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Comparison of Pneumatic versus Laser Lithotripsy in the management of Ureteric stones

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Abstract:
Urinary calculi are the third most common problem affecting the urinary tract, followed by urinary tract infections& diseases of the prostate. Objective of this study is to evaluate and compare the efficacy and safety of Pneumatic versus laser lithotripsy in the management of ureteric stones.Stone migration was more common on pneumatic lithotripsy group than the laser group.
Duration of surgery was more in laser group than pneumatic group. Both of them achieved complete stone clearance with respect to lower ureteric calculi. For upper ureteric calculi, because of less stone migration in laser group, it resulted in better stone clearance.
Keywords: *Pneumatic, Laser Lithotripsy, Ureteric stones, Urospesis*

I. Introduction:

Treatment options for Ureteric calculus depends on the size and location of calculus which include Medical Expulsion of therapy and minimally invasive modalities including SWL,URS, PCNL, and laparoscopic or Robotic-assisted stone surgery2, open surgery.

The advancements in ureteroscopy and related working instruments has made endoscopic management the most important treatment' Stone fragmentation can be done by lithotripters such as H Ultrasonic H Electrohydraulic H Pneumatic and H Laser Of all pneumatic lithotripsy and laser lithotripsy are most commonly used because of favourable outcomes. Pneumatic lithotripsy working on the principle of jackhammer effect is most commonly used because of its low cost, easy setup, and good success rate. But the main disadvantage is the proximal migration of the stone . (retropulsion).

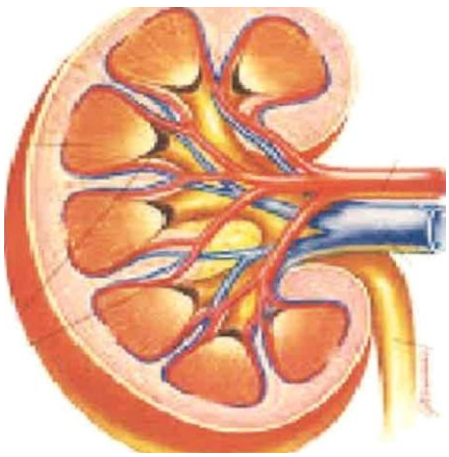
II. Review ofLiterature

Urolithiasis — stones of urinary tract are the third most common disease of urinary tract, after urinary tract infections and diseases of the prostate (BPH and prostate cancer). Stone disease - one of the major health problems of the human population, since antiquity [5].

ANATOMY OF URETER

S The normal ureter

Ureter is a hollow tubular structure that conveys the urine formed in the kidney to the urinary bladder. In the normal adult, the ureter is 25— 30-cm (10-12 inches) long with a 4-5-mm calibre. Ureter commences at the ureteropelvic junction (UPJ). At the UPJ ureter lies posterior to the renal artery and vein.

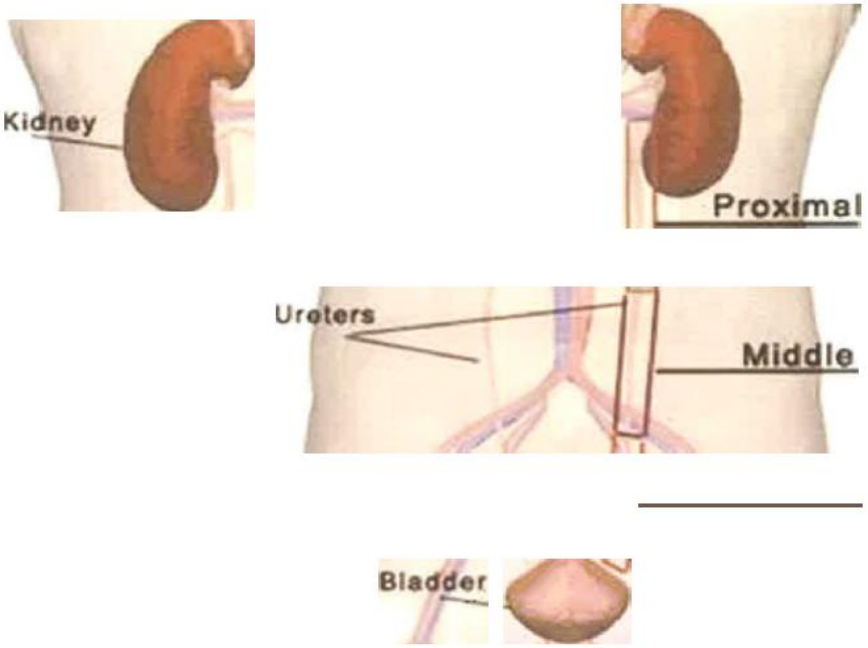


The ureter runs down and medially over the psoas muscle, and ends within the urinary bladder wall at the ureterovesical junction(UVJ).

Ureter is divided into three segments for purpose of localising pathologies and planning interventions.

Proximal ureter Mid ureter Distal ureter

From UPJ up to the pelvic brim Ureteral segment over the sacral bone
From the lower border of the sacrum to the ureteral orifice



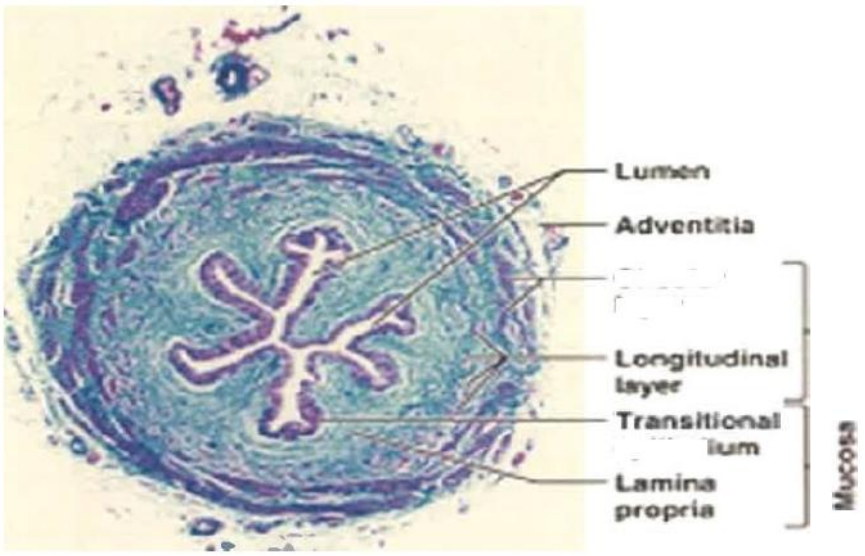
An alternative classification divides the ureter into the

 # Abdominal ureter.• From UPJ to the iliac vessel.

4 Pelvic ureter: From iliac vessels to urinary bladder.

The ureteral wall consists of four layers namely

- Urothelial mucosa
- lamina propria
- Muscular layer
- Adventitial layer.



MICROSCOPIC STRUCTURE OF URETER

Blood supply and lymphatic drainage

Abdominal ureter mainly supplied by the

- Abdominal aorta,
- Renal artery,
- Common iliac artery, and
- Gonadal artery.

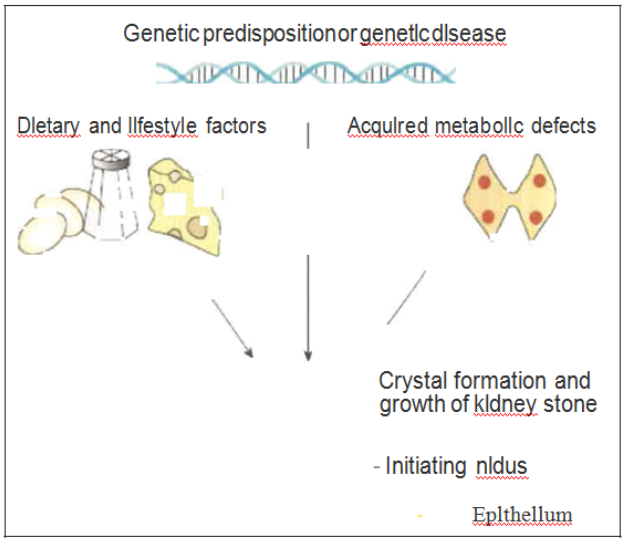
EPIDEMIOLOGY

- Historically males more commonly affected when compared to females but recent studies are showing that the gender gap is narrowing .
- Racial differences may predispose to stone formation. Whites are commonly affected than Asians.
- Stone disease has higher prevalence in hot, arid or dry climates such as deserts. Occupational risk factors such as heat exposure and dehydration predispose to stone formation.
- BMI and weight clearly plays role in stone formation.
- Systemic diseases associated with stone disease include Diabetes, Metabolic syndrome and cardiovascular disease.

PHYSIOLOGY AND PIATHOGENESIS

Mineralization is the process in which the crystals and matrix are interrelated. Urinary stones polycrystalline aggregates composed of varying amounts of crystalloid and organic matrix. Several theories have been proposed to explain urinary stone formation. The main factors responsible for urinary stone formation are Super saturation of urine.

Super saturation of urine depends on various factors such as urinary pH, ionic strength, solute concentration, and complexation. Crystal formation is modified by inhibitor substances found in the urinary tract, which includes magnesium, citrate, pyrophosphate, and a variety of trace metals . Renal calculus composed of both crystalline and non crystalline components. Non crystalline component consists of 2.5 % of renal calculus and it is termed as Matrix.



III. Materials and Methods

STUDY DESIGN :
Retrospective & Prospective observational study

PLACE OF STUDY:
This study was conducted in the Institute of Urology, Rajiv Gandhi Government General hospital ,Madras Medical College, Chennai-3.

STUDY PERIOD :
January 2015 — December 2015 --- 1 year

ETHICAL CLEARANCE :
The institutional ethical review board in our hospital approved the study.

INCLUSION CRITERIA
- Age > 18 yrs

- All patients presenting with symptomatic ureteric calculi were evaluated initially with Ultrasonography of KUB and Non Contrast CT KUB and those who were diagnosed cases of ureteric stones of size between 7 mm to 20 mm were included.

EXCLUSION CRITERIA
- Patients with B/L ureteric calculus
- Patients with associated vesical or renal calculus
- Patients with associated renal anomaly
- Patients with associated musculoskeletal abnormality
- Patients with previous ureteral surgery
- Patients with contraindications for surgery
- Patients with solitary kidney
- Patients not giving consent for study

METHOD OF STUDY
- Informed consent obtained from all the patients after explaining details of the study.
- All the details recorded in a proforma as an inpatient procedure.
- Analysis was done with the data prospectively.

PATIENT EVALUATION
All patients presenting with symptomatic ureteric calculus were screened with history and physical examination, urine culture, renal function tests, imaging with Ultrasonography KUB, Xray KUB , NCCT KUB.
- Size and location of the stone were assessed.
- After getting consent patients who were included in the study were divided into two groups

Group 1: Patients treated with **Pneumatic lithotripsy.**
Group 2: Patients treated with **LASER Lithotripsy.**

- All patients underwent lithotripsy using semi rigid 8 — 9.5fr Storz ureteroscope. URS was done under spinal anesthesia with the use of Hydrophilic guide wire.
- After procedure DJ stenting was placed in all patients which were removed after 2 weeks.
- Patients in both groups were evaluated at the end of first month with NCCT KUB, and if needed CECT KUB.
- Primary end point was stone free rate (stone size < 2mm)

The following details were recorded in both groups
- Operation time.
- Intraoperative complications such as perforation .
- Stone migration.
- Residual stone at the end of 1st month after stent removal.

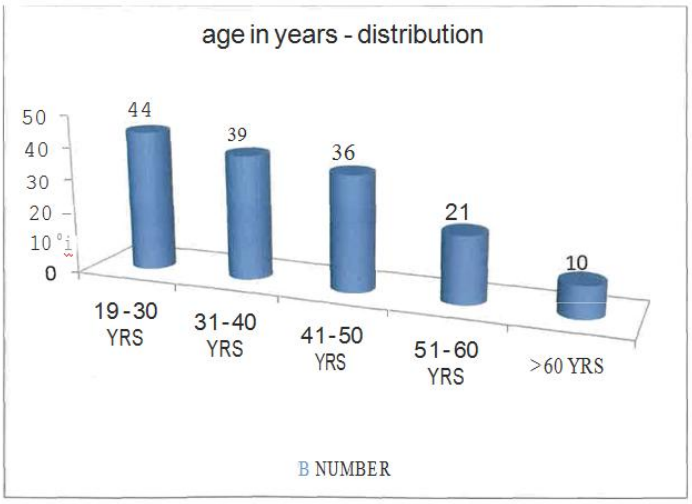
IV. Observation & Results

TOTAL NUMBER OF PATIENTS INCLUDED- 150
Patients were divided into two groups randomly Group 1(Pneumatic lithotripsy) PL-75
Group 2(Laser lithotripsy) LL 75

SEX DISTRIBUTION
In my study which included a total of 150 patients 84 were male and 66 were female.

SEX	GROUP 1 (PL)		GROUP 2 (LL)	
	Number	Percentage	Number	Percentage
MALES	43	57.3	41	54.7
FEMALE	32	42.7	34	45.3
TOTAL	75		75	

AGE DISTRIBUTION



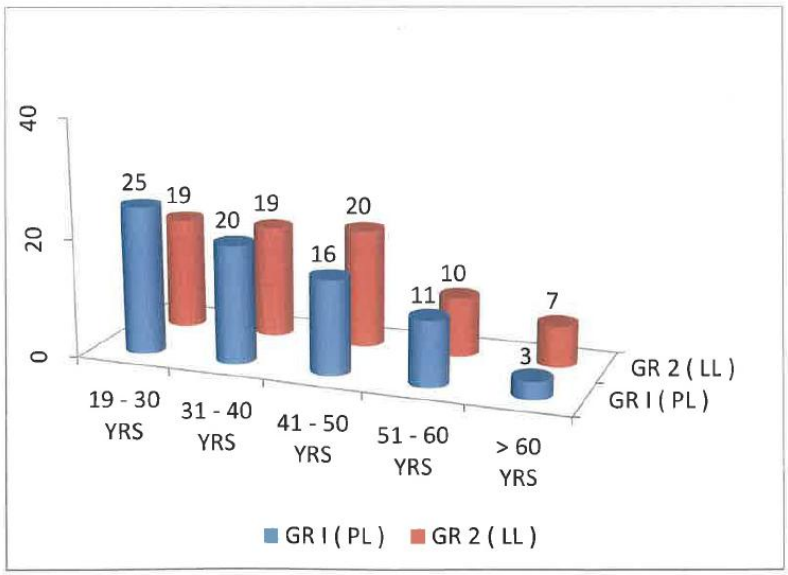
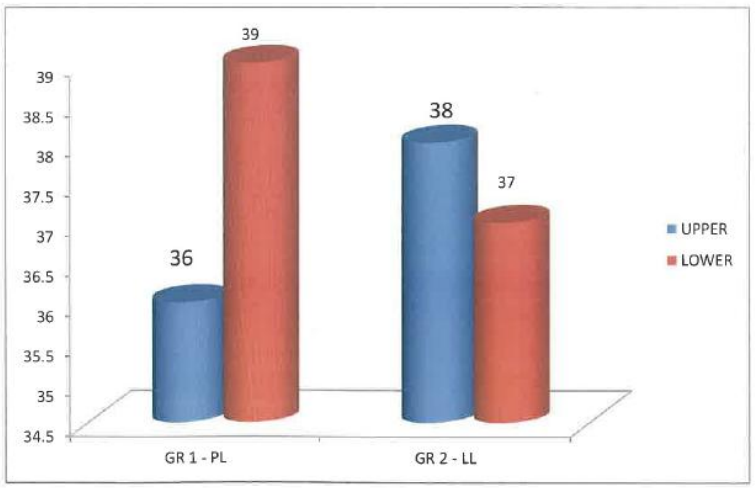
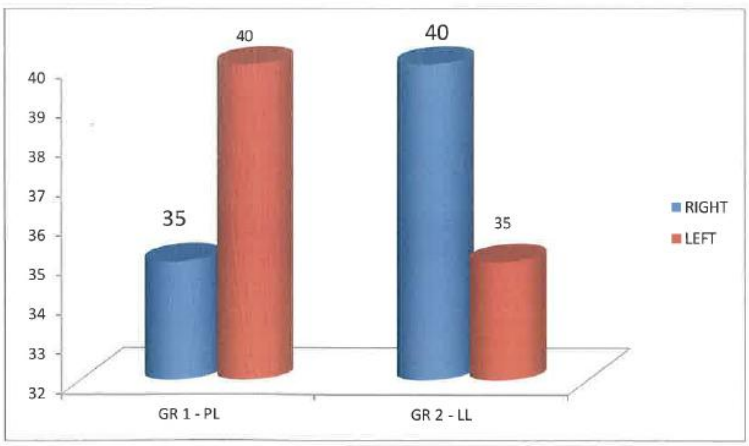


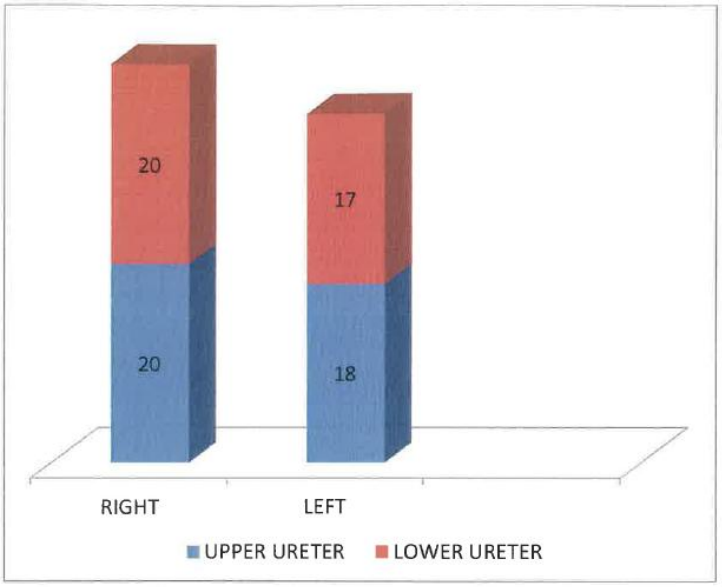
CHART SHOWING SIDE DISTRIBUTION OF STONE



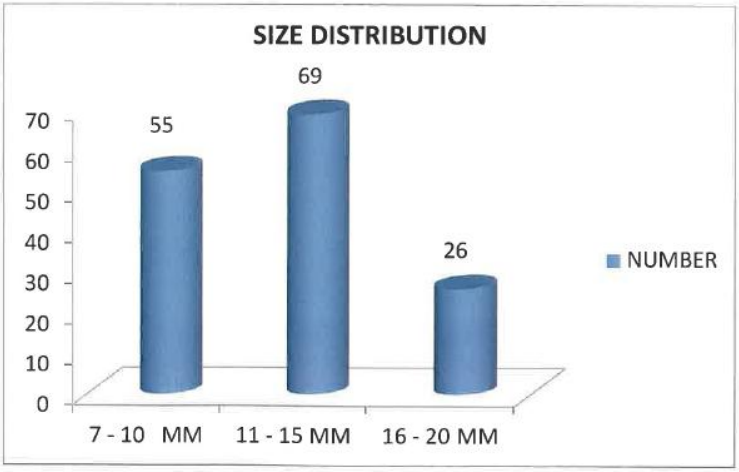
PICTURE SHOWING STONE LOCATION



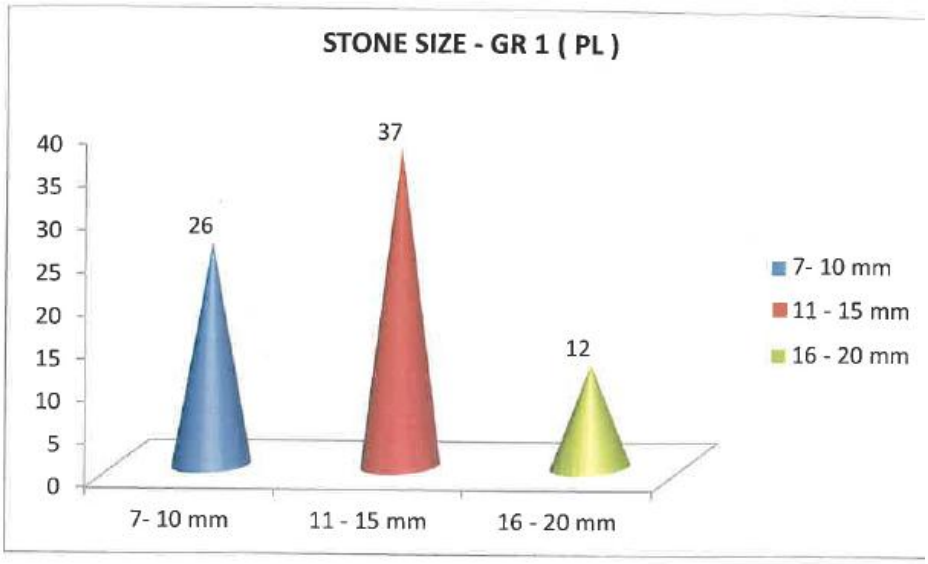
GROUP 2 - LASER LITHOTRIPSY

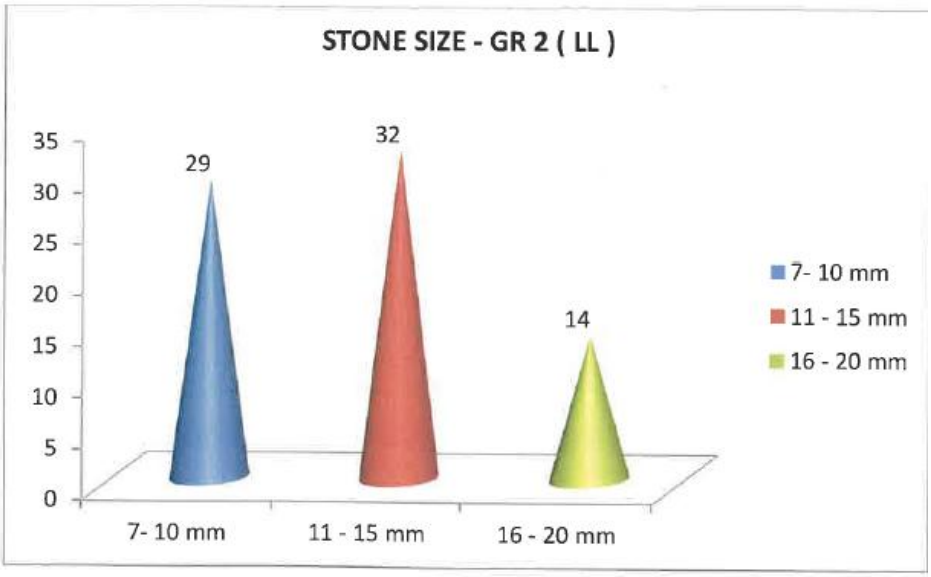


STONE SIZE MM	Number	Percentage
7 – 10	55	36.67
11 – 15	69	46.00
16- 20	26	17.33
Total	150	100



Stone size between 11 to 15 mm was more common in my study.



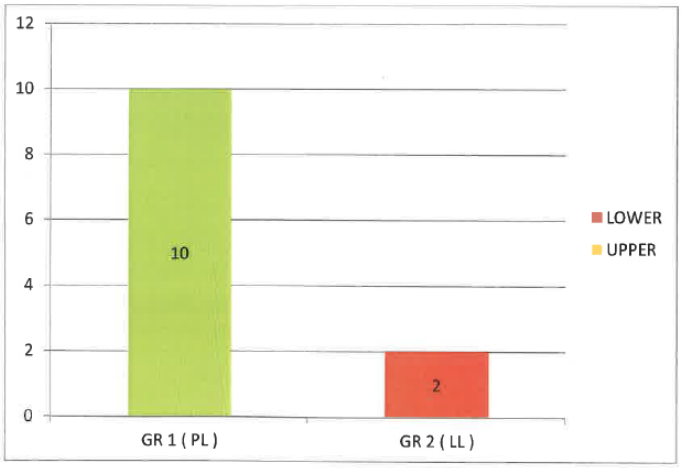


STONE SIZE	GR 1 (PL)	GR 2 (LL)	P VALUE
MEAN	12.31±3.01	12.24±2.99	0.89

STONE MIGRATION

LOCATION	GROUP 1 (PL)	GROUP 2 (LL)	P VALUE
UPPER	10	2	0.035
LOWER	0	0	

STONE MIGRATION



UROSEPSIS

Incidence of uroepsis in both the groups.

The chances urosepsis increases as the stone size increases and the operation time increases.

STONE SIZE MM	GROUP 1 (PL)	GROUP 2 (LL)	P VALUE
	Number	Number	
7 – 10	0	0	0.73
11 – 15	0	0	
16- 20	5	4	
TOTAL	5	4	

V. Conclusion:

In my study, 10 upper ureteric calculi in pneumatic lithotripsy group and 2 upper ureteric calculi in laser group migrated above. But there was no migration in lower ureteric calculi in both groups. This resulted in a P = 0.035, which was significant favoring reduced stone migration in laser group.

Urospesis occurred in both groups when stone size was larger, 16 — 20mm. In pneumatic group, 5 patients developed urosepsis, while only 4 cases in laser group developed urosepsis. This was insignificant with a P=073.

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