RADIOLOGICAL INVESTIGATIONS, BIOCHEMICAL RENAL FUNCTION TESTS AND THE CHANGES AFTER SURGERY IN RENAL CALCULUS OBSTRUCTIVE UROPATHY

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ABSTRACT

Urolithiasis has affected the mankind for long years. These stones cause progressive renal impairment. These patients usually present with characteristic loin pain, vomiting, and sometimes fever. Patients may also be asymptomatic at times. Urinary stones can be classified on the basis of their size, location, X-ray characteristics, aetiology, composition (Mineralogy) and risk groups for recurrent stone formation.

AIMS AND OBJECTIVES

To evaluate the Preoperative and postoperative radiological and biochemical changes in renal calculus obstructive uropathy in patients with cortical thickness of minimum 4mm.

MATERIAL AND METHODS

All patients who were admitted in Department of Surgery, Rama Medical College Hospital and Research Centre, Kanpur, UP with diagnosis of obstructive uropathy due to stone disease and operated upon were included in this study.

RESULTS

After 1 month and 3 months the relief in obstruction was studied by repeating the tests. It was found that urea, creatinine levels took about 3 months to get normalized. USG and IVP at 3 months showed complete normalization of hydronephrosis, however, at one month few cases still had hydronephrosis.

CONCLUSION

Urea, creatinine levels along with USG and IVP form the basis of detection and management of obstructive uropathy. CT scan has a definitive role in few cases where urea creatinine levels are on higher side. Renal scan is mandatory in the cases of delayed/non-functioning on IVP. Nephrectomy should not be done without assessment of renal function (%) on renal scan. After definitive management of relief of obstruction by various methods, it takes about three months for normalization of kidney function.

KEYWORDS

Urea, Creatinine, Ultrasonography, Intravenous Pyelography, Renal Scan, Renal Stone.

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INTRODUCTION

Urolithiasis is a major problem worldwide and can cause progressive renal impairment. These patients are either asymptomatic or may present with characteristic loin pain, vomiting, and sometimes fever. Urinary stones can be classified on the basis of their size, location, X-ray characteristics, aetiology, composition (Mineralogy) and risk groups for recurrent stone formation.[1] Ultrasonography is used as primary modality in diagnosing this disease. A renal contrast study (Enhanced CT or Intravenous Urography) is indicated while planning treatment for a renal stone in addition to assess the function of the affected kidney.[1-3]

Biochemical investigations like urea, electrolytes and creatinine are used to assess the renal functions whereas whole blood examination and midstream urine microscopic culture and sensitivity are used to diagnose sepsis.[4]

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Gamma-camera renography using I-hippuran or 99mTc-DTPA objectively analyses the accumulation, transit and elimination of injected activity by each kidney to produce the well-known time-activity curves. The simple and non-invasive nature of the procedure has an added advantage and is used widely now-a-days.[5] It is emphasized that stone analysis should be performed in all first-time stone formers.[6] Nonsteroidal Antiinflammatory Drugs (NSAIDs) are the drug of choice in cases of renal colic.[7-8]

Urgent decompression of the system is necessary to prevent further complications in infected hydronephrosis either by placement of an indwelling ureteral catheter under anaesthesia or percutaneous placement of a nephrostomy catheter.[8,9] The definitive treatment of the stone should be delayed until sepsis is resolved, which includes endourology techniques like Percutaneous Nephrolitholapaxy (PCNL), Ureterorenoscopy (URS), open and laparoscopic surgery, Extracorporeal Shock Wave Lithotripsy (ESWL).[10-12] In our study we plan to evaluate the radiological and biochemical improvement in the renal function of patients who have undergone surgery for renal stones causing obstruction.

MATERIAL AND METHODS

This study was done in 40 cases who were admitted in Department of Surgery with obstructive uropathy due to renal

and ureteric calculus in Rama Medical College Hospital and Research Centre, Kanpur, UP. As per proforma, patient's history, clinical examination, investigations and treatment was recorded with special emphasis upon the radiological and biochemical renal function status in per and post-operative periods.

All patients with diagnosis of obstructive uropathy due to stone disease were included and operated upon in this study whereas patients below 10 years and above 70 years, severely moribund patient, Septicemic patients, chronic renal failure and patients with known severe cardiac conditions were excluded from this study. Patients undergoing only decompression like PCN or stenting without definitive procedure were also excluded from this study. At the time of admission detailed history with signs and symptoms of all the patients were noted down and every patient was investigated for complete blood tests, blood urea, creatinine, calcium, microscopy and urine culture. Ultrasonography of abdomen, X-rays KUB and IVP were done. CT scan of the abdomen and renal scan was done in few cases only and postoperative improvement was assessed by similar biochemical investigations and ultrasonography done after 1 month, 2-month and 3-month interval. IVP was performed after 3 months in every case during the follow-up.

RESULTS

It is observed that urinary calculi is most commonly seen in age groups between 31-40 years; 13 (32.5%) followed by 51-60 years; 10 (25%), 21-30 years; 07 (17.5%) & 41-50 years; 5 (12.5%). (Table 1). Majority of patients in present study were admitted with the chief complaints of pain (100%) vomiting (37.5%) burning micturition (25%) and fever (20%). (Table 2) Out of 40 patients 15 (37.5%) had urea >40mg/dl Whereas 19 (47.5%) had creatinine >1.4mg/dl in pre-operative period. (Table 3). This was followed by urea >40mg/dl in 15(37.5%) patients whereas 16 (40%) had creatinine>1.4mg/dl in post-Operative period after 1 month. (Table 4) Furthermore 7 (17.5%) patients had urea >40mg/dl and 11 (27.5%) patients had creatinine >1.4mg/dl after 3 months of treatment. Finally it was observed that 33(82.5%) patients had normal urea levels as compared to 25 (62.5%)pre-operatively, similarly 29 (72.5%) patients had normal creatinine levels as compared to 21 (52.5%) pre-operatively (Table 5). P value pre and post-operative urea levels (3 month).

Urea pre: 36.09±9.41

Urea post: 34.66±9.78

P value: 0.021

Which was not significant

P value pre and post-operative creatinine levels (3 month).

Creatinine pre: 1.12±.51

Creatinine post: 1.11±.41

P value: 0.589

Which was not significant

P value for pre and post-operative urea level at 3 month was P-0.021 (Not significant).

P value for pre and post-operative creatinine level at 3 month was P-0.589 (not significant).

On the basis of ultrasonography, 33 (82.5%) patients had hydronephrosis pre-operatively and 4 (10%) were having non obstructive calculus but these cases had hydronephrosis on IVP and thus were included in the study and after 1 month of treatment, 11 (27.5%) patients had residual hydronephrosis whereas 21 (52.5%) had normal kidneys. The number of normal kidneys increased to 32 (80%) after 3 months with only 4 (10%) cases having residual hydronephrosis.

IVP findings in Pre-Operative period suggested 22 (55%) patients had hydronephrosis of right side, 10 (25%) hydronephrosis on left side and 5 (12.5%) patients had bilateral hydronephrosis; 2 (5%) patients were without hydronephrosis; however, these patients had hydronephrosis on USG and they were also selected for the study. (Table 6) and these figures were reduced to 3 (7.5%) patients with residual hydronephrosis on left side and 1 (2.5%) on right side; 32 (80%) had normal kidneys as compared to only 2 cases (5%) in pre-operative period (Table 7). Out of all these cases, right pyelolithotomy was done in 22 (55%) cases, left pyelolithotomy in 9 (22.5%), right ureterolithotomy 3 (7.5%), left ureterolithotomy 1 (2.5%), right nephrolithotomy 3 (7.5%), whereas stones passed after hydrotherapy in 2 (5%) (Medical expense therapy) and D. J. Stenting was done along with other procedures in 28 (70%).

DISCUSSION

Urinary stones appear in 0.1-0.5% of world population with relapse rate of about 80%. Most of kidney stones appear between the age of 20 to 40 years and they may be solitary or multiple with 40% of patients having them bilaterally.[13-16] In our study we found 28 (70%) male and 12 (30%) female patients and majority of these were between 20 to 40 years. Stone formation is usually a result of urinary super saturation and any variation in urine saturation grade, urine pH and the concentration of crystallization inhibitors can lead to urolithiasis.[17,18] Clinical manifestations of urinary calculi are an episode of renal-ureteral colic or gross haematuria, sudden lumbar pain which may be accompanied by nausea and vomiting.[19] Obstructive uropathy refers to the structural impedance to the flow of urine anywhere along the urinary tract leading to ′hydronephrosis and if treated early, it is a potentially curable form of kidney disease.[20,21] Menon (1998) stated that a urinary calculus "Announces" its presence with an acute episode of renal or ureteric colic and urolithiasis create symptoms only when they become trapped in some segment of urinary tract.[22]

In our study it was found that pain i.e. renal, ureteric colic was the commonest complaint 40 (100%) patients, vomiting 15 (37.5%) patients, burning micturition 10 (25%) and fever 8 (20%) patients. The hematocrit is important to assess for anaemia related to chronic renal insufficiency and the WBC count suggests the possible inflammation or infection secondary to obstruction or neoplasm as a cause of the obstruction.[23,24] Urea and creatinine levels are one of the most important predictor of renal change. M Hussain et al. (2012) found grossly deranged blood urea and creatinine levels at the time of admission in his study of 293 patients.

However, on post-operative evaluation, recovery was seen in 183 patients with urine volume of more than 2-8 liters/24 hours followed by 79 (33.2%) with urine output of 1-2 liters while 38 (15.8%) produced volume of less than 1 liter 16. In our study, 14 (35%) patients had pre-operative urea level >40mg/dl and 17 (42.5%) patients had creatinine level >1.4mg/dl and post operatively, after 3 months, it was seen that only 7 (17.5%) patients had post-operative urea level >40mg/dl and only 11 (27.5%) had post-operative creatinine level >1.4mg/dl. Ultrasonography has become one of the most

important tools for assessing urinary tract obstruction because it is rapid, cost effective, safe, sensitive and is the diagnostic modality of choice in pregnancy.[17,25]

Use of duplex Doppler ultrasonography allows determination of the renal resistive index (RI), [peak systolic velocity- lowest diastolic velocity]/peak systolic velocity. An RI in the obstructed kidney that is 0.1 greater than the contralateral kidney is considered significant enough to indicate obstruction.[24,26] However, Heidenreich A (2002) in their study suggested that both plain X-ray KUB and Ultrasound should be performed in patients with suspected stone disease for identifying stone disease and also to exclude other pathology which may produce similar urinary symptoms.[2,18] In our study, USG was done pre-operatively as well as post operatively after 3 months and it was found that residual hydronephrosis was present only in 4 (10%) cases whereas 32 (80%) cases had normal functioning kidney and 4 (10%) cases had gross hydronephrosis with no improvement in the renal function and thus were subjected to nephrectomy.

Intravenous Urogram (IVU) has been the gold standard for the detection of ureteral obstruction. The significant difference in IVU compared with ultrasonography is that the IVU shows both increased anatomic detail and functional attributes of the urinary system.[20] However, in view of nephrotoxicity of the contrast material, the usefulness of the test for patients already suspected of having obstructive nephropathy is questionable.[25] In our study, IVP done after 3 months of treatment showed residual hydronephrosis on right side only in 1 (2.5%) case and on left side in 3 (7.5%) cases; 32 (80%) cases had no hydronephrosis and 4 (10%) cases were subjected to nephrectomy. CT scan equals the accuracy of the IVP in determining the presence of obstruction, but surpasses the IVP in terms of detecting the specific cause of the obstruction.[1,16]

In our study, CT scan was done in three patients as the urea creatinine were more >2mg/dl and in these patients IVP was not possible. MRI gives no added advantage over CT scan and it does not visualise the stones.[26,27] Renal scan and diuretic renography are the most reliable techniques to quantitatively assess the split and total renal function in the presence of hydronephrosis. Moreover, a functional obstruction can also be differentiated from an anatomic cause.[28,29] In our study, three cases which were non-functioning on IVP were subjected to renal scan. Dalrymple et al. (1998) used Unenhanced Computerized Tomography (CT) for the management of acute flank pain and found 95% sensitivity, 98% specificity and 97% accuracy in ureteric stones.[30,31]

Finlayson and Ackerman (1989) have compared the three modalities of treatment for urinary calculi. According to them, the decision strategy depends on equipments, type of stones, needs of patients and skill of surgeon. In their series 87% of patients were treated with ESWL while open surgery was required in 4% patients.[32] In our study, right pyelolithotomy was done in 22 (55%) cases, left pyelolithotomy in 9 (22.5%), right ureterolithotomy 3 (7.5%),left ureterolithotomy 1 (2.5%), right nephrolithotomy 3 (7.5%), whereas stones passed after hydrotherapy in 2 (5%) (Medical expense therapy) and D. J. Stenting was done along with other procedures in 28 (70%). It is reported in the literature that there is return of renal function when the kidney was salvaged if cortical thickness was adequate, even though pre-operative renography depicted poor renal function.[33,15] Today, the emphasis is on saving as much of the functioning renal tissue as is possible.

CONCLUSION

Urea, creatinine levels along with USG and IVP form the basis of detection and management of obstructive uropathy. CT scan has a definitive role in few cases where urea creatinine levels are on higher side. Renal scan is mandatory in the cases of delayed/non-functioning on IVP. Nephrectomy should not be done without assessment of renal function (%) on renal scan. After definitive management of relief of obstruction by various methods, it takes about three months for normalization of kidney function. Main objective of the surgeon should be to preserve the kidney function and nephrectomy should be done as a last resort when all other methods to salvage the kidney function are used.

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Sl. No.	AGE	MALE	FEMALE	TOTAL
1	<20 yr.	1 (2.5%)	0 (0%)	01 (2.5%)
2	21-30 yr.	6 (15%)	1 (2.5%)	07 (17.5%)
3	31-40 yr.	8 (20%)	5 (12.5%)	13 (32.5%)
4	41-50 yr.	4 (10%)	1 (2.5%)	05 (12.5%)
5	51-60 yr.	5 (12.5%)	5 (12.5%)	10 (25%)
6	>60 yr.	4 (10%)	0 (0%)	04 (10%)
TOTAL		**28 (70%)**	**12 (30%)**	**40 (100%)**

Table 1: Age and Sex wise Distribution of cases

Sl. No.	AGE	PAIN	FEVER	VOMITING	B. MICTURITION	TOTAL
1	<20 yr.	01 (0.4%)	00 (0%)	00 (0%)	01 (2.5%)	02 (5%)
2	21-30	07 (2.8%)	02 (5%)	02 (5%)	01 (2.5%)	12 (30%)
3	31-40	12 (30%)	01 (2.5%)	07 (17.5%)	03 (7.5%)	23 (57.5%)
4	41-50	05 (12.5%)	00 (0%)	00 (0%)	01 (2.5%)	06 (15%)
5	51-60	11 (27.5%)	02 (5%)	04 (10%)	04 (10%)	21 (52.5%)
6	>60 yr.	04 (10%)	03 (7.5%)	02 (5%)	00 (0%)	09 (22.5%)
TOTAL		**40 (100%)**	**08 (20%)**	**15 (37.5%)**	**10 (25%)**	**73**

Table 2: Age wise Distribution of Cases according To Chief Complaints

Sl. No	AGE	UREA		CREATININE	
		<40mg/ dl	>40mg/ dl	<1.4mg/dl	>1.4mg/ dl
1	<20 yr.	1 (2.5%)	0 (0%)	1 (2.5)	0 (0%)
2	21-30 yr.	6 (15%)	1 (2.5%)	4 (10%)	3 (7.5%)
3	31-40 yr.	6 (15%)	7 (17.5%)	6 (15%)	7 (17.5%)
4	41-50 yr.	3 (7.5%)	2 (5%)	2 (5%)	3 (7.5%)
5	51-60 yr.	6 (15%)	4 (10%)	6 (15%)	4 (10%)
6	>60 yr.	3 (7.5%)	1 (2.5%)	2 (5%)	2 (5%)
TOTAL		**25 (62.5%)**	**15 (37.5%)**	**21 (52.5%)**	**19 (47.5%)**

Table 3: Age wise Distribution of Pre–Operative Urea Creatinine levels

Sl. No.	AGE	UREA		CREATI NINE	
		<40mg/ dl	>40mg/ dl	<1.4mg/ dl	>1.4mg/dl
1	<20 yr.	1 (2.5%)	0 (0%)	1 (2.5%)	0 (0%)
2	21-30 yr.	4 (10%)	3 (7.5%)	2 (5%)	5 (12.5%)
3	31-40 yr.	8 (20%)	5 (12.5%)	6 (15%)	7 (17.5%)
4	41-50 yr.	3 (7.5%)	2 (5%)	3 (7.5%)	2 (5%)
5	51-60 yr.	6 (15%)	4 (10%)	8 (20%)	2 (5%)
6	>60 yr.	3 (7.5%)	1 (2.5%)	4 (10%)	0 (0%)
TOTAL		**25 (62.5)**	**15 (37.5%)**	**24 (60%)**	**16 (40%)**

Table 4: Age wise Distribution of Post-Operative Urea, Creatinine levels After 1 Month

Sl. No.	AGE	UREA		CREATININE	
		<40mg/ dl	>40mg/ dl	<1.4mg/dl	>1.4mg/dl
1	<20 yr.	01 (2.5%)	00 (0%)	01 (2.5%)	00 (0%)
2	21-30 yr.	06 (15%)	01 (2.5%)	05 (12.5%)	02 (5%)
3	31-40 yr.	12 (30%)	01 (2.5%)	08 (20%)	05 (12.5%)
4	41-50 yr.	03 (7.5%)	02 (5%)	04 (10%)	01 (2.5%)
5	51-60 yr.	08 (20%)	02 (5%)	08 (20%)	02 (5%)
6	>60 yr.	03 (7.5%)	01 (2.5%)	03 (7.5%)	01 (2.5%)
TOTAL		**33 (82.5%)**	**07 (17.5%)**	**29 (72.5%)**	**11 (27.5%)**

Table 5: Age wise Distribution of Post-Operative Urea, Creatinine levels After 3 Months

Sl. No.	SEX	HDN			NORMAL
		B/L	RT	LT	
1	<20yr	0 (0%)	0 (0%)	1 (2.5%)	0 (0%)
2	21-30	2 (5%)	4 (10%)	1 (2.5%)	0 (0%)
3	31-40	1 (2.5%)	8 (20%)	4 (10%)	0 (0%)
4	41-50	0 (0%)	5 (12.5%)	0 (0%)	0 (0%)
5	51-60	1 (2.5%)	4 (10%)	3 (7.5%)	2 (5%)
6	>60yr	1 (2.5%)	1 (2.5%)	1 (2.5%)	0
TOTAL		**5 (12.5%)**	**22 (55%)**	**10 (25%)**	**2 (5%)**

Table 6: Age wise Distribution of Cases Showing Pre-Operative IVP Findings

Sl. No.	AGE	HDN			NORMAL
		B/L	RT	LT	
1	<20yr	0 (0%)	0 (0%)	0 (0%)	01 (2.5%)
2	21-30	0 (0%)	0 (0%)	1 (2.5%)	04 (10%)
3	31-40	0 (0%)	1 (2.5%)	0 (0%)	11 (27.5%)
4	41-50	0 (0%)	0 (0%)	0 (0%)	05 (12.5%)
5	51-60	0 (0%)	0 (0%)	1 (2.5%)	08 (20%)
6	>60yr	0 (0%)	0 (0%)	1 (2.5%)	03 (7.5%)
TOTAL		**0 (0%)**	**1 (2.5%)**	**3 (7.5%)**	**32 (80%)**

Table 7: Age wise Distribution of Cases showing Post-Operative IVP Findings after 3 Month