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Supine versus prone percutaneous Nephrolithotrispy for renal stones more than 2cm comparative prospective study

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Abstract

Renal stones, mainly due to the excretion of too much salts or their precipitation in the urine, are more common in men and increase with age until 60 years, causing flank pain. Extracorporeal shock wave lithotripsy (SWL) is a therapy that is non-invasive for stone removal, eliminating the need for a ureteral stent or instrumentation, but it may not be effective in many stone locations, leading to higher treatment needs. The AUA and EAU guidelines recommend Percutaneous Nephrolithotripsy (PCNL) for large stones, achieving up to 95% stone-free rates, as the initial treatment option for staghorn calculi. Supine PCNL was first reported by Valdivia Uria et al. in 1987 to overcome the drawbacks of prone PCNL. T While positioned recumbently, the patient's influenced flank is elevated while a one-liter container of liquid is positioned beneath the lumbar fossa. The patient displays complete relaxation while extending the ipsilateral limb. Place little pillows on pressure points, and place the ipsilateral arm across the thorax. Prone PCNL, a standard percutaneous kidney access procedure, has a successful 30-year record with a range of 76% to 91% for the absence of stones and acceptable complication rates.

Keywords: Renal stones, SWL, PCNL.

Full length article *****Corresponding Author*, e-mail: edoin3000@yahoo.com

1. Introduction

Urolithiasis, the third-most frequent urological disease worldwide, is influenced by factors such as lifestyle and diet. It affects both males and females, with a higher risk in the western hemisphere. Ancient Egypt reported a correlation between urinary tract infection and stone development, highlighting the importance of understanding and managing this condition. Initially, PCNL managed larger stones, while ESWL treated smaller ones. According to advances in miniaturization, energy, & optics, even tiny stones can be treated with PCNL with less morbidity & greater stone elimination [1]. Sixty-eight percent of stones measuring five millimeters or smaller pass spontaneously, whereas larger stones necessitate ureteroscopy with fragmentation-extraction or SWL intervention. PCNL is the treatment of choice for ureteral stones exceeding fifteen millimeters, which are most frequently located in the upper ureter. These stones necessitate intervention through medical expulsive therapy. Both prone & supine PCNLs are equally likely to result in complications & stones. but supine accounts for 20% of PCNLs globally, with many surgeons learning from prone position mentors [2]. The objective of this study was to compare percutaneous nephrolitholapaxy of kidney stones larger than two centimeters while supine versus prone. A comparative prospective study.

2. Renal stones

Renal stones may develop as a result of sodium precipitation in the urine, excessive excretion, or a lack of inhibitory substances. The prevalence rises with age up to the age of 60 and affects more men than women. Flack pain is a nonspecific sign that may be related to other entities, & stones are typically recurrent [3].

2.1. Incidence of renal calculi

Globally, the prevalence of kidney and ureteric stones is rising, especially in men and with age, and they are associated with chronic kidney disease. They typically occur between 20 and 60, especially in hot climates. About 10% of people will experience recurrence within 5–10 years, & 75% within 20 years [1].

2.2. Pathophysiology of renal calculi

In order for stones to form, crystals must first form in supersaturated urine; these crystals will subsequently attach to the urothelium, establishing the nidus.

We still have a poor understanding of the precise biological mechanisms that affix crystals to the urothelium. Contemporary theories place emphasis on the function of cell surface molecules that either promote or impede crystal adhesion [3].

2.3. Presentation of renal stones

Renal calculi should be considered in the differential diagnosis of abdominal pain, which typically presents as sudden, excruciating unilateral or lower abdominal pain, often starting as vague flank pain [4].

2.4. Risk groups for stone formation

Since the risk status of stone formers determines the possibility of recurrence or regrowth, it is crucial for pharmaceutical treatment & hence of special interest. Around fifty percent of recurrent stone forms occur only once in their lifespan. The patient population identifies extremely recurrent disease in slightly more than ten percent of cases [5].

2.5. Complications of renal stones

Patients with obstructive calculi may experience chronic renal function loss as a result of untreated obstruction, which may render them asympto stones rarely cause hazardous hematuria. However, serious complications such as abscess formation and kidney infection can occur. Prolonged obstruction can result in urinary fistula formation, ureteral fibrosis, stenosis, perforation, extravasation, urosepsis, & renal loss [6].

3. Types of stones

3.1. Calcium calculi

60% of renal stones are Ca oxalate stones, followed by Ca phosphate stones. High calcium levels are the main risk factor, leading to a number of health problems [7].

3.2. Cystine stones

Cystinuria is an autosomal recessive disease that affects only a small percentage of urinary stones [7]. It is responsible for 1-2% of adult renal stones because of problems with amino acid absorption.

3.3. Struvite calculi

Struvite calculi, which are composed of ammonium phosphate & magnesium, account for 5–15% of adult stones, more common in females due to urinary tract infections [7].

3.4. Uric acid calculi

Being overweight & having T2D are associated with the development of uric acid stones, which make up five to ten percent of all kidney stones. Hyperuricosuria, acidic urine, & low urinary volume is all contributing factors; medication is frequently associated with low urine pH [7].

3.5. Matrix calculi

Matrix calculi, accounting for 1-2% of renal stones, are common in patients with proteus infections, Escherichia coli, and Candida albicans, and consist mainly of coagulated mucoids with minimal calcium [7].

3.6. Indinavir calculi

Indinavir, a protease inhibitor used in HIV treatment, is a known cause of urinary calculi, which are formed by precipitating Ca oxalate & phosphate within the indinavir crystals [7].

3.7. Oxalate calculi

Oxaluria, a common cause of renal stones, can be a result of underlying conditions like chronic inflammation of the colon & short bowel syndrome, leading to increased urolithiasis risk [7].

3.8. Stone classification based on composition

Calcium-based stones comprise crystals and proteins. for 70%–80% of renal stones. Struvite stones, composed of magnesium ammonium phosphate, account for 5%–15%. Urinary alkalinization, which comprises five to ten percent, can dissolve uric acid stones. Pre-treatment determination is crucial for effective management and disease prevention [8].

4. Factors influencing treatment decisions

Urinary tract calculus management depends on factors like size, location, number, anatomy, and chemical composition. Oral medications can manage urinary acid stones, whereas shock wave lithotripsy is effective for struvite stone treatment. Depending on the size and type of stone, there are different ways to treat urine stones, such as active monitoring, minimally invasive treatment, open or laparoscopic surgery, medical expulsive therapy, hydration, and painkillers [9].

5. Surgical Anatomy of the Kidney

5.1. General Anatomy

The kidneys have the morphology of paired retroperitoneal beans, characterized by a convex medial border & a convex lateral border. With an angle of 30° to 50° from the frontal coronal plane & rotated anteriorly and posteriorly. The patient's supine or prone position doesn't affect kidney orientation (Figure 1) [10].

5.2. Perirenal Coverings

Gerota's orrenal fascia surrounds the kidneys, closing cranially and laterally. In the retroperitoneum, the anterior & posterior sheaths diminish caudally & are tenuously fused around the ureters. The subperitoneal fascia continues Gerota's fascia laterally. The posterior sheaths fade in the prevertebral fascia, forming Zuckerkandl's fascia. The true capsule and Gerota's fascia are crucial in percutaneous renal surgery. The needle passes through the lumbodorsal fascia and true capsule, experiencing initial resistance and sudden give. The needle moves within the renal parenchyma with respiration [10].

5.3. Kidney Relationships with Diaphragm, Ribs, and Pleura

Placing themselves on the diaphragm, the superior poles make contact with the pleura, the cost diaphragmatic recess, &the 12th rib (which is also the 11th rib on the left). The diaphragm & pleura are thus traversed during all intercostal renal punctures, in addition to certain subcostal ones [10].

5.4. Kidney Relationships with Liver and Spleen

The peritoneum separates the right kidney from the liver, with the exception of the posterior bare area of the liver, which is in touch with the right kidney's anterior side. The hepatorenal ligament connects the right kidney to the liver. The anterior surface of the left kidney (supero-laterally) is related to the spleen, which is attached to the kidney by the lienorenal ligament [11].

5.5. Relationships between kidneys with ascending and descending colons

The hepatic colic flexure, also known as the hepatic angle, is located anterior to the right kidney's inferior part, while the left kidney's colic flexure is located anterolateral to it. The prone position increases the risk of bowel injury due to the anterior body wall's compliant nature, pushing the kidney backwards. According to Kahai et al., (2023), the position of the retroperitoneal colon, which can be posterolateral or posterior to the kidney, raises the risk of percutaneous injury, especially to the inferior poles [12].

6. Renal blood supply

6.1. Intrarenal arteries

Renal arteries are derived from the aorta's lateral margin & branch into anterior & posterior branches, providing the kidney's homonymous segment. They divide into interlobar arteries, which enter renal parenchyma and columns, and arcuate arteries [12].

6.2. Intrarenal Veins

The brain's venous drainage system is segmental, with intrarenal veins that are diffusely anastomosed to prevent congestion. Stellate veins subsequently discharge the cortex. The stellate veins converge to form interlobar veins, which in turn form the renal vein [12].

7. Relation between the intrarenal vessels and the collecting system

The relationship between intrarenal vessels and the collecting system is important because this helps endourologists get a safe puncture and reduce vascular injuries [12].

7.1. Intrarenal fornic access (trans-papillary)

Experimental confirmation has been obtained that the fornix, which is the apex of the calyx, is the most suitable and secure entry site when performing renal dilatation & percutaneous puncture. This is the most delicate area of the kidney tissue, where the microvasculature plays a more significant role. The big renal segmental vessels play a more significant role than the others. Therefore, this puncture shows less than 8% venous injury and no arterial injuries [12].

7.2. Intrarenal access through an infundibulum (non-papillary)

The inferior segmental artery brings blood to the upper pole infundibulum. This is where most renal punctures happen, and in 67% of those cases, the interlobar vessels are damaged. The lower pole, supplied by the inferior segmental artery, may have an infundibular artery in 38% of cases [12].

7.3. Renal pelvic access

Should be avoided as the nephrostomy tube can be easily dislodged, and the access via the pelvis might increase the probability of damaging the retro pelvic vessels (Figure 2) [13].

8. Configuration of the Renal Collecting System

A comprehensive comprehension of the anatomy of the collecting system is imperative in order to carry out dependable endourologic procedures & uroradiologic analysis [14].

8.1. Basic Intrarenal Anatomy

The renal parenchyma consists of an outer cortex & an inner renal medulla, surrounded by renal columns. Minor renal calyces, ranging in number from 5-14, 8, enclose pyramids and can be single or compound. Polar calyces are often compound, and minor calyces can drain into an infundibulum [15].

8.2. Variability of the Pelvicalyceal System Anatomy

Endourologists must understand pelvicalyceal system anatomy and calyceal arrangement. Brodel's kidney type has a short anterior calyx, while Hodson's kidney type has a longer anterior calyx and a shorter posterior calyx. Both kidney types have different calyceal arrangements [16].

8.3. CT Analysis of Calyceal Anatomy in the Supine and Prone Positions

Sengupta et al., (2000) conducted research on 14 cases using 5mm-cut contrast enhanced CT scans to determine how different patient positions affect the location of the kidneys. They measured kidney orientation and calice orientation, comparing prone and supine positions [17].

9. Management of renal stones

9.1. Observation

Ultrasound-neutrophic intraparenchymal stones that are very small may stay in one place and not cause any symptoms because they don't move along the ureter. twenty-eight percent will induce colic within three years, while other two percent will result in silent obstruction. In these cases, we can temporarily substitute observation with serial imaging to evaluate interval growth, as the potential drawbacks of intervention may not outweigh the advantages [18].

9.2. Medical expulsive therapy

Informed patients should only undergo medical expulsive therapy when active stone removal is contraindicated. Patients should discontinue treatment if they experience complications such as infection, refractory pain, or deterioration of renal function. We utilize multiple pharmacological classes for MET. Possible adverse effects associated with the use of α-blockers for MET encompass retrograde ejaculation & hypotension [19].

9.3. Pain relief

Nonsteroidal anti-inflammatory drugs (NSAIDs), including paracetamol, exhibit superior analgesic efficacy in patients suffering from acute stone colic when compared to narcotics.

Antispasmodics added to NSAIDs do not improve pain management. Limited data is available regarding non-

NSAID, non-opioid medications. Patients taking NSAIDs are less likely to meet long-term analgesic needs [20].

9.4. Prevention of recurrent renal colic

Patients who are anticipated to experience spontaneous passage of ureteral stones may benefit from the use of NSAIDs or suppositories containing diclofenac sodium (100–150 mg/day, 3–10 days) to decrease inflammation & the likelihood of experiencing recurrent pain. While diclofenac may impair renal function in patients with pre-existing impairment, it does not exert any functional impact on patients with normal kidney function [18].

9.5. Chemolysis

Percutaneous chemolysis via irrigation for pragmatic reasons is rarely utilized in the present day. Theoretically, percutaneous irrigation chemolysis could potentially be utilized to treat both infections & uric acid stones. Stravite stones can be broken up with Suby's G solution, which contains 10% hemiacidrin and has a pH range of 3.5 to 4 [21].

9.6. Extracorporeal shock wave lithotripsy (SWL)

SWL is lacking efficacy for large stones, hard stones, cysteine, & Ca phosphate, & in contravention of obstruction settings, anticoagulation patients, pregnant women, and those with urinary tract infections [22].

9.7. Ureteroscopy (URS) (retrograde and antegrade; RIRS)

At present, rigid ureterorenoscopes are characterized by tip diameters of less than 8 F. The rigid URS is applicable to the entire ureter. On the other hand, digital scopes and other technological advancements have made flexible ureteroscopes the preferred method of accessing the ureter [23].

9.8. Percutaneous nephrolithotomy

For significant renal calculi, percutaneous nephrolithotripsy is the conventional treatment method, with various endoscopes available. Adult patients increasingly use smaller sheaths, with access tracts ranging from 24–30 F. It is very important to keep an eye on people who are taking blood thinners, and where the nephrostomy tube goes depends on things like remaining stones, second-look procedures, blood loss, and kidneys that are not working together [24].

9.9. Open or laparoscopic surgery

Anatrophic nephrolithotomies & pyelolithotomies are two surgical procedures that can be used to treat stone disease. However, these procedures are rarely performed because of the increased risk of complications & morbidity. In uncommon circumstances where SWL, ureteroscopy, & percutaneous nephrolithotomy fail or are improbable to be successful, these techniques may be contemplated [25].

9.10. Endoscopes

Standard PCNL uses sheath sizes ranging from 24 to 30 F, while mini-PCNL/miniperc uses sheath sizes of 14 to 20 F. Mini-PNL nephroscopes have 12 Ch caliber and allow ballistic probes and laser fibers for intracorporeal lithotripsy energies. Larger nephroscopes (17–20 Ch) can use a 24 Ch Amplatz sheath [26].

9.11. Evolution from Prone to Supine PCNL

Valdivia introduced the first PCNL in the supine position in 1987, a breakthrough that pleased anesthesiologists, nurses, and operating room personnel but hindered vision during percutaneous tract dilatation [27].

10. Dilation Set

There are several ways to perform the dilation of the renal tract, a costly step in PCNL, including:

10.1. Fascial Dilators

Bigger polytetrafluoroethylene tubes slide over a guide wire in the fascial dilator system., but they have limitations like affecting wire integrity and being restricted for postoperative scar tissue patients [28].

10.2. The Amplatz dilators

We implant dilators made of semi-rigid plastic (polyurethane) over an 8F PTFE guiding catheter. The dilators are passed consistently, not coaxially like the Alken dilators, propelling one dilator, extracting it, and then propelling the bigger dilator, etc., until the ultimate tract dilatation is reached. Ultimately, the last dilator propels the Amplatz sheath [28].

10.3. Metal Dilators (Alken Dilators)

The telescopic configuration of stainless-steel dilators resembles a collapsible radio antenna. The dilators gradually expand until they achieve the desired degree of tract dilation. A hollow guide rod with a diameter of 8 F & six metal cylinders with diameters ranging from 9 to 30 F constitute the dilators. By conforming their ends to the lumen of the subsequent dilator, they maintain the same horizontal plane [28].

10.4. Balloon Dilatation

Balloon dilators are designed to eliminate repetitive dilations in semi-rigid plastic & rigid metal systems, which are potentially hazardous & time-consuming. High-pressure balloons with 15–30 atmospheres are available commercially, with balloon lengths up to 15cm and diameters of 10–12 mm [27].

10.5. The Economical One-shot PCNL Set (Ecoset)

It's a unique set that is composed of a single 30-F dilator, a 30-F sheath, & 8-F polyurethane dilator. Frattini A et al. initially described it; subsequent studies have revealed several benefits of this dilatation method, such as a shorter operative time and reduced radiation exposure [26].

11. Technical Aspects

11.1. Pre-PCNL Preparation

Pelviabdominal CT imaging is recommended before PCNL to identify hepatosplenomegaly or retro-renal colon, while routine investigations, urine culture, hemoglobin concentration, coagulation, renal function, and urosepsis evaluation are crucial [29].

11.2. Anesthesia for PCNL

General anesthesia with endotracheal intubation & controlled ventilation is likely the preferred technique for the majority of prone & supine PCNL cases [29].

11.3. Patient positioning

11.3.1. Prone position

To increase the space available for kidney access, secure a rolled saddle beneath the rib cage or upper abdomen to press the kidneys posteriorly. With the shoulders lowered to a 90-degree angle and the elbows bent at 90 degrees, resting on an arm board to prevent injury to the brachial plexus, this posture is ideal for relieving pressure points [29].

12. Advantages of supine PCNL

12.1. Improvements in anesthetic management

Supine PCNL is superior to prone anesthesia in several ways. This includes improved access, reduced risk of nervous system injuries and thromboembolism, and enhanced ventilator-related metrics for individuals with obesity [30].

12.2. Improved patient positioning and shorter operative time

Since the patient is not required to be repositioned following ureteral catheter placement, the operating room staff has less work to do with a spine PCNL compared to a typical prone PCNL. A solitary draping and position are maintained for the duration of a supine PCNL. This benefit becomes even more apparent in patients who are rotund [30].

12.3. Decreased intrarenal pressures

The renal sheath usually lies either perpendicular to the floor when the patient is supine or at an angle with its downward face toward the floor. Contrary to prone PCNL, in which the renal lamina is inclined upward toward the ceiling (i.e., away from the floor), this is not the case. Renal sheath angulation during supine PCNL consequently increases fluid & stone fragment drainage from the kidney [31].

12.4. Decreased radiation exposure and improved ergonomics of fluoroscopy

Supine PCNL reduces the surgeon's radiological exposure because the hands of the surgeon are not directly beneath the X-ray beam. When utilizing conventional prone access techniques such as triangulated or bull's-eye guided approaches, the csurgeon holds this within the radiation field. a puncture [32].

12.5. Easier endoscopic combined intrarenal surgery (ECIRS)

The classic Valdivia-Galdakao position or the Giusti-modified Valdivia position, both of which involve lying down on the operating table, are the two positions used to treat complex stone disease. Scoffone popularized ECIRS-supine PCNL with the addition of retrograde transurethral f-URS to maintain a high percentage of stone-free PCNL and reduce the number of punctures required for stone-free individuals [32].

12.6. Improved endoscopic access to the upper pole from the lower pole puncture tract

Eighty percent of the time, the lower calyx puncture tract makes it easier to use an endoscope to reach the upper calyx when the PCNL is in the supine position [33].

13. Disadvantages of supine PCNL

13.1. Mobility of the kidney

In general, supine kidney position mobility is greater than prone kidney position mobility, particularly in individuals who have a BMI of less than 25 kg/m^2, which is noticeable during percutaneous puncture and dilation [31].

13.2. Longer percutaneous tract

Percutaneous puncture in supine PCNL may increase tract length due to lateral positioning on the patient's flank, while in prone PCNL, tract length is shorter due to the more pliable anterior abdominal wall, which restricts kidney mobility [31].

14. Acquiring access

14.1. The puncture site selection

The puncture site through the kidney should be via the fornix of the posterior renal calyx [31].

14.2. Modalities of access guidance

14.2.1. Fluoroscopy guided access

Fluoroscopic access is widely used in urology due to its advantages, like clear visualization and better residual stone evaluation, but it also increases radiation risk, requiring lead aprons and thyroid shields [34].

14.2.2. Ultrasound guided access

US guidance offers advantages like reduced radiation exposure, better imaging, no contrast administration, and safety for pregnant women and children, but challenges include non-dilated kidney access and guide wire manipulation (Figure 3) [35].

14.3. CT and MRI assisted percutaneous guidance

CT guidance is crucial in special conditions like morbid obesity, hepato-splenomegaly, retro renal colon, severe skeletal anomalies like scoliosis or kyphosis, patients with minimal or no dilatation of the collecting system, and additionally [31].

14.3.1. Endoscopic guidance

Grasso et al., (1995) utilized the f-URS technique for assisting access in obese patients, minimally dilated collecting systems, and those with failed previous access trials [36].

14.3.2. Robotic and laparoscopic assisted access

Endourology is changing because of robotics and laparoscopy. The newest ANT-X automated needle targeting device uses fluoroscopy to guide PCNL access.

The system uses computer vision software to automatically calibrate navigation, reducing radiation exposure and complications post-procedure [34].

14.4. Fluoroscopic access techniques

14.4.1. Bull's eye technique (Eye of the Needle technique)

We sterilize the C-arm and use a scout view to identify the target calyx. We position an 18-gauge diamond-tip needle in line with the image intensifier and advance it. The entry through the renal capsule is verified, and the depth of the needle tip is assessed [37].

14.4.2. Triangulation Technique

We use fluoroscopy to identify the targeted calyx and a triangulation technique to position a puncture line. Retrograde contrast injection is used for system opacification and distention [38].

14.4.3. Techniques in the supine position

Safety landmarks should be drawn along the iliac crest, costal flange, & posterior axillary line. The puncture process starts with a neutral position, with the with the needle parallel to the floor, and the collecting system adjusts direction [31].

14.5. Renal Access and Endovision Procedure

The renal calyx is punctured in accordance with adult rules., depending on surgeon preference. Direct vision puncture under an X-ray or ultrasound allows for better security, lower hemorrhagic risk, and shorter X-ray exposure time [26].

14.6. Technical Difficulties of PCNL in Supine Position

Nephroscopy in a supine position can be challenging due to restricted lateral deflection, limited visual field, and lower success rates. Upper pole caliceal puncture is more difficult and associated with higher risks of hydrothorax or pulmonary injury. In prone positions, the longitudinal dimension of the iliac crest increases in comparison to the 12th rib., affecting nephroscopic maneuvers and potentially increasing parenchymal damage and bleeding [39].

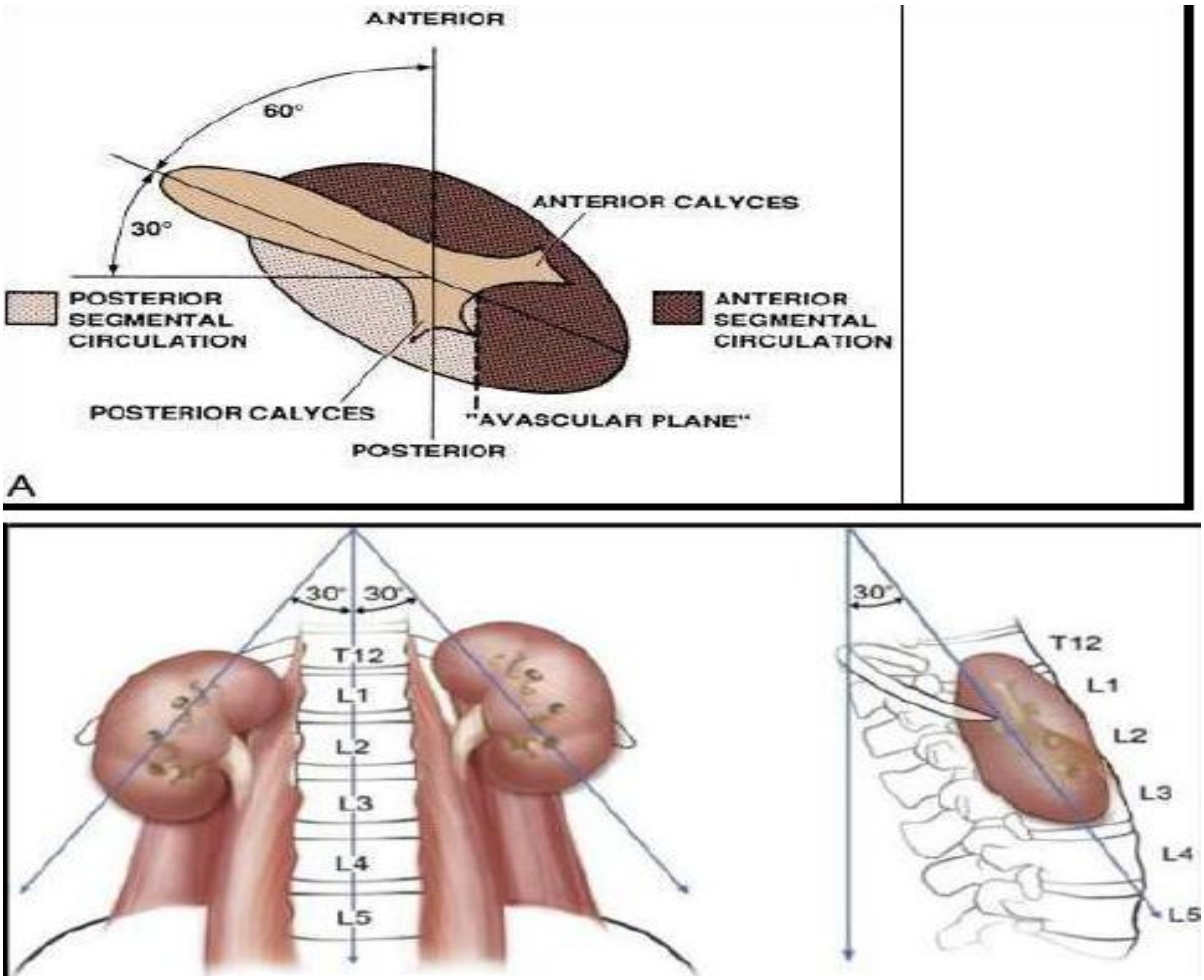

Figure 1: Appropriate axes of rotation for the kidney. A transverse view of the left kidney illustrates an anterior rotation of about thirty degrees from the coronal plane. B, Coronal section illustrating a marginal inward inclination of the renal upper poles. C. Sagittal view illustrating the lower pole of the right kidney displaced anteriorly [43].

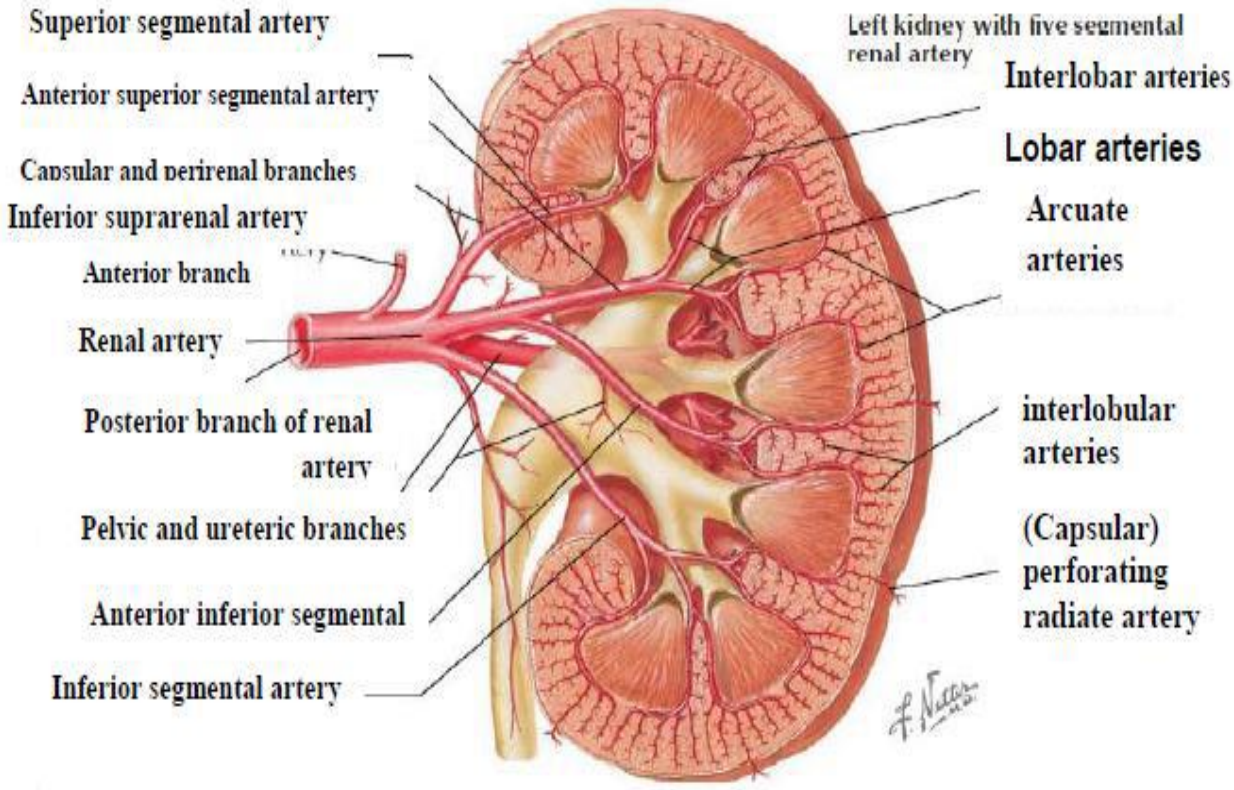

Figure 2: Arterial supply of the kidney & relation to the collecting system [44].

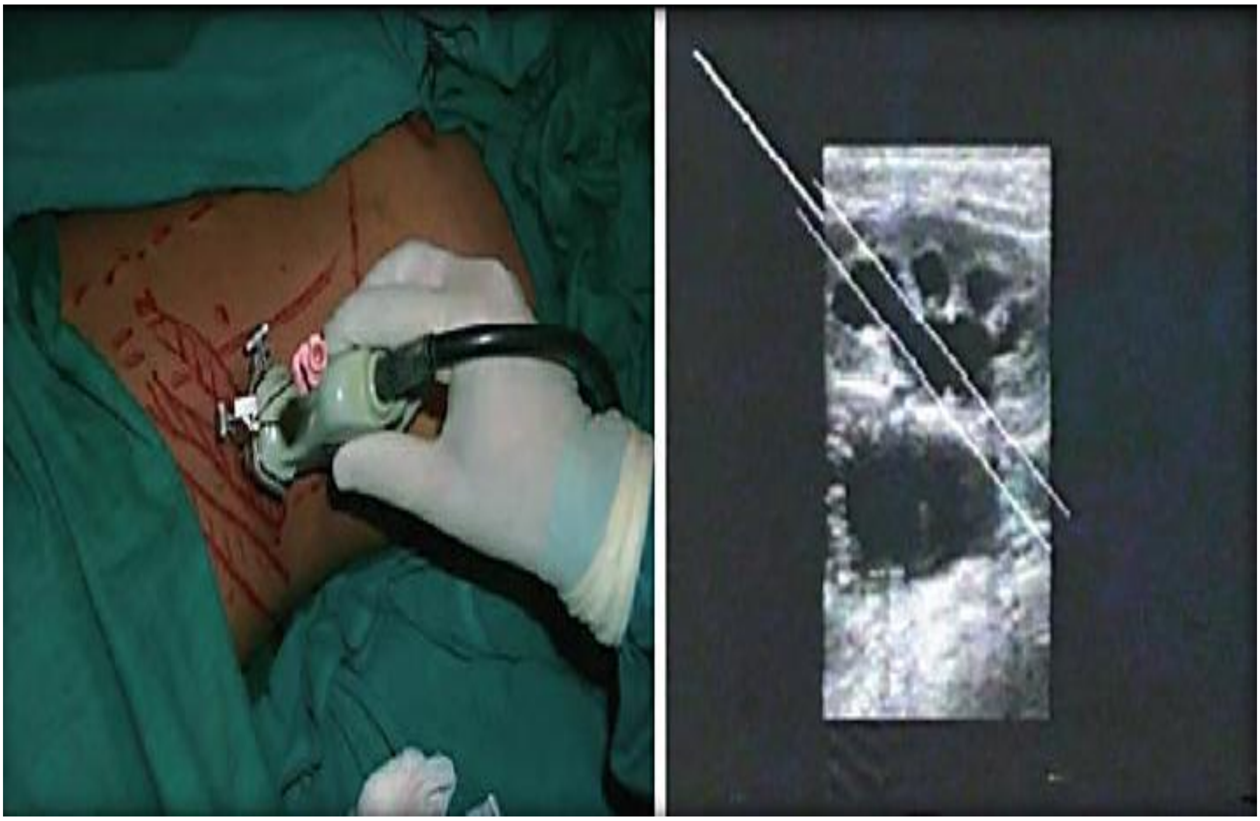

Figure 3: US guided access in PCNL [45].

15. Prone PCNL

By utilizing Brodel's avascular line to access the posterior kidney, this technique effectively reduces kidney hemorrhage and prevents visceral injuries. Insertion of a ureteric catheter is performed cystoscopically., and retrograde pyelography is performed. However, turning the patient prone can be hazardous and add to operative time. To reduce musculoskeletal complications, the utilized equipment consists of the Montreal mattress & the Prone View protective headgear system. By facilitating percutaneous renal access & enabling access to the upper urinary tract, modified prone positions can be utilized to treat potential stone fragment migration [40].

15.1. Prone PCNL as a safe and effective procedure

Prone PCNL has disadvantages like patient discomfort, complications, and prolonged surgery. However, neurosurgical and orthopedic literature reports most adverse events, and most patients experience longer operation times than the average for prone PCNL [40].

15.2. Collecting system access

Percutaneous coronary nephrolithotomy (PCNL) involves percutaneous access into the intrarenal collecting system via biplanar fluoroscopy and/or ultrasonography. Using Brodel's bloodless line—the ideal site of renal entrance that prevents vascular injury—is the fundamental principle of percutaneous access [41].

15.3. Outcomes of the PCNL

Among the advantages of PCNL performed in the supine position, there are a number of urological benefits, considering the many anesthesiological benefits that have received extensive media coverage. The supine position resolves the ventilatory, CVS, & pharmacokinetic issues associated with the prone position by providing improved access to the airways & CVS [42].

16. Conclusions

A CT study found retrorenal colons in just 1.9 percent of patients lying flat on their backs & ten percent of those lying face up, potentially impacting renal procedures, despite being a rare complication of PCNL. Advocates of supine PCNL suggest that a decrease in pyelovenous back flow can reduce postoperative fever and sepsis, but there is no significant difference compared to supine patients in terms of postoperative pyrexia & sepsis rates.

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