How to Cite:
Maharaul, H. H., Brar, G., & Dhorajia, D. (2022). Clinical profile and management of nephrolithiasis. *International Journal of Health Sciences*, *6*(S4), 711–725.
https://doi.org/10.53730/ijhs.v6nS4.5638

Clinical profile and management of nephrolithiasis

Dr. Honeypalsinh H. Maharaul
Associate professor, Department of surgery, Smt B.K.Shah Medical Institute and Research Centre Sumandeep Vidyapeeth Institute and Deemed to be University Pipariya Vadodara

Dr Gurnihalsingh Brar
Resident, Department of surgery, Smt B.K.Shah Medical Institute and Research Centre Sumandeep Vidyapeeth Institute and Deemed to be University Pipariya Vadodara

Dr. Dhvanilkumar Dhorajia
Consultant, Surbhi Hospital, Navsari

***Abstract*---**Nephrolithiasis is the most common chronic kidney condition, after hypertension, and also an ancient one: treatments for patients with stones have been described since the earliest medical texts. It affects over 25% of adults in the India [1], and the prevalence is rising. The fundamental cause for all stones is supersaturation of urine with respect to the stone components; factors affecting solubility include urine volume, pH, and total solute excretion. Calcium stones are the most common, in adults and children, and are associated with several metabolic disorders, the most common of which is idiopathic hypercalciuria. Therapy to prevent stones rests on lowering supersaturation, using both diet and medication. Effective treatment decreases stone recurrence and need for procedures for stone removal. So, this challenging subject is taken up for the present study in which we studied the clinical presentation of Nephrolithiasis at our hospital." To evaluate age, sex, etiological, epidemiological factors causing nephrolithiasis and to study varied spectrum of clinical manifestations of renal calculi its investigations , management , outcome and complications. This prospective study was conducted on patients admitted to S.B.K.S.M.I.R&C. Dhiraj Hospital Piparia Vadodara. 150 patients with Nephrolithiasis were enrolled for the study. This prospective study conducted at S.B.K.S.M.I.R&C. Dhiraj Hospital Piparia Vadodara, included 150 patients with acute pancreatitis, male and female (M: F =104:46). Kidney Stones is a preventable cause of morbidity, accounting for, both for hospitalization and procedures to remove symptomatic stones, as well as time lost from work. It has a male

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
***Corresponding author**: Dr. Dhvanilkumar Dhorajia; Email: Honeypal.219@gmail.com*
Manuscript submitted: 27 Jan 2022, Manuscript revised: 18 Feb 2022, Accepted for publication: 9 March 2022

preponderance and most commonly presents in the age group 20-40 the most productive age group. Farmers/labourer classes of people are the vulnerable group of population followed by service class people. Geographical distribution of nephrolithiasis includes hot places with long summers like Rajasthan, Kutch. Water Intake and type of water also affects its incidence with higher incidence in those drinking water <1 litres / day. It is mainly a diagnosed with the help of X-ray KUB and Ultrasound but sensitivity is less compared to CT KUB/ IVP. The management is conservative in those having stone of smaller size, with intervention done for patients with larger stones. Patient does usually prefer to undergo minimal invasive surgery than open surgery. ESWL and PCNL are common minimal invasive intervention done with newer techniques like RIRS being evolving technique. Open Surgery are done in those patients having staghorn calculi which are not feasible by PCNL/ESWL. ESWL is done in stone size <1.5 cm and PCNL for stone>1.5 cm. Complications have been reported in all procedures with haemorrhage being most common complication in all. Recurrence was common in those patients managed conservatively. In surgical group more number of patients had recurrence after ESWL.

***Keywords*---**kidney stones, calcium oxalate, kidney calculi, nephrolithiasis.

Introduction

Urolithiasis is one of the oldest diseases in humans and has been documented in ancient Greek. Urinary stones have been found in the remains of Egyptian mummies dating as far as seven thousand years and the symptoms were described by Hippocrates who suggested that drinking of soiled river water causes the excretion of sand in urine. Those times the occurrence of calculi was confined to urinary bladder and renal stones were unknown. Roman physician Galen stated that factors like diet, climate, hereditary, race and some abnormalities cause the stone formation [1]. The prevalence and incidence are of renal stone disease are estimated to be 5-10% and 100-300/100,000/year, respectively. Relapses have occurred in 50-70% of all cases [2]. It is linked to changes in lifestyle, eating patterns and obesity. One of the common causes for acute and chronic renal failure is the stone formation or lithiasis that includes both nephrolithiasis (stone formation in kidney) and urolithiasis (stone formation in ureter or urinary bladder or both).

Kidney stone is a solid lump (as small as grain of sand to as large as the size of golf ball) made up of crystals that separate from urine and build up on the inner surfaces of the kidney. Kidney stones result from the precipitation of certain substances within the urine. In some cases, the stone is not able to travel through ureter, causing pain and possibly obstruction, blocking flow of urine out of kidney [3]. Severe pain or aching in the back on one or both sides, sudden spasms of excruciating pain (renal or uteric colic), bloody, cloudy or smelly urine, feeling of being sick, a frequent urge to urinate, or a burning sensation during urination, fever and chills, etc. are commonly observed symptoms in the patients.

Supersaturation creates calculus by combining two ions with one another into a solid substance called nucleation. Calcium and oxalate ions can get oriented themselves on surfaces of another crystal, like uric acid, and such nuclei can promote calcium oxalate stones. Imbalance in ratio of urolithiasis promoters (calcium, oxalate, uric acid and inorganic phosphate) and inhibitors (citrate and magnesium) and alterations in urothelial surface partly explains why only a small fraction of people suffer from calcium oxalate stones though urinary calcium oxalate supersaturation is almost universal[4]. Hereditary and personal history of renal stone and geographic conditions also influences stone formation [5]. Urine analysis, X-ray images, intravenous urogram and ultrasound were only used till now for diagnosis but now recently introduced non-contrast computerized tomography is the first-line investigational tool [6]. Presently crystallographic examination is one of the most precise and less expensive methods to identify the nature of the concretion [2]. Thiazide diuretics, allopurinol, etc. are used for treatment but they have their own pharmacological limits and number of side effects on long term use. Thus, surgery is the only prime treatment of urolithiasis. Extra-corporeal shockwave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), Open surgery, Ureteroscopic stone removal method and Laparoscopic pyelolithotomy are surgical interventions used in various conditions. After spontaneous passage or surgical treatment, a subset of these patients will have recurrent calculi. These recurrent stone events are significantly morbid and can potentially lead to serious chronic renal disease, thus prevention is a very important treatment goal [7].

It is widely known that urolithiasis is characterized by high recurrence if patients are not treated appropriately. Despite tremendous advances accomplished in surgical management, by the introduction of highly sophisticated technologies to eliminate kidney stones, failures occur. Therefore, efforts are required to assess medical therapy better and develop new agents that can be used either alone or in combination to prevent stone formation efficiently in lithiasis patients.

Materials and Methods

Location: SBKS Medical Institute and Research Centre, Pipariya

Inclusion Criteria

- All patients presenting and diagnosed of Nephrolithiasis at surgical OPD/ Urology OPD at Dhiraj Hospital, Pipariya will be included in study.

Exclusion Criteria

- Patient with ureteric calculi
- Patient not willing for study
- Multiple pathologies.

Methodology of Study

- A prospective Cohort study starting has been carried out in SKBS medical college hospital after approval of study from Sumandeep Vidyapeeth ethics committee.
- Total 150 patients presenting with features of nephrolithiasis have been included in study.
- Blood investigations like complete blood count, random blood sugar, Urine routine and microscopy, X-ray KUB and ultrasonography for stone size and cortex features were done and patients were admitted.
- 120 patients were selected for IVP/CT KUB for renal function and study of anatomy of patient's urinary tract.
- Patients were monitored intra operatively and post operatively and complications were noted.
- The outcome is evaluated as per the predesigned proforma of study.

Result and Comparison

1) AGE DISTRIBUTION:

(FIGURE 1)

Most of the patient in our study belongs to 21-40 age group.

2) SEX DISTRIBUTION:

(FIGURE 2)

In our study out of 150 patients 104 (69.3%) were males and 30.7% were females.

3) OCCUPATION:

(FIGURE 3):

In present study most of the patients (66%) were farmers/ daily wager/ labourer.

4) LOCALITY:

(FIGURE 4

Most of the patient in present study belongs to Rajasthan (46.7%).

5) Clinical features:

(TABLE 1)

Common presentation in patient with renal sone was haematuria ranging from 86.70% in present. 66.7% patients had complaints of abdominal pain.

6) TYPE OF WATER INTAKE:

(FIGURE 5)

Most of the patient in our study belongs to low socioeconomic status and belonging to Rajasthan where accessibility to municipal water is low therefore tend to drink bore water.

7) QUANTITY OF WATER:

(FIGURE 6)

In present study most of the patients have 1 litre or less amount of water intake.

8) INVESTIGATION:

(TABLE 2)

X ray KUB is still the first investigation done for diagnosis of renal stone in developing countries like India followed by Ultrasound.
Sensitivity if CT KUB/IVP is 100% but cost of which is also high and as stated earlier our study consisted of low socioeconomic population CT scan was done on merit basis and in those who needed to undergo surgery. CT scan was done to find out exact anatomy of renal system before patient is undergoing surgery.

9) SURGICAL MANAGEMENT:

(TABLE 3)

In present study most of the patient underwent Minimal access surgery (91.80%) in the form of PCNL (65.60%) or ESWL (26.20%) .

10) COMPLICATION OF OPEN SURGERY

(TABLE 4)

1 patient had haemorrhage, infection which were managed conservatively. One patient had injury to pleura which was managed by insertion of Intercostal drainage tube.

11) COMPLICATION OF PCNL:

(TABLE 5)

In our study most common complication was urinoma and fever which was managed conservatively.

12) COMPLICATIONS OF ESWL:

(TABLE 6)

Most common complication following ESWL in present study was renal colic.

13) RECURRENCE:

(TABLE 7)

Discussion

This prospective study conducted at Dhiraj General Hospital S.B.K.S Medical

Institute & Research Center, Pipariya, Vadodara. 150 patients of nephrolithiasis were enrolled for the study. The purpose of the present study was to evaluate the age and sex prevalence, the varied presentation, various diagnostic modalities, management and complication of renal stone. The findings of this study were compared with those available in literature. There is a male preponderance with 69.3% of the total patients being males. Patients in the age group 21-40 were commonly affected. Farmers/ daily wagers/laborers were commonly affected population consisting 66%. Most of the patients were from Rajasthan (46.7%) followed by Madhya Pradesh (33.3%) and Gujarat (20%). The most common presentation was haematuria in 87% followed by pain abdomen mainly situated in the loin region associated with nausea and vomiting in few patients and burning micturition. Most of the patient had bore water intake (60%) followed by Municipal water (30%) and other sources (10%). Patients had low water intake <1 liters (56%). Most common modality of investigation was X-ray KUB and USG Abdomen with sensitivity being 81.3% and 95.3% respectively. Ct KUB was most sensitive investigation with 100% sensitivity. Most of the patient were managed surgically (81.3%) and 18.7% patients managed conservatively. Conservative management included analgesics and flush therapy. PCNL was done in 65.6%

patient; ESWL was done in 26.2% patient and Open Surgery done in 8.2% patient. Common complication in open surgery was Haemorrhage, infection and thoracic injury. Urinoma and Fever were noted in 5% patients who underwent PCNL. Patient complained of renal colic (12.8%) and 1 patient reported to have renal hematoma after ESWL. Recurrence was found after conservative management in 35.7% patient while 12.5% patient after ESWL developed stone. In open surgery and PCNL 10% recurrence was noted. All the patients were managed by PCNL.

Most of the patient in our study belongs to 21-40 age group. which is the most productive population which is comparable to Khan G. et al [8] and Aaisha et al [9]. This age group is working population most of them staying away from home for longer hours & low intake of water which leads to renal stone formation. Also, in this age group there is higher incidence of obesity and hypertension which are comorbid factor for development of renal stone. In our study out of 150 patients 104 (69.3%) were males and 30.7% were females. In present study incidence of male patients is more than female patients which is comparable to Khan G. et al [8] , Aaisha et al[9] and Harpreet et al[10] .Male predominance may be attributed to those patients who were staying away from home and had low water intake. Due to low water intake dilution of uric acid does not occur. So, PH level of kidney drop and become more acidic which leads to formation of stone. In Parul study [11] conducted at Saurashtra it was found that also it is found that normal women excrete more citrate and less calcium than normal men which may be reason for male predominance. Also, the incidence of obesity and high blood pressure in Indian male is more compared to female so they are more prone to stone disease. Hyperparathyroidism is more common in male where male: female ratio being 3.3: 1; which leads to increase in serum calcium level, and increasing chance of calcium stone formation. In present study most of the patients (66%) were farmers/ daily wager/ labourer which are comparable to Parul study [11] and Ali Asghar et al[12]. These people are hard workers who stay away from home for long hours, work in hot climatic condition, low socioeconomic status, have low water intake, drink hard water; all these factors contribute to stone formation. Second common group belongs to service class population working at offices or industries tends to have low intake of water and needs to exert on work causing dehydration and leading to renal stone formation. Incidence is lower in students, house wife and business class population as these people have access to portable drinking water. Most of the patient in present study belongs to Rajasthan (46.7%) which was also found in Aniruddha et al [13] study. Rajasthan being a developing state compared to Gujarat, Maharashtra and Madhya Pradesh, most of the patient belonging to low socioeconomic strata are devoid of portable drinking water and therefore drink hard water. Also, this part of India has less rain, mostly hot climatic condition with long summer and high temperature population in these parts are more prone to dehydration with less urine output. These factors lead to supersaturation of urine and acidic urine leading to crystallization and stone formation. Common presentation in patient with renal sone was haematuria ranging from 86.70% in present study to 90.3% in Fredric et al [14] which is due to irritation of stone to mucosal lining of kidney leading to damage producing haematuria. Second common presentation was burning micturition ranging from 78% in Fredric et al [14] to 80% which is due to obstruction of urine due to stone

and stasis of urine and growth of bacteria in urine. 66.7% patients also had complaints of abdominal pain but abdomen being Pandora box it cannot be a guide line for diagnosis of renal stone. Most of the patient in our study belongs to low socioeconomic status and belonging to Rajasthan where accessibility to municipal water is low therefore tend to drink bore water. Parul study [11] was conducted at Saurashtra in Gujarat which is more developed state and this part of Gujarat has access to drinking water from Sardar Sarovar Narmada Project supplied through Municipal Corporation. Few populations are devoid of such water tending to get water from pound/lakes and have to travel a long for such which in turns leads to dehydration. Bore water which is hard and content large amount of calcium and magnesium salts as compared to municipal water and Purified water at home. Most of the patient in our study belongs to low socioeconomic status and cannot afford water purifier drinks hard bore water leading to high calcium levels in urine and renal stone formation. Amount of drinking water required for human is variable.[15] It depends on physical activity, age, health, and environmental conditions.[15] In the United States, the reference daily intake (RDI) for total water intake is 3.7 litres per day (L/day) for human males older than 18, and 2.7 L/day for human females older than 18 which includes drinking water, water in beverages, and water contained in food.[16] For those working in a hot climate, up to 16 litres per day may be required.[15] Water intake and renal clearance are interrelated. More amount of water leads to increase urine formation and thus renal clearance. In present study as well as Parul Study [11] most of the patients have 1 litre or less amount of water intake which leads to decrease urine formation and thus clearance of waste products does not occur leading to renal stone formation. X ray KUB is still the first investigation done for diagnosis of renal stone in developing countries like India followed by Ultrasound. But the present study shows its sensitivity 81.3% compared to 45% in Levine et al [17] which is low for diagnosis. While for Ultrasound it was 95.3% in our study compared to 76% in Carlo et al [18] and 91% in Haddad et al [19] which may be attributed to user bias and experience of the radiologist. The size of the stone is an important predictor of spontaneous passage. A stone less than 4 mm in diameter has an 80% chance of spontaneous passage; this falls to 20% for stones larger than 8 mm in diameter. These stones were managed conservatively [21]. In present study most of the patient underwent Minimal access surgery (91.80%) in the form of PCNL (65.60%) or ESWL (26.20%) which is comparable to El-Husseiny et al [20]. The dramatic advances in endourological technology are considered to be the main reason for changing the indications for open surgery. That a surgeon can reach almost every part of the collecting system using small-calibre, semi-rigid and flexible ureteroscopes ensures that patients usually have a successful diagnostic or therapeutic procedure. As it is a minimally invasive procedure, many patients can usually be discharged on the same day as the procedure, and hence the techniques have gained popularity with surgeons and patients [20]."

"Advances in technology have also allowed for the development of more effective intracorporeal lithotripsy devices, such as the holmium laser and pneumatic lithotripters. Improvements in flexible grasping devices and the introduction of Nitinol baskets have further improved efficacy. Another factor has been the development of retrograde and antegrade techniques to correct anatomical

obstructions associated with stone disease, including PUJ obstruction, calyceal diverticulum, infundibular stenosis, and ureteric stricture [22,23]. All of these factors, in addition to the improvement in the technical expertise of endourological surgeons, have contributed to a significant decline in the current indications for open stone surgery. However, there are still patients who are candidates for this approach; the appropriate selection of these patients is critical in obtaining optimal surgical results. The most common current indications for open stone surgery include: patients in whom a reasonable number of less-invasive procedures would not be useful; those with a complex stone burden; failure of ESWL or endourological treatment; anatomical abnormalities (e.g. PUJ obstruction and infundibular stenosis with or without renal calyceal diverticulum), morbid obesity, concurrent open surgery, renal transplantation, severe limb contractures and patient preference. Therefore, it remains the critical responsibility of the treating urologist/surgeon to recognise those rare cases in which open stone surgery might represent at least a reasonable alternative to less-invasive methods, if not even the primary treatment option. In present study only 10 patients underwent open pyelolithotomy for renal stone owing to development of minimal invasive surgery. Of them only 1 patient had haemorrhage, infection which were managed conservatively. One patient had injury to pleura which was managed by insertion of Intercostal drainage tube. Khalaf I et al [24] study was conducted among 5172 patients of which most common complication was haemorrhage in 35% owing to dissection required for stone removal. Khaled et al [25] also reported higher incidence of haemorrhage which may be due to same reason but infection rate was higher which may be attributed to a greater number of patients in study as well as longer time period of surgery. With development of newer techniques and experience incidence of complications following PCNL have decreased. In our study most common complication was urinoma and fever which was managed conservatively, while in Seitz C. et al[26], Gremmo et al[27]and Seyed et al [28] was haemorrhage requiring transfusion due to blood loss following puncture. These complications are user related and with experience and proper pre-operative workup it can be prevented. Other complications include organ injury, thoracic complication during access nephrostomy tube placement, and embolization due to inadvertent injury to vessel. Most common complication following ESWL in present study as well as Rasssweiler J et al[29] was renal colic which is due to small stone fragments passing through ureter leading to pain. Bacteriuria which occurs due to stasis of urine can be treated by urinary antibiotics. Renal Hematoma is dreaded complication which can be prevented by preoperative assessment of patients for bleeding disorder. Other compilations which include cardiovascular arrhythmias, bowel perforation, injury to solid organ which are rare and can be prevented. Upper GI erosions were found in 80% in Mohemad et al[30] which was conducted in 1985 and bowel perforation was noted in 1.7 % in Kurtz et al [31] in 1999 but with advances in recent instruments these complications have become rare. Khalaf I et al[24] to 31.8% in Alim et al[32] which may be due to time period of study as in our and Khalaf I et al[24] patient was followed up till 2 years compared to 3-5 years in Alim et al[104].Recurrence was found more after ESWL in present as well as Chongruksut W et al [33] and Alim et al [32] study which may be attributed to residual fragment remaining after procedure providing nidus for recurrence."Chongruksut W et al [33] study showed that risk factors for recurrence

after ESWL included lower calyx stones, multiple stone. Similarly risk for recurrence of stone after PCNL was found to be stone size>20 mm, lower calyx stone.

Our study was conducted in south Gujarat region with limited number of patients presenting to medical college most of those belonging to lower socioeconomic class thus result of this study cannot be generalised to whole population. Also, follow up in our study was 6 months thus long-term recurrence and complications was not accessed.

Kidney Stones is a preventable cause of morbidity, accounting for, both for hospitalization and procedures to remove symptomatic stones, as well as time lost from work. It has a male preponderance and most commonly presents in the age group 20-40 the most productive age group. Farmers/labourer classes of people are the vulnerable group of population followed by service class people. Geographical distribution of nephrolithiasis includes hot places with long summers like Rajasthan, Kutch. Water Intake and type of water also affects its incidence with higher incidence in those drinking water <1 litres / day. It is mainly a diagnosed with the help of X-ray KUB and Ultrasound but sensitivity is less compared to CT KUB/ IVP. The management is conservative in those having stone of smaller size, with intervention done for patients with larger stones. Patient does usually prefer to undergo minimal invasive surgery than open surgery. ESWL and PCNL are common minimal invasive intervention done with newer techniques like RIRS being evolving technique. Open Surgery are done in those patients having staghorn calculi which are not feasible by PCNL/ESWL. ESWL is done in stone size <1.5 cm and PCNL for stone>1.5 cm. Complications have been reported in all procedures with haemorrhage being most common complication in all. Recurrence was common in those patients managed conservatively. In surgical group a greater number of patients had recurrence after ESWL.

References

1. Butt AJ. Historical survey. In Etiological factors in renal lithiasis. ED. Butt AJ, Springfield, Illinis, CC Thomus. 1956:3.
2. Saita A, Bonaccorsi A, Motta M. Stone composition: where do we stand? Urol Int 2007; 79(1):16-9.
3. Ringold S, Glass T, Richard M. JAMA-Kidney stones 2005 March; 293(9):1158.
4. NIH Consens statement, treatment & prevention. March 1998
5. Ramello A, Vitale C, Maragella M. Epidemiology of nephrolithiasis. J Nephrol 2000 Nov-Dec; 13(3):S45-50.
6. Masarani M, Dinneen M. Ureteric colic: new trends in diagnosis and treatment. Postgrad Med J 2007 Jul;83(981):469-72.
7. Long LO, Park S. Update on nephrolithiasis management. Minerva Urol Nefrol 2007 Sep;59(3):317-25.
8. Khan G, Ahmad S, Anwar S, Marwat M. Gender and age distribution and chemical composition of renal stones. Gomal J Med Sci 2013: 11:167-70.

9. Aaisha Obaid Zayid Al-Risi, Nida'a Mohammed Ali, Alka Ahuja. Study on Prevalence and Management of Renal Stones among Omani in Patients at Sohar Hospital, Scholars Journal of Applied Medical Sciences, 2014; 2(1A):22-33
10. Harpreet Kaur, Jagmohan Singh, Minni Verma and Kamaljit Singh, Analysis of biochemical profile of renal stones referred to advanced Biochemistry laboratory of a multispecialty tertiary care Hospital in Punjab, European Journal of Experimental Biology, 2012, 2 (3):543-546
11. Patel, Parulaben B.,"Analysis of Kidney Stones Prevalent in Saurashtra Region", Indian Journal of Biomedical Research 2012:1:17-21.
12. Ali Asghar Ketabchi, Gholam Abbas Aziziolahi. Prevalence of Symptomatic Urinary Calculi in Kerman, Iran. Urology Journal: 2008;5(3):156-60.
13. Aniruddha Roy, Anjan Adhikari , Sunil Kanti Das , Deepashree Banerjee , Radharaman De , P. K. Debnath. "Evaluation of Efficacy and Safety of Renomet, a Polyherbal Formulation in the Treatment of Urolithiasis: A Double Blind Randomized Study". International Journal of Pharmaceutical Sciences and Drug Research 2012; 4(2): 130-133.
14. Coe,Fredric L., Andrew Evan, and Elaine Worcester. "Kidney Stone Disease". Journal of Clinical Investigation 115.10 (2005): 2598–2608.
15. Ann C. Grandjean, "Water Requirement, Impinging factors and Recommended intake". World Health Organisation,August 2004:3:25-34.
16. Institute of Medicine (U.S.) Food and Nutrition Board. Panel on Dietary Reference Intakes for Electrolytes and Water, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes: *Dietary reference intakes: Water, potassium, sodium, chloride and sulfate*. Washington DC, National Academies Press, 2004.
17. Levine JA, Neitlich J, Verga M, Dalrymple N, Smith RC. Ureteral calculi in patients with flank pain: correlation of plain radiography with unenhanced helical CT. Radiology 1997;204:27-31.
18. Carlo Passerotti, Jeanne S. Chow, Andres Silva, Cynthia L. Schoettler, Ilina Rosoklija, Jeannette Perez-Rossello, Marc Cendron, Bartley G. Cilento, Richard S. Lee, Caleb P. Nelson, Carlos R. Estrada, Stuart B. Bauer, Joseph G. Borer, David A. Diamond, Alan B. Retik and Hiep T. Nguyen. "Ultrasound Versus Computerized Tomography for Evaluating Urolithiasis". The journal of urology, October 2009: Vol. 182, 1829-1834.
19. 19 M C Haddad, H S Sharif, M S Shahed, M A Mutaiery, A M Samihan, B M Sammak, L A Southcombe, and A D Crawfor. Renal colic: diagnosis and outcome.Radiology 1992:83-88.
20. El-Husseiny, Tamer, and Noor Buchholz. "The Role of Open Stone Surgery."*Arab Journal of Urology* 10.3 (2012): 284–288.
21. Assimos DG, Krambeck A, Miller NL, et al. Surgical Management of Stones: American Urological Association/Endourological Society Guideline. American Urological Association.
22. Inglis J.A., Tolley D.A. Ureteroscopic pyelolysis for pelvi-ureteric obstruction. Br J Urol. 1986;58:250–252.
23. Nakada S.Y., Pearle M.S., Clayman R.V. Acucise endopyelotomy. Evolution of a less-invasive technology. J Endourol. 1996;10:133–139.
24. I. Khalaf, E. Salih, , E. El-Mallah, S. Farghal, A. Abdel-Raouf.Al-Azhar Faculty of Medicine, Cairo, Egypt. The outcome of open renal stone surgery calls for

limitation of its use: A single institution experience. African Journal of Urology Volume 19, Issue 2, June 2013, Pages 58–65.
25. Khaled M. Al-Kohlany, Ahmed A. Shokeir , Ahmed Mosbah,Tarek Mohsen,Ahmed M. Shoma, Ibrahim Eraky, Mahmoud El-Kenawy, Hamdy A. El-Kappany.Treatment of complete staghorn stones: a prospective randomized comparison of open surgery versus percutaneous nephrolithotomy. The Journal of Urology: 2005; 173(2):469-73.
26. Seitz C, Desai M, Hacker A, Hakenberg OW, Liatsikos E, Nagele U, Tolley D. Incidence, prevention, and management of complications following percutaneous nephrolitholapaxy. European Urology. 2012 Jan;61(1):146-58.
27. Gremmo E , Ballanger P , Doré B , Aubert J.Hemorrhagic complications during percutaneous nephrolithotomy. Retrospective studies of 772 cases. Europe PMC; 2011:12(2);32-50
28. Seyed Habibollah Mousavi-Bahar, Sasan Mehrabi, Mohammad Kazem Moslemi.Percutaneous Nephrolithotomy Complications in 671 Consecutive Patients A Single-Center Experience. Urology Journal.2011;8:271-6.
29. Rassweiler J, Rassweiler M-C, Frede T, Alken P. Extracorporeal shock wave lithotripsy: An opinion on its future. *Indian Journal of Urology : IJU : Journal of the Urological Society of India*. 2014;30(1):73-79.
30. Mohamed Ali Al Karawi, Abdel Rahman El-Sheikh Mohamed, Ketab Eid El-Etaibi, Mohamed Said Abomelha, Richard F. Seed. Extracorporeal shock-wave lithotripsy (ESWL)-induced erosions in upper gastrointestinal tract Prospective study in 40 patients.Urology.1987;3:224-27.
31. Kurtz, V., Muller-Sorg, M. & Federmann, G. Chirurg. Urology.1999; 70: 306-307
32. Alim Kosar,Kemal Sarica,Kagan Aydos,Sadettin Kupeli,Kadir Turkolmez and Orhan Gogus. Comparative Study of Long term recurrence after ESWL and Open Stone surgery.International Journal of Urology.1999;6:125-9
33. Chongruksut W, Lojanapiwat B, Tawichasri C, Paichitvichean S, Euathrongchit J, Ayudhya VC, Patumanond J.Kidney stones recurrence and regrowth after extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy. JOURNAL OF Medical Association Thailand. 2011 Sep; 94(9):1077-83.

TABLE 1: COMPARISION OF CLINICAL FEATURES:

COMPLAINS	PRESENT STUDY	FREDRIC L et al [14]
Pain in abdomen	66.7%	72.1%
Haematuria	86.7%	90.3%
Burning micturition	80%	78%

TABLE 2 : COMPARISION OF SENSITIVITY OF INVESTIGATION:

INVESTIGATION	PRESENTSTUDY	OTHER STUDIES
X-ray KUB	81.3 %	45% (Levine et al [17])
Ultrasound	95.3 %	6%(Carlo et al [18])91% (Haddad et al[19])
CT KUB/IVP	100 %	100% (Carlo et al [18]) 99% (Haddad et al[19]))

TABLE 3: COMPARISION OF SURGICAL MANAGEMENT:

INTERVENTION	PRESENT STUDY	EL-HUSSEINY et al [20]
Open pyelolithotomy	8.2%	
ESWL	26.2%	

PCNL	65.6%	

TABLE 4 : COMPLICATION OF OPEN SURGERY:

COMPLICATION	PRESENTSTUDY	KHALAF I. et al[24]	KHALED et al[25]
Infection	10%	3.2%	31.1%
Haemorrhage	10%	35%	37.8%
Organ Injury	0%	1.3%	-
Thoracic Injury	10%	1.9%	-
IVC injury	0%	0.2%	-
Perinephric Abscess	0%	0.4%	-

TABLE 5: COMPARISION OF COMPLICATION OF PCNL:

COMPLICATION	PRESENTSTUDY	SEITZ C. et al[26]	GREMMO et al[27]	SEYED et al[28]
HAEMORRHAGE	0%	7%	2.3%	0.9%
EMBOLISATION	0%	0.4%	-	-
URINOMA	5%	0.2%	-	-
FEVER	5%	10.8%	-	1%

TABLE 6 : COMPARISION OF COMPLICATION OF ESWL:

COMPLICATION	CSEN T STUDY	RASSWEILE R J et al[29]	MOHAME D ALI et al[30]	T al[31]
RENAL COLIC	12.8%	20.4%	-	
BACTERIURIA	3.33%	7.7%	-	
SEPSIS	0%	1.27%	-	
RENAL HEMATOMA	3.33%	19%	-	
CARDIOVASCULAR	0%	1.59%	-	
UPPER GITEROSIONS	-	-	80%	
ALL BOWELPERFORATION	-	-	-	%

TABLE 7 : COMPARISION OF RECURRENCE:

RECURRENCEAFTER	PRESENT STUDY	OTHER STUDIES
ONSERVATIVEMANAGEMENT	35.7%	-

OPEN SURGERY	10%	11%(Khalaf I et al[24]) 31.8%(ALIM et al [32])
PCNL	10%	.6 %(Chongruksut Wet al [33])
ESWL	12.5%	5.5%(Chongruksut Wet al [33]) 13.9% (ALIM et al[32])

FIGURE 6 : GRAPH SHOWING COMPARISION QUANTITY OF TYPE OF WATER INTAKE: