

TREATMENT OF RENAL STONES

Saeed Amir

*Department of Surgery,
Agency Headquarter Hospital,
Landikotal.*

ABSTRACT

Objective: To understand and update our knowledge about the evolution of renal stone treatment.

Material and Methods: A study of 50 consecutive cases of renal stones treated by open surgery in Surgical unit Agency Headquarter Hospital, Landikotal from Jan 2002 to Dec 2002 were included in the study.

Results: High success rates were achieved by open surgery in those patients who presented earlier and had good renal functions.

Conclusion: Open surgery still remains the choice of treatment especially for large renal calculi in terms of stone clearance and stone free period.

Key words: Renal Stones, open surgery, stone clearance, stone free period.

INTRODUCTION

Renal stones are one of the oldest entities known to mankind (eg. Egyptian mummies with renal stones). In terms of aetiology there are two types of stones, primary stones which are formed in the normal urinary tract while the pathology either lies somewhere else in the body or no obvious pathology can be detected in the body (stone former) and secondary stones which are formed due to some pathology in urinary tract like infection, obstruction, foreign body etc.

It has been found that in stone formers, there is defect in the side channels of distal tubules of kidney, which become leaky,

leading to plaque formation; hence the stone generation. Dietary manipulation is in accordance with new understanding of urolithiasis, according to which if crystalloids are decreased and colloids are increased in diet, the process of stone formation can be arrested. If oxalates are off balanced by increasing citrates in urine, not only stone formation can be prevented but the size of existing stone(s) can be diminished. Commonest stones are calcium oxalate (75%), while rest of the stones are magnesium-ammonium-phosphate, uric acid, cystein and xanthene.^{1,2,3}

Hindus of subcontinent were the first known lithotomists and they used the same incision at that time for renal stones extraction which is used now-a-days.^{4, 5}

Open surgery and irrigation therapy was the mainstay of treatment for renal stones till early seventies when ESWL was discovered by stroke of luck. The mechanism of stone fragmentation by ESWL is shown in Fig. 1.

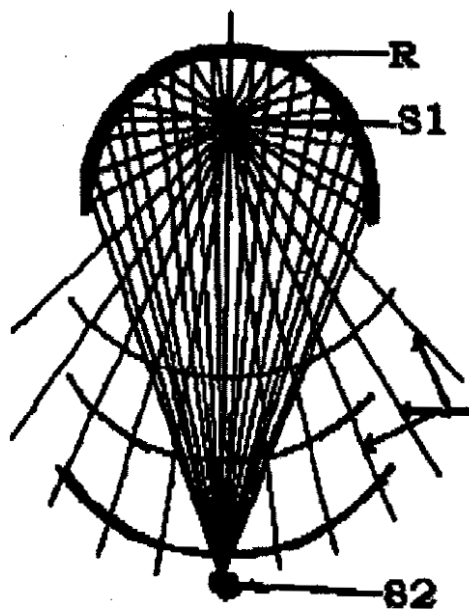


Fig. 1

Mechanism of ESWL. (Spark-gap system). Shock waves from source (S1) are reflected by reflector (R) and are focused on stone (S2).

In this method shock waves transfer kinetic energy to air /gas present inside stone leading to blast effects thus causing fragmentation of stone. Source of shockwaves could be spark-gap system (commonly used in Pakistan), a piezoelectric plate, or ultrasonic. Fragments are then washed down to the bladder.^{6, 7}

PCNL was introduced by Fernstrom I and Johansson B in 1976. In this method two or three cannulae are passed into the renal pelvis on to the stone under local or general anaesthesia. Through these cannulae stone

is either extracted or fragmented in situ. More so, through these channels solution can be introduced to dissolve the stone.^{8,9} (Fig. 2).

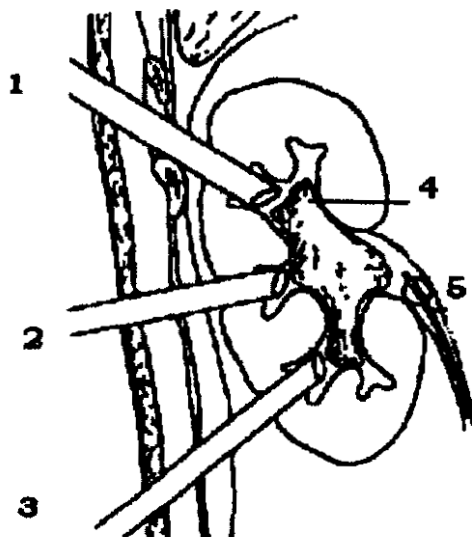


Fig.2

Percutaneous Nephrolithotripsy (PCNL)

Tubes 1, 2, 3 can be used for stone fragmentation, extraction or for sandwich therapy. 4 is stone and 5 is ureteric catheter.

Chemolysis is based on the fact that citrate replaces oxalate in stones making them softer and dissolvable. In this method of treatment certain solutions like Solution G or Solution R are directly delivered on to the stone which either dissolves or made soft enough to be fragmented by ESWL or PCNL.¹⁰

TUNL is another method of in situ fragmentation, by which stones are directly hit by passing a probe via ureter in to the renal pelvis. The probes used in TUNL and PCNL for stone fragmentation can be hydraulic, ultrasonic, or laser.¹¹

All four methods can be used as single or in combinations (sandwich therapy) which

depends upon whether the patient is standard or non-standard. A standard patient means that a patient should have good general health with normal functioning body systems with good bilateral renal function and in whom all four options for stone treatment can be applied (including open surgery). Non-standard patient is the one in whom due to some systemic disease / diseases only one or more options from ESWL, PCNL, TUNL, and Chemolysis can be applied excluding open surgery.^{12,13}

Open surgery remains the only treatment available to the majority of the population in this part of world although ESWL has become available here and there. It remains out of the reach of common man because of cost and non-availability in public sector. In fact open surgery is still the most effective form of treatment for larger stones. We in this study have compared results of open surgery with new modalities for renal stone treatment in patients with different stones burden.

MATERIAL AND METHODS

We treated 50 patients with different stone burden from Feb 2002 to Dec 2002 by open surgery. These patients were "standard patients". The diagnosis of renal stones was based on history, physical examinations and investigations. Commonest complaint was dull to acute pain with dysuria in lumbar region (table-1).

Physical examination was followed by plain x-ray (KUB) and urine R/E (table-2). To augment the diagnosis and assess the anatomy of kidney, sonography was also performed in all cases. IVU was performed on all patients to determine and classify the physiology of the kidneys. Depending upon the results of IVU 10 patients were subjected to DTPA scanning. DTPA results showed that three patients had non-functioning kidneys i-e < 10% renal function.

CLINICAL FEATURES AT PRESENTATION

Features	No. of patients	Percentage
Nausea/vomiting	1	2
Flank pain	50	100
Unilateral	45	
Bilateral	5	
Symptoms of UTI	40	80
Passage of fragments	5	10
Tenderness at renal angle	45	90
Recurrent stones	4	8
Hypertension	2	4
Bronchitis	1	2
Diabetes mellitus	2	4

TABLE-1

Other investigations related to renal pathophysiology included urine c/s (where it was required), Hb, blood, urea and serum creatinine were also done where required. Other body systems were evaluated according to age and relevance. Patients ranged between 12-50 years and male to female ratio was about 2:1 (Fig-3).

All 50 pts were subjected to surgery. Three patients were offered nephrectomies but only one agreed for that. Kidneys were approached through lumbotomy incisions

STONE BURDEN ON PLAIN X-RAY (KUB)

Burden	No. of patients	Percentage
Unilateral Stone	40	(80%)
Single	30	
Multiple	5	
Staghorn	5	
Bilateral	10	(20%)
Single	5	
Multiple	2	
Staghorn	3	

TABLE-2

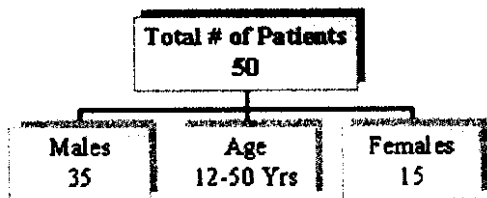


Fig. 3. Age and Sex Breakup.

and in some patients 12th rib resection was done (especially on the right side) to enhance the exposure. All kidneys were fully mobilized. Surgery on kidney itself was decided per-operatively except in one case where nephrectomy was decided pre-operatively. Surgeries included pyelolithotomies, pyelo-nephrolithotomies, nephrolithotomies (Boyce's procedure), extended pyelolithotomies, lower pole nephrectomies and pyeloplasties(V-Y, Culp and Anderson-Hynes)¹³ (table-3).

Perinephric drain was placed in all patients while stents were put in cases of pyeloplasties. Stents were removed on 5th day while drains were removed on 3rd to 7th day. Most of the patients were discharged from hospital on 5th to 7th day after surgery. On discharge from the hospital, patients were advised to take excessive amount of fluids, to increase intake of citrate containing foods and avoid certain foods which contain excessive oxalates.

SURGICAL PROCEDURES PERFORMED

Procedure	No. of patients
Pyelolithotomy	25
Pyelolithotomy & Pyeloplasty	5
Pyelolithotomy & Lower pole nephrectomy	4
Pyelo-nephrolithotomy	5
Nephrolithotomy	10
Nephrectomy	1
Total	50

TABLE-3

RESULTS

Most of the patients were cleared of renal stones by surgery except in four patients where small stones (<8mm) were missed during procedures, although main burden of stones was cleared from kidneys. Analysis of stones revealed 37 (74%) patients having calcium oxalate stones while 13(16%) patients had triple phosphate stones.

We believe that 17 patients had secondary stones i-e those patients who underwent pyeloplasties. Recurrent stones, and staghorn stones are formed either due to obstruction or infection. Rest of the stones were primary because no obvious aetiology of stone formation was found in 33 patients.

The patients were followed at one month, three months and six months. On each visit patients were examined physically, an x-ray KUB, U/S and urine R/E was done. Only 4 patients who had "missed" stones had repeated complaints of dysuria while rest of patients had no recurrence of stones. Pain on the side of surgery was the commonest complaint. It was noted that the patients who had gross hydronephrosis before surgery had a decrease in the hydronephrosis following surgery. After six months of surgery all patients had IVUs done, which showed normal functioning kidneys on operated side with some residual hydronephrotic changes.

DISCUSSION

Renal stones can present in variety of ways like renal colic/pain, with urinary tract infection, chronic dull pain in lumbar region(especially in cases of staghorn stones), acute/chronic renal failure(especially in solitary kidney) and even as hypertension.

Till early seventies open surgery and irrigation therapy (i-e Chemolysis) were the only treatments available but after that newer

methods to treat renal stones have been introduced to keep scalpel at bay. First one was ESWL and because of its non-invasiveness can be applied to standard as well as non-standard patients being very effective in smaller stones. For larger stones it is not only costly but there is increased incidence of undesirable complications like haematuria, arrhythmias, stone-street formation (steinstrasse) in ureter and very high recurrence rate due to retained fragments of stones. However the complication of stone-street formation has been overcome by passing ureteric catheter before procedure.^{15,16}

Here in our part of the world it remains out of the reach of common man because of high cost and non-availability in public sector. In staghorn stones there are chances of flare up of infection during process of fragmentation because they are infected stones.¹⁷

PCNL is an invasive procedure which can be performed both under local and general anaesthesia. Like any invasive procedure it is not without complications like injury to surrounding structures (during insertion of catheters), bleeding leading to abandoning of procedure, A-V fistula formation.¹⁸ It has certain advantages over ESWL because stones are dealt under direct vision so the success rate and results which are high as compared to ESWL, reach to that of open surgery in terms of stones clearance and stone free period.

Chemolysis like open surgery is the oldest form of treatment for renal stones which was revived by D.Holden et al in 1991, reporting results of up to 79% for stone dissolution at initial treatment. These results were not supported by any other study. This treatment could not gain popularity because of the high rate of complications like time consumed for dissolution, sepsis and hypermagnesia leading to death. It has been successful when applied in combination with ESWL and PCNL.^{16, 17, 18, 19} (Table-4).

STONE FREE RESULTS REPORTED AT THE TIME OF DISMISSAL OF PATIENTS

Author	ESWL	PCNL	Combination	Open surgery
Assimos DG (1991)	—	—	29%	90%
Percy JC (1993)	—	78%	—	—
Essen AA (1994)	32%	—	50%	80%
Joel MH (1995)	57%	77%	—	—

TABLE-4

As mentioned earlier these newer treatments can be applied in combination. Researchers have compared the combination therapy (i.e sandwich therapy) with open surgery. PCNL and combination therapy gives better results in keeping patients stone free. As reported when the stone burden increases the complications rate also increase with these new modalities. Although success rate after sandwich therapy is high as compared to the results when these modalities are used alone, the incidence of residual fragments is still high (10-40%).^{20,21,22,23} (Table-5)

Although open surgery which is still the commonest procedure applied world over has high success rate and better long time results in keeping patients stone free, yet it has its limitations like it can be applied only to standard patients, has to be performed under general anaesthesia with all potential complications. But as compared to PCNL which is also an invasive procedure it has low complications like injury to surrounding structures, bleeding etc.

Although there was a selection bias, yet our results show that there was no regrowth of stone in six months follow up period which correlate well with the international studies.

**STONE FREE RESULTS 3 MONTHS
FOLLOW UP**

Author	ESWL	PCNL	Combi- nation	Open surgery
C.R Chrig (1991)	82%	69%	—	—
Nicholas May (1988)	15%	62%	—	—
F.D Silvario (1990)	78%	—	81%	83%
Murray MJ (1995)	27%	—	—	—

TABLE-5

CONCLUSION

As is evident from tables 4, 5 the results of new modalities are not consistent as compared to open surgery therefore it can be concluded that "Although new modalities have been added to the armoury of surgeons to treat renal stones and patients now have more choice, still open surgery, followed by dietary manipulation, is a more favourable option in our part of world, keeping in view the socio-economic conditions".

REFERENCES

- Mandel M. Crystal membrane interaction in kidney stone disease. *J-Am-Soc-Nehrol* 1994; 5(5Suppl-1).
- Olivero. Case in point. *Hospital Practice* 1994; 118.
- Berland Y, Dussol B. New insight in renal stone formation. *Curr-Opin-Nephrol* 1994; 3(4):413-17.
- H.P.Winbury-White. Text book of Genito-Urinary Surgery (1948), 882-927, Livingstone.
- Mark M, Ravitch. A century of surgery (1980). Vol. 1, 2. J.B. Lippincot.
- Joseph WS. Surgical management of urinary calculi. Seminar in Nephrology 1990. Vol. 10, No.1, 53-63.
- T. Bruns J, Stein R.Tauber. Extracorporeal piezoelectric shock wave lithotripsy as mono and multiple thrapy for large renal calculi including staghorn stone in unanaesthetized patients under semi-ambulant condition. *Br.J.Urol* 1995. 75; 435-440.
- Fenstrom I, Johansson B, Percutaneous pyelolithotomy. *Scan. J Urol Nephrol* 1976; 10:257.
- Lam HS, Lineman JE, Russo R ,et al. Stone surface area determination technique. A unifying concept of staghorn stone burden assessment. *J.Urol.Nephrol* 1992; 148:1026.
- Suby HI, Albright F. Dissolution of phosphate calculi by retrograde introduction of a citrate containing magnesium. *N.England.J.Med* 1943; 228:81.
- Aso Y, Ohta N, Nakano M, et al. Treatment of staghorn calculi by fibroptic transurethral nephrolithotripsy. *J.Urol* 1990; 144: 17-19.
- Kenneth ES, Hower NW. Management of staghorn calculi, PCNL vs. ESWL. Seminar in Urology 1994; 12(1):15.
- JosephWS, Glen MP, Dean JA et al. Nephrolithiasis, clinical and guidelines, panel summery report on management of staghorn calculi. *J. Uroi* 1994; 151:1648.
- Boyce WH, Smith MJV. Anatrophic nephrolithotomy and plastic calyorrhaphy. *Tran-Am-Genito-Urinary Surgeons*1967; 59:18.
- Fedullo LM, Pollack HM, Banner MP et al. The development of stein-strasse after ESWL, frequency, natural history and radiological management. *A.J.R* 1988; 151:1145.
- Assimos DG, Boyce, Harrison, et al. The role open of surgery since ESWL. *J. Urol* 1989; 142:263.
- Percy JC. P.C.N.L for large and staghorn calculi. *J. Endourol* 1993; 7:293.
- Essen AA, Kirkali Z, Guler C. Open surgery. Is it still a preferable procedure in management of staghorn calculi? *Int-Urol-Nephrol* 1994; 26(3):247.

19. Joel MH, Teichman DL, Thon CH. Long term renal fate and prognosis after staghorn calculus management. *J.Urol.* 1995; 153:1403.
20. C.R Chrig, D.R Web, S.P Pyne, J.E.A Wikham. Comparison of treatment of renal calculi by open surgery, PCNL and ESWL. *Br.M.J* 1986; 292:879.
21. F.D Silvario, M.Galucci, G. Alpi. Staghorn calculi of kidney, classification and therapy. *Br.J.M* 1992; 65:449-452.
22. Nicholas M, Sabri Challah, Swatic Patel et al. Clinical comparison of ESWL and PCNL in treating in renal calculi. *B.M.J* 1988; 297:253.
23. Murray MJ, Chandhoka PS, Berman CJ, Sankey NE. Outcome of ESWL monotherapy for large renal calculi, effect of stone and collecting system, surface area and cost effectiveness of treatment. *J-Endo-Urol* 1995; 9(1): 9.

Address for Correspondence:

Dr. Saeed Amir,
Department of Surgery,
Agency Headquarters Hospital,
Landikotal.