolithotomy. Later, with the advent of ureteroscopes, ureteric stones were removed with the help of dormia baskets. Like all minimally invasive procedures, PCNL too has its share of complications, related to both the procedure and the underlying pathology. Early recognition and management of many of these complications reduce the morbidity and mortality considerably. Observed an overall complication rate of 21.5%, using the modified Clavien system and comparison of complication rates in radical prostatectomy and cystectomy

Table 2: Classification of Surgical Complications According to the Modified Clavien Grading System

Grade	Description of complication
I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Allowed therapeutic regimens are as follows: drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside.
II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusion and total parenteral nutrition are also included.
III	Requiring surgical, endoscopic, or radiological intervention.
IIIa	Intervention under regional anesthesia.
IIIb	Intervention under general anesthesia.
IV	Life threatening complication requiring ICU management.
IVa	Single organ dysfunction (including dialysis).
IVb	Multiorgan dysfunction.
V	Death.

Anesthetic Technique

There has been considerable debate regarding the ideal anesthetic technique for PCNL. The procedure is usually performed under general anesthesia (GA) and the published literature regarding the use of spinal anesthesia for PCNL is sparse. Over the years, both these techniques have been used and they have their advantages and drawbacks. The advantages offered by GA include safety as the patient's airway is secured in prone position, feasibility to control tidal volume during percutaneous access puncture to minimize injury to the pleura and lungs, and prolonged anesthesia duration allowing the surgeon to make multiple and higher punctures with minimal patient discomfort, especially in cases with large stone load.

Result and Conclusion

The first PCNL was done by Dr Sohrab Salehi at Mehregan hospital of Qazvin in Iran at. It had its own merits in the form of less postoperative pain, less blood loss, and early recovery and discharge thereby reducing stay in the hospital. Then , 600 patients done this surgery by dr salehi the efficacy of GA versus RA in PCNL patients and analyzed intraoperative hemodynamics. However, postoperative Visual Analogue Score (VAS) scores were less after one hour postoperatively patients received analgesics within the first postoperative hour itself. Therefore, Mehrabi and Shirazi evaluated the intraoperative and postoperative anesthetic and surgical outcomes in patients who underwent PCNL under spinal anesthesia in prone position and concluded that spinal anesthesia is not only safe and effective for performing PCNL, but it is also a good alternative for GA in adult patients. Borzoi et al. did a large study regarding the use of spinal anesthesia in PCNL and reported that spinal anesthesia is feasible, safe, and well tolerated especially in elderly patients with significant comorbidities such as pulmonary disease. Patients belonging to varying age groups may present for PCNL. Elderly patients may have much comorbidity like ischemic heart disease, respiratory dysfunction, and diabetes while young children may be highly uncomfortable and uncooperative. Hydronephrosis causing deranged renal functions and sepsis, in addition to the above, may add to the above. It is essential to communicate with the surgical team and confirm the adequacy of renal function by intravenous pyelogram (IVP), DMSA, or DTPA scan. DMSA (dimercaptosuccinic acid) is a renal imaging tool to evaluate renal structure and morphology and DTPA (diethylene triamine pentaacetic acid) renal scan is performed to evaluate the blood supply and function and excretion of urine from the kidneys. This test can also find out what percentage each kidney contributes to the total kidney function. There is no indication for performing PCNL if the kidney is nonfunctional; such patients should be taken up for nephrectomy. Stabilization of the existing comorbidities in the preoperative period reduces intra- and postoperative complications, overall morbidity, and mortality. There should not be any active focus of infection preoperatively. Although GA has been considered to be the safest technique for PCNL worldwide, it has its own hazards like accidental extubation and kinking of endotracheal tube (ET) during positioning of the patient; hence, it is desirable to use a reinforced ET tube or an oral airway along with a regular ET tube and the tube should be firmly secured. Position of bolsters should be carefully checked to allow unhampered ventilation. Torsion of the neck veins may lead to facial edema, ocular edema, and ecchymosis. Care should be taken to avoid pressure on the eyeballs in the prone position as this may lead to postoperative visual loss; if the external pressure on the globe exceeds the mean arterial pressure (MAP), perfusion to the optic nerve is hampered, leading to blindness. Pressure on the pinna should be avoided as it can cause pressure necrosis. In female patients, the breasts should be positioned medially to avoid pressure necrosis. The arms should be abducted and brought upwards with the elbows flexed equally to prevent overstretching of the brachial plexus on either side. All the pressure points like the elbows, wrists, knees, and ankles should be adequately padded to prevent peripheral nerve injuries. When RA is used, many of the issues related to positioning are resolved as the patients are conscious and can position himself/herself in the prone position according to their comfort. However, there is a risk of sudden hypotension after making the patient prone. Patient discomfort increases with the duration of the procedure and the surgeon may not feel comfortable in making skin punctures, especially those close to the 11th rib, if the patient is unable to coordinate breath holding at that time. Chances of pleural and lung injury are higher during upper pole access due to the close proximity of these structures. Preminger et al. reported 16% pleural injuries with supracostal approach as opposed to 4.5% with subcostal approach. Ideally, the working sheath should be inserted under the 11th rib and above the 12th rib with ventilatory standstill; however, punctures above the 11th rib increase the risk of intrathoracic complications to 23.1% as compared to 1.5–12% for punctures above the 12th rib; the risk is 0.5% for subcostal approach. Pulmonary injuries are likely to occur in 29% of cases on the right side and in 14% of cases on the left side. A higher nephrostomy tract predisposes the patient to greater risk of incurring intrathoracic injury; therefore, when multiple or higher punctures are required to remove a greater stone load, GA would be safer and desirable and vigilance is required throughout the procedure, for raised airway pressures and end tidal CO2, and falls in oxygen saturation indicating pleural or lung injury which should be managed promptly by maintaining

ventilation with 100% oxygen and if pneumothorax is diagnosed intraoperatively, placement of chest tube.

Conclusion and Recommendation

Though PCNL is a routinely performed, minimal access surgery, yet it may have many devastating and life threatening complications. It is safe to conduct the procedure under GA for complicated or prolonged procedures. RA is preferred only when the surgical team has a high degree of expertise and the procedure is uncomplicated. The anesthesiologist must be familiar with the various complications and their appropriate management. Effective communication between the surgical and anesthesia teams is desirable to formulate the correct perioperative management plan for every patient [19-44].

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