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STUDY OF PELVI-URETERIC JUNCTION OBSTRUCTION WITH SPECIAL REFERENCE TO HISTOPATHOLOGY

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ABSTRACT

Introduction: What can be expected from clinical and pathological stand point in a child or an adult who has hydronephrosis due to obstruction or dysfunction at pelvi-ureteric junction was a question and study started in 1935 providing some interesting information regarding the question. Our aim of the present study is to find out what is the primary cause of this effect and whether its early detection can reverse the kidney back to normalcy, if not, prevent the kidney from further damage by institution of suitable surgery and to minimise the complications of surgery. **Materials and methods:** Total 77 cases are entered into the present series. Study includes 20 cases attending during this tenure and 57 cases were reviewed which were carried out in the past. Selection of the cases were done from the patients attending surgical outdoor to the present unit and referred to this unit directly. Contribution from some of the units was acquired specially for reviewing the histopathology and clinical history of the past. The cases after investigations were subjected to surgery. Depending upon the extent of damage some patients were operated as semiemergencies and some were operated as elective.Type of operation selected to relive obstruction were Anderson Hynes pelviuretroplasty and Foley's V-Y pyeloplasty. **Results:** Results were analysed in view of age, sex, presentation features, size of hydronephrosis, findings of intravenouspyelogram, kidney function test, etiology, histopathology and complications. **Conclusion:** The result of early instituion of surgery are rewarding, and recommended in every case.

KEY WORDS: pelvi-ureteric junction, histopathology, hydronephrosis, intravenouspyelogram.

INTRODUCTION

What can be expected from clinical and pathological stand point in a child or an adult who has hydronephrosis due to obstruction or dysfunction at pelvi-ureteric junction was a question and study started in 1935 providing some interesting information regarding the question. Diverse clinical manifestations of periureteric obstruction in children notably simulating gastrointestinal disorder frequently obscure the diagnosis for long periods.[1,3]

Older tendency towards conservative surgery in the treatment of hydronephrosis aroused new interest in problem of defining the primary cause of the idiopathic or congenital type of this disease. Early exploration for this condition started in 1958 and is now a common practice and provided an opportunity for the study of pelvi-ureteric junction before stasis and infection have rendered the renal pelvis inert and before the cause and the effect of pelvic dilatation are largely confused. Such opportunity prompted the study of pelvi- ureteric junction in greater detail.[5,7]

The paucity of information obtained from conventional pathological study was disappointing. Therefore, we embarked on the study of pelvi-ureteric junction with a hope that better understanding would lead to clarification of the indications of different relief operations. Specially when majority of pelvi-ureteric junction fail to show gross evidence of mechanical obstruction.[9]

Though there is a controversy about true etiology and appropriate operation for hydronephrosis due to pelvi-ureteric junction obstruction, it can present in patient of any age in any stage from early case with excellent underlying renal function to the late case with non function of the kidney.

Our aim of the present study is to find out what is the primary cause of this effect and whether its early detection can reverse the kidney back to normalcy, if not,

prevent the kidney from further damage by institution of suitable surgery and to minimise the complications of surgery by few modifications from the guide under the limited facilities available at this teaching institute.Another aspect of the work is to study its important implications in pediatric urology as there are increasing number of antenataly diagnosed hydronephrosis.[13,16] These patients will need regular review and investigations in order to identify those who may be at risk of loosing functional renal parenchyma even in the absence of radiological obstruction at presentation.

MATERIAL AND METHODS

Total 77 cases are entered into the present series. Study includes 20 cases attending during this tenure and 57 cases were reviewed which were carried out in the past. Selection of the cases were done from the patients attending surgical outdoor to the present unit and referred to this unit directly. Contribution from some of the units was acquired specially for reviewing the histopathology and clinical history of the past.The patients who had other associated pathology contributing to hydronephrosis like.

a. Stones
b. Vesicoureteric reflux
c. Retroperitoneal tumor and fibrosis, have been excluded from the study.

Investigations to which the patients were subjected

a. Routine Haemogram: Hb, TLC, DLC
b. Kidney function test
c. X-ray KUB
d. Ultrasonography
e. Intravenouspyelography
f. C.T.Scan
g. Retrograde Pyelography
h. Micturating cystourethrography
i. Urine routine and culture sensitivity
j. Histopathology of the excised pelvi-ureteric junction and redundant pelvis.

Treatment: Surgical:-
Reparative- Pyeloplasty
Ablative- Nephrectomy
Palliative- Nephrostomy, Pyelostomy.
Anesthesia used whether
a. General
b. Spinal

Incision employed and intraoperative findings like
State of pelvi-ureteric junction
Adhesions
Fibrous bands
Kinks
Angulations
Aberrent renal vessel
Mucosal folds
Papilloma
No demonstrable pathology were noted.
In the postoperative period recovery was uneventful or not was noted.
Immediate - Haematuria/Blockade of stent
Late - Infection/Nonfunctioning of stoma/Rupture were noted and treated.

Follow up

In the follow up special attention was given to symptomatology
a. Pain
b. Lump
c. History of recurrent Urinary tract infection.

In the patient presenting with recurrent pain or infection or with lump immediate Ultrasound and intravenouspyelography was done. Routinely intravenouspyelography was done three months after operation. Urine culture and sensitivity was done every 3 monthly and infection if any was treated accordingly.

Special attention was given to those facts on history which were anticipated to solve the problem of etiology of pelvi-ureteric junction obstruction.Ultrasound was the first investigation after routine investigations. It was followed by intravenouspyelography. The cases after investigations were subjected to surgery. Depending upon the extent of damage some patients were operated as semiemergencies and some were operated as elective.
Type of operation selected to relive obstruction were Anderson Hynes pelviuretroplasty and Foley's V-Y pyeloplasty

Adopted Technique in the preset series

There are few modifications and it deviates from the standard given by Ravitch M. based on work of Whitaker R.H. and originally described by Anderson Hynes in the following aspects:-

a. Excreting units of the kidney which have suffered considerable damage depending upon the duration of obstruction may be damaged further by putting a nephrostomy drain. Hence in order to protect the available functioning nephrons trauma was avoided by not keeping a nephrostomy drain. The purpose for which nephrostomy drain is left was taken care of by putting a fine PVC canula in continuation with ureteric stent No.8 in adults and No.6 in pediatric age group having holes on the side of the pelvis as well on the side of the ureter. Ideal stent would be silicon coated PVC where tissue reaction is nil. Since we could not get the material, ordinary Infant feeding tube was used. It was taken out of the pelvis from the upper most non dependent part.

b. Anastomosis was done with 000 chromic catgut, mucosa to mucosa. It avoids granuloma formulation.

c. Blood was not allowed to collect at the site of anastomosis during operation by repeated saline washes or inside the pelvis. Tip of the suction was not allowed to

touch any part of the mucus membrane of the pelvis. Handling, traction, holding of the pelvis and the ureter was minimally done with fine maclndoe forceps that too from serosal aspect. Accumulation of blood leads to deposition of fibroblast and extensive scarring. Anastomotic leak is expected for 28 to 48 hours and hence perinephric drain was kept.

d. External oblique, internal oblique and the transverses abdominis muscles were closed with chromic catgut with interrupted sutures.

e. Subcutaneous tissue was sutured with 00 chromic or 0 plain catgut.Skin was approximated with 0 or 00 sutupack with horizontal matress sutures.

Specimen excised was sent for histopathological examination. Findings of histopathological examination of the pelvis, the ureter and pelvi-ureteric junction was noted after studying the gross.

- Epithelium
  - Atrophic
  - Heaping
  - Normal
  - Abscent
- Muscles
  - Absent
  - Hypoplastic
  - Hyperplastic
  - Normal
- Nerve endings and ganglion cells
- Inflammatory cells
  - Acute
  - Chronic
- Collagen tissue

Correlation of examination findings on gross and on operation table was done with histopathology and the possible etiology for this pathology was explored.

RESULTS

Total 30 specimen of the excised pelvi- ureteric junction were available for histopathological examination.

[Table No.1] Showing age wise distribution of patients in present series

Sr. No.	Age Group in years	No. of patients out of 77	Percentage
1.	0-2	4	5.19
2.	2-20	35	45.45
3.	20 - 30	28	36.36
4.	30 or more	10	12.98

Out of all the patients entering in the series youngest patient was 18 months old and majority of patients were in the age group of 2 to 20 years. However, oldest patient was of the age of 45 years who had nephrogram signifying still functioning kidney on intravenouspyelography.

[Table No.02] Showing sex distribution of the patients in the present series

Sr. No.	Sex	No. of patients out of 77	Percentage
1.	Male	48	62.30
2.	Female	29	37.70

[Table No.03] Showing side predilection of kidney affected

Sr. No.	Side affected	No. of patients out of 77	Percentage
1.	Left	39	50.70
2.	Right	23	29.80
3.	Bilateral	15	19.50

Present work has shown from the above mentioned table that left side is more vulnerable to develop pathology, however, this condition always has a tendency to have bilaterality. The observation in initial phase is unilateral i.e. left and subsequently right may also be involved but it may require time. Therefore calling the condition as a potentially bilateral. Fully manifested cases of bilateral presentation in the ongoing series is 19.5% (15 cases).

[Table No.04] Showing presentation according to their incidence in the present series

Sr. No	Presentation	No. of patients out of 77	Percentage
1.	Loin/Groin pain	39	50.60
2.	History of U.T.I.	30	38.00
3.	Loin lump	12	15.50
4.	Haematuria	8	10.30
5.	Hypertension	1	1.29
6.	Enuresis	0	0.00
7.	Failure to thrive	0	0.00
8.	Accidental finding	0	0.00

Commonest symptom for which the patient presented in these series was pain which was further investigated. Symptoms of urinary tract infection were next common. Hypertension is a very rare event and in the present series it is seen in only one patient.

Findings recorded in this study on ultrasound are noted below

[Table No.05] Showing number of cases of intrarenal and extrarenal pelvis

Sr. No.	Type of Pelvis	No. of Cases out of 50	Percentage
1.	Extrarenal	49	98
2.	Intrarenal	1	02

[Table No.06] Showing approx. Size of hydronephrosis in this Series

Sr. No.	Approximate Size	No. of cases out of 55	Percentage
1.	Mild	10	20
2.	Moderate	30	60
3.	Severe	10	20

The mild, moderate and severe were the grades awarded by Ultra-sonologist and the criteria for deciding this was arbitrary.

[Table No.07] Showing findings of IVP in the present series

Sr. No.	Function	No. of cases out of 77	Percentage
1.	Functioning Kidney	67	87.1
2.	Non-functioning Kidney	10	12.9

In majority of the cases pelvis was moderate to hugely dilated. The ureter was not seen in any of the case. The calices were clubbed replacing its usual cup shape.

[Table No.08] Showing findings of kidney function test in the present series

Sr. No	Kidney Function Test	No. of cases out of 77	Percentage
1.	Normal	76	98.71
2.	Abnormal	1	1.29

[Table No.09] Showing different etiological factors noted in the present series

Sr. No.	Etiological factor	No. of patients out of 77	Percentage
1.	Local loss of peristalsis with narrowing and Elongation	68	88.00
2.	High insertion of ureter	7	9.09
3.	Mucosal flaps across	7	9.09
	interior of P.U.J.		
4.	Aberrent vessel	5	6.40
5.	Fibrous bands	5	6.40
6.	Kinks (ureteral folds)	3	3.80
7.	Stenosis	1	1.29
8.	Papilloma	1	1.29

One of the important observation we anticipated was loss of peristalsis and was seen in majority of the patients i.e. 68 (88%). In addition to this observation the segment was seen to be elongated and narrowed. A segment below has normal caliber of the ureter with peristalsis which could be very easily described.

[Table No.10] Showing various elements studied on histopathology

Sr. No.	Element	Abnormality	No. of cases	Percentage
1.	Epithelium	Atrophy Heaping Normal Normal Absent	0 0 28 2	0.00 0 .00 93.33 6.67
2.	Muscle	Absent Paucity Hypertrophy Normal	2 21 3 4	6.67 70.00 10.00 13.33
3.	Nerve endings	Present Absent	30 0	100.00 0.00
4.	Ganglion cells	Not seen	30	100.00
5.	Inflammatory Cells	Acute Chronic	4 14	13.33 46.67
6.	Collagen tissue	Normal Abundant Paucity	30 0 0	100.00 0.00 0.00

[Table No.11] Showing complications noted in the present series

Sr. No.	Complication	No. of patients of 77	Percentage
1.	Wound infection	8	10.30
2.	Leakage	1	1.29
3.	Hypertension	1	1.29
4.	Hospital death	0	0.00
5.	Urinomas	0	0.00
6.	Failure of pyeloplasties	0	0.00
7.	Stones	0	0.00

The most frequent complication noted in this series was wound infection. It occurred in 8 patients (10.3%). This infection was mild, in the form of localised collection of seroma in some and in some it was stitch abscess. They were dressed and patients were fit to go home after short stay of 4 days. It did not require heavy antibiotic systemically. Leakage occurred in one patient after the removal of stent on 7th day. It continued for 48 hours and little more and stopped without formation of any urinoma attaching little or no significance. Hypertension in one patient was noted (1.29%). This one patient was hypertensive preoperatively and continued to have it in post operative period even after relieving obstruction. This patient had solitary kidney. The kidney biopsy at the time of operation was avoided with the hope that blood pressure may respond after release of obstruction. This patient was put on medical treatment for hypertension and responded to it.

Follow up of the patients was done with ultra sound, intravenouspyelography and kidney function test. Follow up of the patients reviewed from hospital data was not available except one case who came for follow up 8 years after surgery. In this patient intravenouspyelography revealed same preoperative changes. There was no improvement in function and caliceal appearances. Kidney function of a patient who had solitary kidney returned to normal after surgery though intravenouspyelography picture revealed same changes.

DISCUSSION

Age- The percentage of presentation below the age group 2 yrs. is considerably low i.e. from 11% of Kelalis[11] and to 30% of Uson[19], whereas present series has only 5% of the cases. Large number of the cases (30%) by Uson[26] is reported because the study was carried out in large pediatric urology hospital in New York where referal is much more.

William[15] and Karlatis have reported 26 infants suffering from hydronephrosis of the age less than 6 months. It is worth commenting here that for detection of pathology in child, modern equipment is very important which directly influences the age incidence.

As commented by Whitfield et al[17] Diuretic Radionuclide urography may diagnose early(subclinical) cases. Furthermore pediatric urologists who sees increasing number of antenataly diagnosed hydronephrosis may change the age of presentation in future.

Over and above, some may present nonobstructive hydronephrosis which on standing for some months or year may convert into obstructive hydronephrosis. So the age is flexible and is truly dependent on educated population and the health facility available at a particular place.

Sex- Disease is more common in males. Uson[19] and Kelalis[11] have reported male preponderance in their series. Zincke[17] has also found 2:1 male preponderance as noted by Uson[19] and Kalalis.[11]

In the present series, there were 48(62.3%) male patients and 29 female patients (37.7%) and male to female ratio was 1.65:1.

In the present series findings are comparable with the findings Of Uson[19] and Kelalis[11] and Zincke[17], However, number of the cases are less in comparison to Zincke[35]

The cause for male predominance is, however, not been commented by any author.

Side affected- It is observed in the present series that left kidney suffered the most i.e. in 50% of the cases. On review from literature, the findings exactly matches with the findings of authors i.e. Uson[26] Kelalis[11] and Zincke[17].Similarly, affection of right side and both also matches with other series. The findings are so constant that there is hardly a difference of one.

It has been observed that since the year 1969 till the date, the findings are similar and there is no change in the trend.

Presentation- Kelalis[11] and Zincke[19] noted the impressive observation that the pelvi-ureteric junction obstruction simulate gastrointestinal disease thereby delaying the diagnosis from few days to few years.

The most common symptom encountered by Kelalis[11] and Johnston[9] was pain in abdomen.

24% patients of Kelalis[11] and 48.4% patients of Johnston[9] presented with pain. In present series 50.6% of patients had paid as first symptom. Finding of present series matches with the findings of Johnston[9] closely and also Kelalis.[11] Pain is usually vague and in repeated attacks.Recurrent attacks of pain often severe and colicky but occasionally localised to one side of the abdomen and rarely to flank is also known.33% of patients in Johnston's[9] series had urinary tract infection while 38% patients in the present series presented with urinary tract infection. Thus, urinary tract infection is next common symptom.

Patient usually presents with fever, burning in micturation and pyuria.33% of patients in series of Uson[19] presented with lump in abdomen, while Kelalis[11] and Johnston[9] have reported incidence as 12.8% and 13.2%. In present series, 15.5% of patients presented with lump. The findings are comparable with those of Kelalis[11] and Johnston.[9]

The dimensions of the mass varies greatly from nearly 6 cm. to football size crossing the midline. The other common urologic complaint is haematuria. 11% patients of Kelalis[11], 18% patients of Zincke[17] and 13.2% patients of Johnston[9] had haematuria as presenting complaint.

In the present series 10.3% patients presented with haematuria. Infection and trauma are common cause of haematuria. Kelalis[11] has stated that in absence of infection and trauma, it is speculated that mucosal vessel at or near the level of obstruction may rupture suddenly because of venous congestion accompanying urinary retention or variation of pressure inside the hydronephrotic sac, leading to haematuria.

Hypertension is a rare cause of presentation. Johnston[9] has reported 1 case and in the present series also 1 patient presented with hypertension. He had solitary kidney and his hypertension did not respond after corrective surgery and the patient was put on medical line of treatment for control of hypertension.

The findings of presentations in the present series are comparable with those reported by Johnston[9] in his large series of 219 cases.

Etiology- Uson[19] reported intrinsic pelvi-ureteric obstruction is 81% of his patients as the commonest cause of obstruction. Pelvi ureteric angulation or uretero ureteral angulation was reported as the commonest cause of obstruction by Johnston[9] in 74.8% of the cases.

In the present series, local loss of peristalsis with narrowing and elongation was found to be commonest cause of obstruction. It was seen in 88% of patients.

The other cause reported is aberrent vessel. Uson[19] reported it in 28% of patients and Johnston[9] in 26.9% of patients. In the present series such aberrent vessel as noted in only 6.4% of cases.Uson[26] has noted fibrous bands in 21% of cases, while in present series fibrous bands were noted in 6.6% of cases. Other causes reported are mentioned in the table.

Inspite of getting few of the etiological factors at pelvis ureteric junction, the etiology is still debatable. This is because many of the times more than one cause is evident and it is difficult to state which factor is actually causing obstruction. Uson[19] in his many patients who were reported to have intrinsic pelvi-ureteric obstruction could not demonstrate mechanical obstruction. Similarly,Johnston[9] in his series have reported that in many patients though external etiological factor was evident, there was no mechanical obstruction.

Similarly, few patients are reported who had no obvious external cause for obstruction. These findings have lead to the conclusion that the pathology lies in the segment and these are the associated concomitant pathologies.

In present series, we have reported loss of peristalsis in 88% of patients and this supports the above view.

Histopathology- Histopathology has paved way to the exact cause of pelvi-ureteric junction obstruction.Predicting urothelial heaping, muscular hypertrophy, mucosal flap as possible causes of obstruction, were studied by authors. Murnaghan G.F.[18] noted paucity of musclein his study.There was preponderance of longitudinal muscle though the total muscle mass was less as compared to normal. Similarly, Foote noted in his study that 63% (37) patients were having paucity of muscles. Muscle hypertrophy was seen in 14% (8) of the cases.Paucity of muscle at pelvi-ureteric junction and longitudinal muscle preponderance is responsible for giving an impression to a segment as an elongated one.

Obviously an elongated segment has to have folds and bends and remain near the pelvis which may further go for forming adhesions depending upon the degree of infection. Pelvi ureteric junction may change its direction giving an impression that it is inserted at the higher level depending upon the distension and sagging of the pelvis. These particular points were observed in the present series based on the findings of Murnaghan[18] and Foote[4] and we have found comparable findings.

The epithelium was normal in all the patients of Foote J.W.[4]

In the present series,in 28 patients (93.3%),epithelium was normal. In two patients epithelium was not seen. This may be because the section might have missed the epithelium. We do not attach any significance to this finding. Epithelial heaping was seen by Uson[26] as possible cause of obstruction which was not seen in the present series.

Paucity of muscle was seen in 63% (37) patients by Foote J.W.[4] In present series, 70% (21) patients had paucity of muscles at pelvi-ureteric junction.

As described by Murnaghan G.F.[18] normal pelvi-ureteric junction has mixed spirals of muscles running in all directions which is responsible for peristalsis. This mixed pattern is selectively absent in obstructed pelvi-ureteric junction in the series of Murnaghan[18] and Foote J.W.[4], place of which has been taken by longitudinal muscle which also showed paucity.

Present series concentrated on these findings of above mentioned authors and noted nearly similar findings i.e. 70% (21) cases had paucity of muscle and 6.6% (2) had no muscles. Impaired conduction of peristaltic wave from the pelvis to the ureter is explained by a narrow aperistaltic ureteral segment. This in turn is result of replacement of normal muscular spirals by longitudinal fibers which are also sparse.

Variation in distribution of muscle fibers in this region or even absence of muscle is because of developmental arrest due to indeterminate cause as stated by Zincke[17]. In our series nerve endings were seen in all the patients as noted by Notley R.G[18]. Ganglion cells could not be studied as electronmicroscope is not available here.

Notley[18] tried to correlate these segments with aganglionic segment of achalasia cardia. Hirschprung disease but subsequent discovery of nerve fibers under electronmicroscope laid to change the theory of neuromuscular incoordination. Under electron microscope, he could not see ganglion cells and the number of axons seen were far less i.e. 1 for every 100 muscle cells. Thus he concluded that there is no role of autonomic nervous system in regulating ureteric peristalsis and further he evoked the theory of muscle to muscle transmission of peristaltic wave.

Pelvis is known to go for secondary changes depending upon the pathological equation of infection first or obstruction first.If infection precedes the obstruction pelvis goes for thickening in which case it is likely to have cellular infiltrate and thickening by the collagen and if obstruction precedes, the pelvis is likely to go for huge dilatations with less amount of cellular infiltrate. In present series 18 patients (60%) had inflammatory cells. Out of which 4 had (13.3%) acute and 14 (46%) had chronic inflammatory cells.

In all the cases of present series collagen tissue was found to be normal in amount. There are diverse views about the collagen and its contribution to pelvi-ureteric junction leading to obstruction.

CONCLUSION

The patients admitted were investigated and suitably operated under the guidance and supervision of the guide. The findings were noted in observation and the results obtained and compared with the literature available.

1. We found that common age of presentation was between 02-20 years.

2. In the present series male (48) to female (29) ratio was found to be 1.65:1.

3. It was observed that the left kidney was affected in 50%, right side was affected in 29.8% and bilateral affection was in 19.5% of cases.

4. The commonest presentation in the present series was loin or groin pain (50.6%) followed by

Urinary Tract Infection	...	38.00%
Lump in abdomen	...	15.50%
Haematuria	...	10.30%
Hypertension	...	01.29%

5. The chief responsible factor isolated from study causing obstruction is local loss of peristalsis with elongation and narrowing (88%).
6. A very rare and interesting case was encountered as papilloma which was satisfactorily treated.

7. Histopathology of segment studied gave an eye opener. We found paucity of muscle and its absence in 70% and 6.6% of cases.

8. 12.9%(10) of patients had radiologically non functioning kidney in present series. Salvage could be achieved with good results in 100% cases.

9. Whatever may be the size of the pelvis it does not necessarily reflect on renal function impairment except an intrarenal one.

10. We observed whatever may be the state of the renal corpus a chance for the kidney survival should always be given and nephrectomy not to be thought in the first instance unless the renal parenchyma is papery thin and hopelessly damaged provided the other kidney is normal.

11. Pelvi-ureteric junction obstruction is associated with lower genitourinary anamolies. It is seen in 5.19% of cases in present series.

12. By scrupulously observing the discipline and fine technique and guide's modifications given in the work, complication has been reduced to nil except for minor wound infections which are unrelated.

13. Renal functions usually return immediately. Caliceal dilation require longer time approximately an year and in one case after 8 years also caliceal pattern was similar.
The result of early instituion of surgery are rewarding, and recommended in every case.

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