Paediatric Nephrolithiasis in Pakistan

Pages with reference to book, From 177 To 182

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Abstract

Eighty children, upto the age of twelve, with documented evidence of renal calculi were studied over eight years (1973-81).
The peak age group was between 11 and 12 years and the male to female ratio was 2.2:1. Majority of the patients (56.25%) presented during the summer months. The urine culture was positive in 48.75% cases. B. Proteus was the commonest organism in males and E. Coli in females. On analysis, 36% stones contained Magnesium Ammonium Phosphate and 28% Calcium Oxalate. Overall recurrence after surgery was 11.25%. In 57-5% children, the possible etiological factors remained unknown (JPMA 32:177, 1982).

Introduction

Childhood urolithiasis is outstanding not only in variation in geography but also in the pattern of disease. In several European countries (Ghazali, 1975; Scholten et al., 1973; Anderson, 1969) the predominant type of calculi in children are the upper urinary tract stones. North American studies (Daeschner et al., 1960; Malek and Kelalis, 1975; Churchill et al., 1980) confirm this observation. In Asia, Eckstein (1961) in Turkey and Levy and Falk (1957) in Israel have reported that the majority of infants and children with urolithiasis have renal and uretric stones.
However, a belt stretching from Egypt (Loutifi et al., 1974), Iran (Gharib, 1970; Sadre et al., 1973), Pakistan (Illahi, 1967; Shahjehan and Rahman, 1971; Rizvi, 1975; Khan, 1977), India (Anderson, 1962; Aurora et al., 1964), Thailand (Unakul, 1961; Halstead and Valy-asevi, 1967) to Indonesia (Thalut et al., 1976) continues to witness the problem of paediatric urolithiasis as one of lower urinary tract.
Calculous disease of childhood is missing from the map of urolithiasis in bulk of Africa, South America and Australia (Bass and Emanuel, 1966). Coupled to this is the fact that Britain (Lett, 1936), Sicily (Anderson, 1968) and Japan (Inada et al., 1958) saw a visible change of pattern from lower to upper tract calculi in children with the change in diet and socio-economic conditions.
This difference in the pattern between industrialized and developing countries merits an enquiry into an anticipated change in the pattern of paediatric urolithiasis, with the change in socio-economic conditions, in developing countries.

Patients and Methods

Between July 1973 and June 1981, 790 children were admitted in the paediatric section of urology department. 560(70.8%) of them had calculous disease of the urinary tract. The majority of children (80%) had stones lodged in the lower tract and 20% had upper tract stone disease.
Eighty children with either a radiologic demonstration, operative removal or spontaneous passage of radiologically documented renal stone were studied. Twelve children had bilateral renal stones. Of the 68 cases with unilateral calculi, 37 had stones in the left kidney and 31 in the right.
The clinical, radiological, laboratory and stone analysis findings were reviewed and compared with other reported series.

Results

There were 55 boys and 25 girls (male to lemale ratio 2.2 to 1) ranging in age from 5 months to 12 years. Majority of children (51.25%) were in the older age group of 9 to 12 years (Fig. 1).

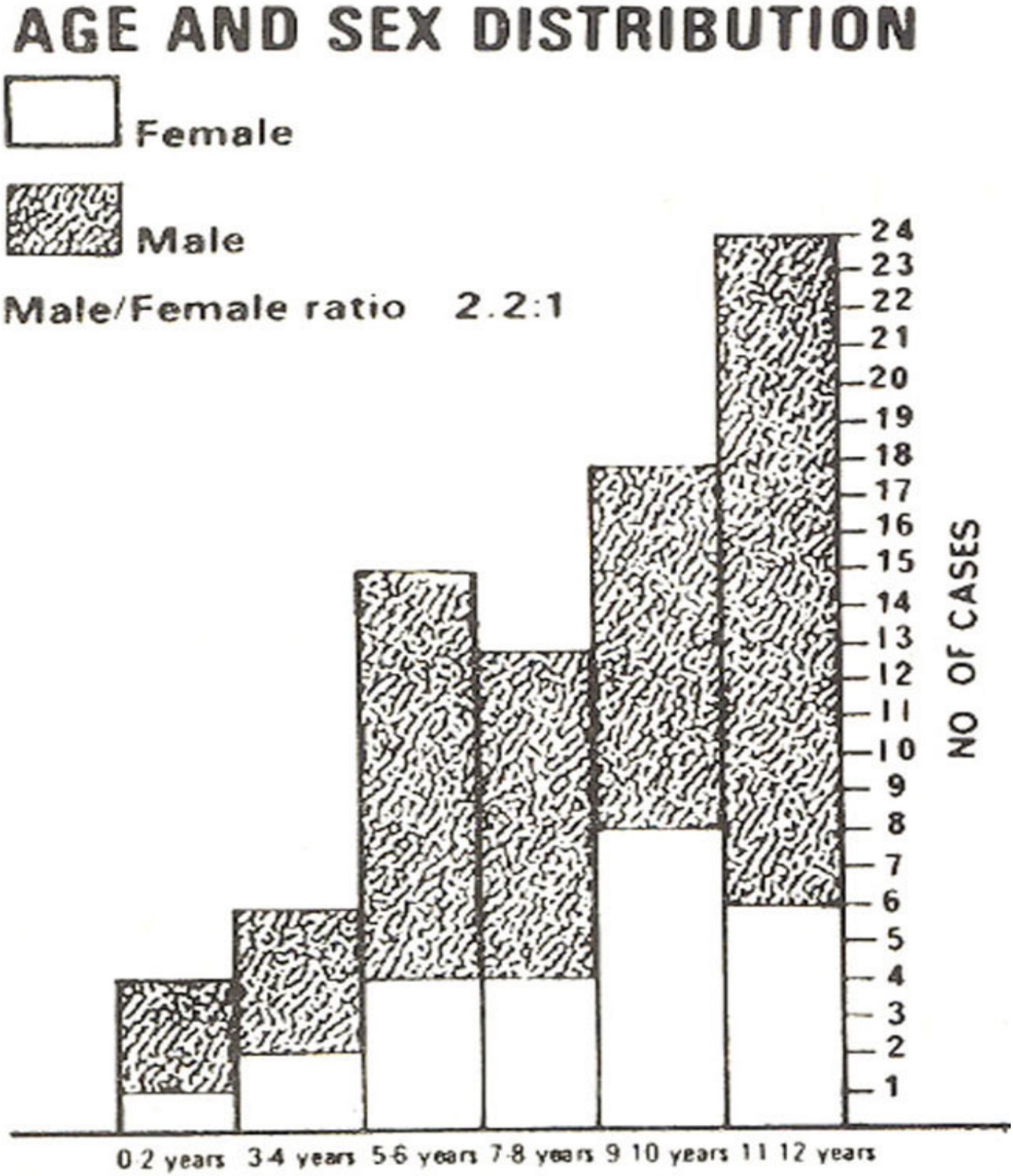

Fig. 1: Age and Sex Distribution

A positive family history of urolithiasis was found in 9(11.25%) cases. Fifty six per cent cases

presented in summer months when temperature and humidity were high (Fig. 2).

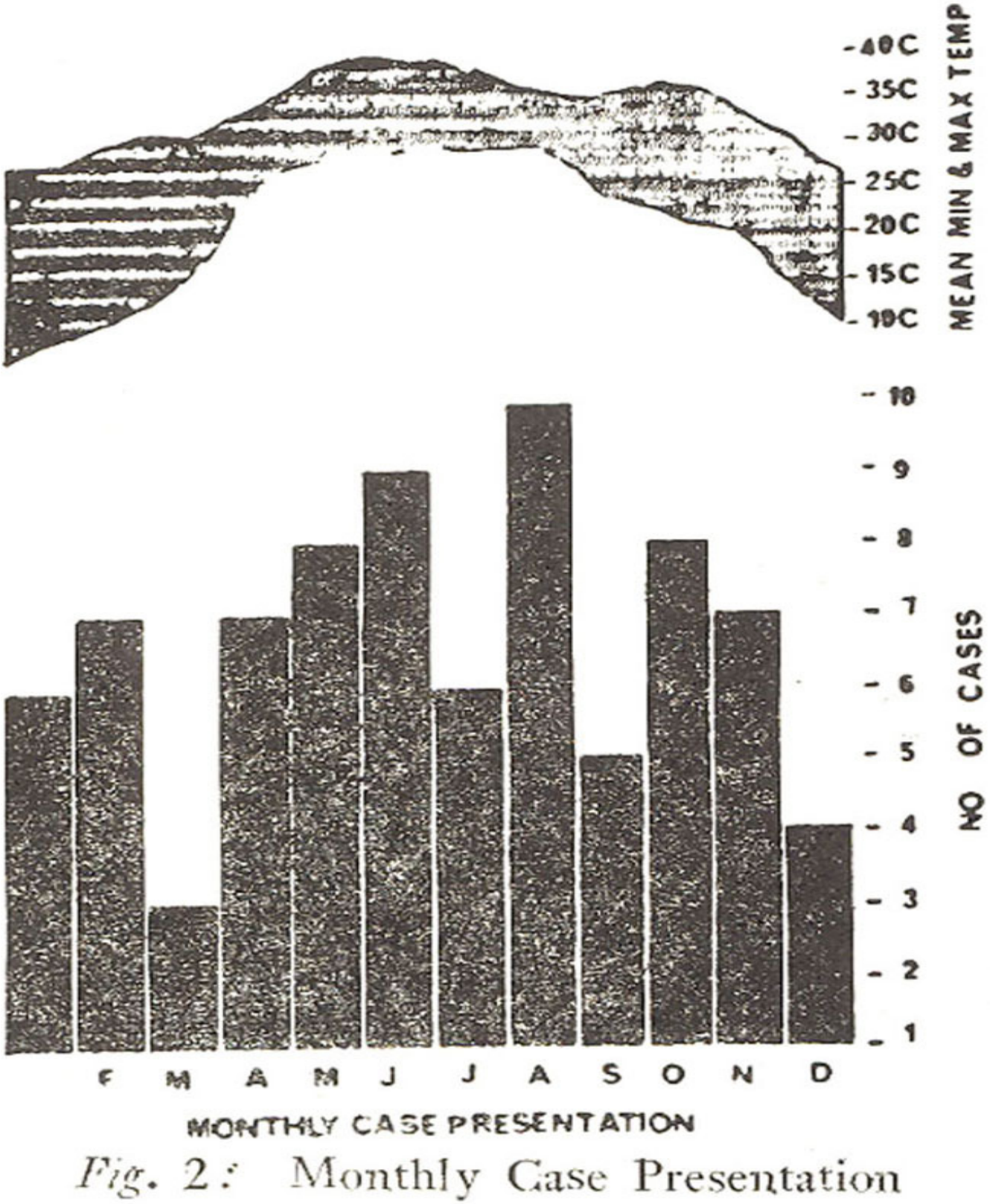

Fig. 2: Monthly Case Presentation

August was the month of peak presentation of cases (12.5%).
Abdominal and loin pain were the presenting symptoms in 65 (86.25%) cases (Fig.3).

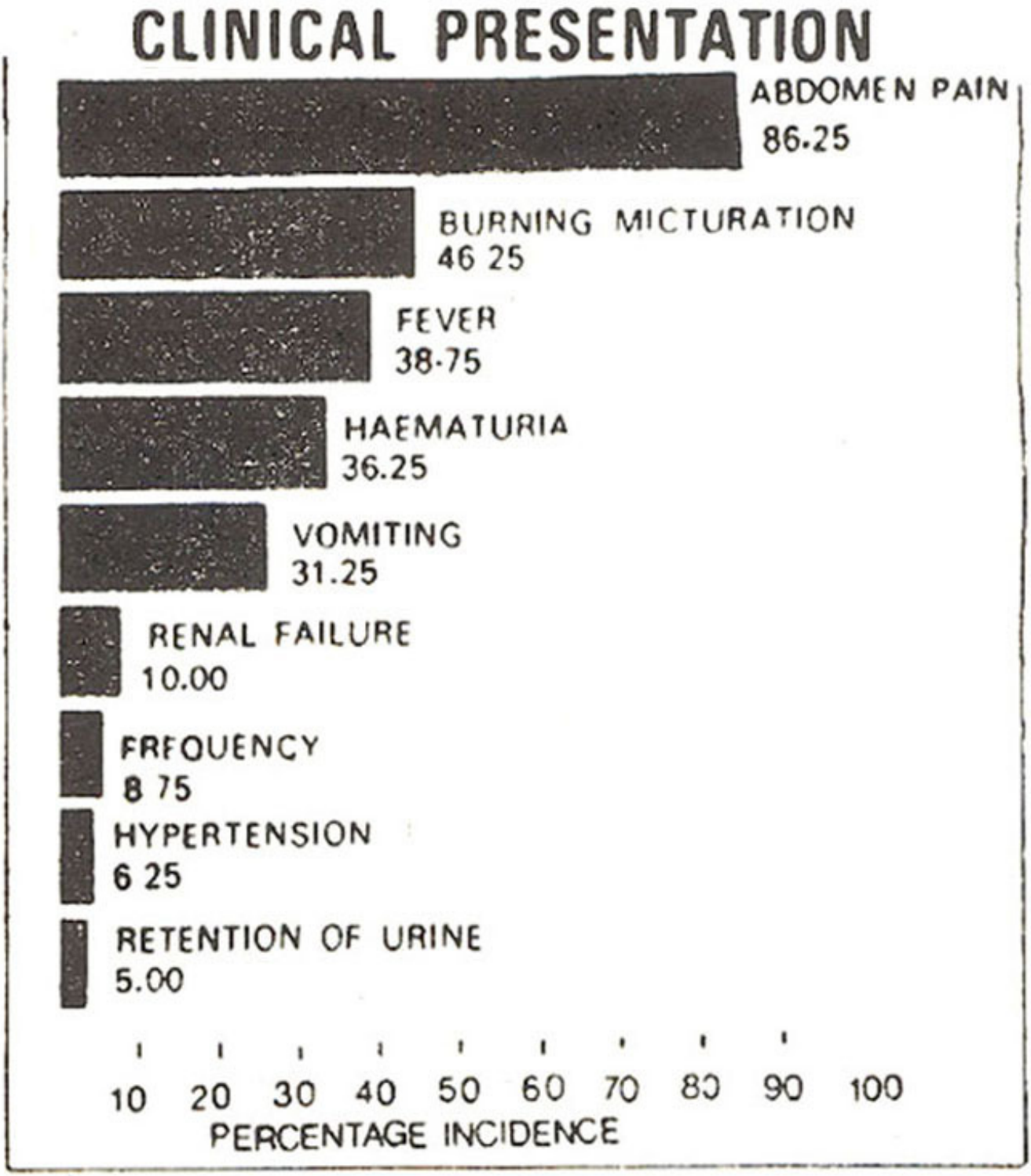

Fig. 3 : Clinical Features

Haema-turia was the fourth commonest symptom (36.25%). Eight (10%) patients were admitted in renal failure. Two of them died following surgery for removal of the obstructing calculi. Five (6.25%) children were found to be hypertensive on admission. In 2 out of 5 the blood pressure returned to normal following surgery. The duration of symptoms in more than 50% cases was less than one year and the shortest time between the onset of symptom and the hospital visit was 1 week. One case,

however, presented with the history going back to 9 years.
Urinary pathogen were isolated in 39 (48.75%) cases (Table I).

Table I
Urinary Pathogen in 39 Cases

Organism	*No. of Cases*	
	Male	*Female*
B. Proteus	14	3
E. Coli	6	5
Klebsiella	4	1
Pseudomonas	3	—
Staphlococcus	2	1
	29	10

*No growth in 41 cases (51.25%).

B. Proteus was the commonest organism (43.5%) of all and 48% infected male cases. E. Coli was the commonest organism in female children and 5 of the 10 infected females cultured this pathogen in their urine.
Excretory urography was done in all but two children (Table II).

Table II

Intravenous Urography in 78 Cases

	No. of cases (%)
Normal	19 (24.35)
Hydronephrosis	33 (42.31)
Hydroureter	10 (12.82)
Renal scarring	4 (5.12)
Poor function	8 (10.28)
Trabaculated bladder	4 (5.12)
Total:	78 (100.00)

Nineteen (24.35%) cases had normal urograms. Radiological evidence of pressure was seen in 47(60.25%) cases with hydronephrosis in 42.31%, hydroureter in 12.82% and enlarged trabeculated bladder in 5.12% cases. In 8 (10.28%) cases the renal function was poor.

An enquiry into the etiologic factors predisposing to stone formation was unsuccessful in 57.5% cases (Table III).

Table III
Probable Predisposing Factors

	No. of cases	(%)
ANATOMIC		
. Abnormalities of fusion rotation	3	
. PUJ obstruction	5	
. Uretric stenosis	2	
. Severe uretric reflux	3	17 (21.25)
METABOLIC		
. Idiopathic hypercalciuria	3	
. Uric acid lithiasis	2	
. Renal tubular acidosis	1	6 (7.50)
INFECTIVE		11 (13.75)
IDIOPATHIC		46 (57.50)
		80 (100.00)

Structural anomalies were detected in 17(21.25%) children, the commonest being the obstruction of pelvi-uretric junction. Severe uretric reflux was seen in 3 cases. Infection as a probable cause of stone formation could be attributed to in 11 cases. These children had infection with urea-splitting organism and stone analysis detected magnesium ammonium phosphate as major constituent. The yield in the identification of metabolic factors was small (7.5%). Three of the 6 had idiopathic hypercalciuria and two cases had uric acid lithiasis. One child had renal tubular acidosis. None of the children had primary hyperparathyroidism or hypercortisonism.

Seventy children (87.5%) underwent seventy eight operations for removal of stones (Table IV).

Table IV Management

Operative	*No. of cases (%)*
Pyelolithotomy	55 (68.75)
Pyelonephrolithotomy	6 (7.50)
Nephrolithotomy	3 (3.75)
Partial nephrectomy	2 (2.50)
Nephrectomy	4 (5.00)
Non-Operative	
Passed stone spontaneously	5 (6.25)
Refused surgery	3 (3.75)
Unfit for surgery	2 (2.50)
	80 (100.00)

*70 patients underwent 78 operations.

Fyelolithotomy was done in 55(68.7%) and nephrectomy in 4 children. Complication as a result of surgery occurred in 13(16.6%) cases, of which 7 had wound infection and 4 had secondary haemorrhage. The operative mortality was 3.8%. One case died of septicaemia and two children, who were in renal failure, died after surgery. One of them had bilateral renal stones and the other had stone impacted in the pelvi-uretric junction of the only functioning kidney. Seven patients were managed non-surgically, 5 passed stone spontaneously and 2 were declared unfit for surgery (one had congenital heart disease). Three patients refused surgery.

Fifty stones removed after surgery were analysed by chemical and crystallographic methods (Fig. 4).

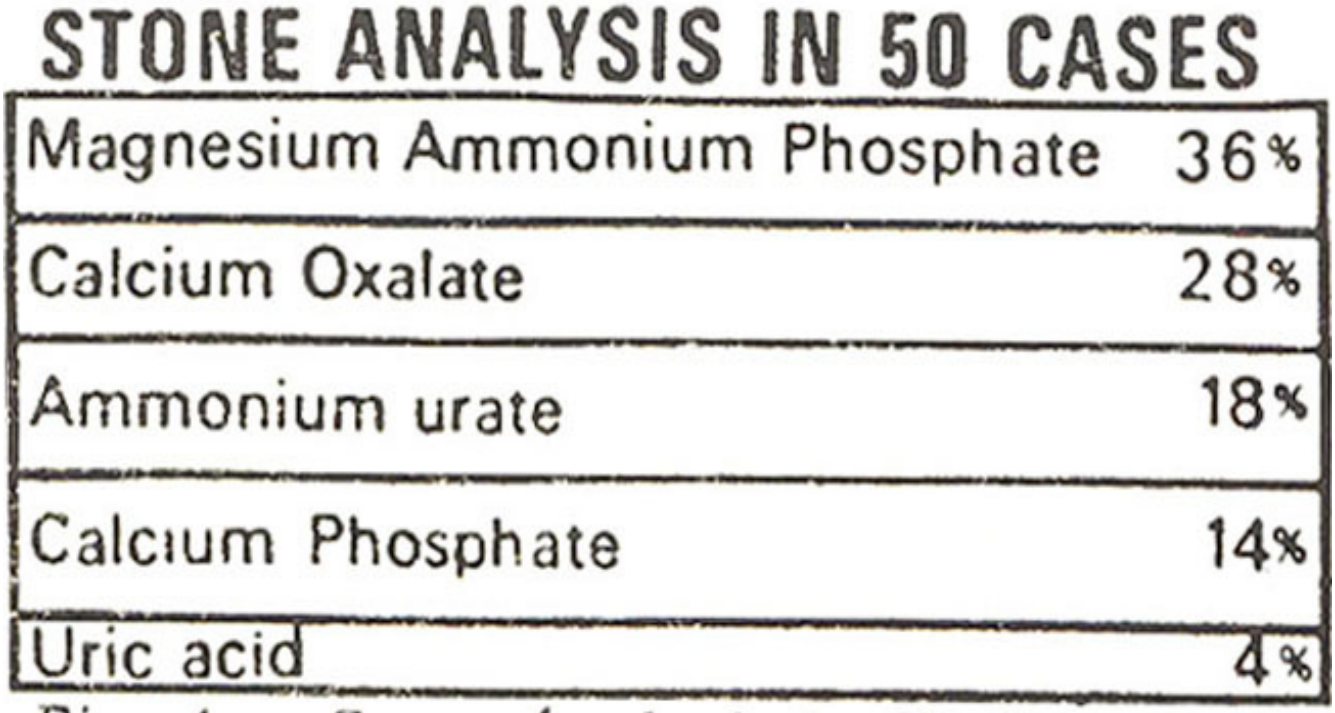

Fig. 4: Stone Analysis in 50 Cases

Magnesium Ammonium Phosphate (struvite) was the major constituent in 36% stones. These children had alkaline urine and infection predominantly with B. Proteus. Calcium oxalate (Whewellite and Weddellite) was found in 28%. In 50% children harbouring these stones, no growth was isolated on culture and had a pH of urine between 5.8-6.4. Seven (14%) stones contained calcium phosphate (apatite) and in only 2 stones the major constituent was uric acid.
The overall recurrence was seen in 9(11.25%) children (Table V).

Table V Recurrence

	No. of cases (%)
Incomplete surgical removal	4 (5.00)
True recurrence	5 (6.25)
Overall recurrence	9 (11.25)
Follow-up	
Satisfactory	61 (76.25)
Unsatisfactory	19 (23.75)

Four cases with staghorn calculi had retained stones, the surgical removal having been incomplete. In 5 out of 9 cases the stone recurred post-operatively and in 2 children there was evidence of recurrence within 3 months. Jn two-third of cases the cause attributed to recurrence was the inability to eradicate infection despite prolonged antibiotic therapy post- opera-tively. Sixty-one children followed up regularly from few weeks to 8 years but 19(23.75%) children were lost to the stone clinic during the study.

Discussion

Analysis of the data revealed that the majority of patients were in the older age group (6-12 years) the peak being between 11 and 12 years. Teotia and Teotia (1977), Malek and Kelalis (1975) and Sadre et al. (1973) reported a similar finding. This is in contrast to Ghazali, Barratt and Williams (1973) and Gaelics et al.(1975) where the peak age group was 3 years. Gaches et al. (1975) noticed a second peak at 10 years. Failure to recognize the disease, in view of a low index of suspicion by physicians who regard childhood urolithiasis as one of lower tract, may explain, in part the late reporting of children in this region.

The male to female ratio of 2.2:1 in this study is similar to studies m United States (Daeschner et al., 1960; Reiner et al., 1979; Ghazali, 1975). Gharib (1970) in Iran and Aurora (1977) in India reported a male preponderance of more than 5:1 but Levy and Falk in Israel observed the ratio as 1:1. The observation that childhood urolithiasis should be similar to females with the incidence of males and females to be the same as against 3:1 in adults because of decreased tendency of testosterone secretion and equal tendency for citrate excretion in both boys and girls (Welshman and McGeown, 1976) has not been fully supported by this study.

Majority of patients presented in the hot summer months. In Britain, Gashes et al. (1975) reported a similar finding. Fujita (1979) and Prince et al. (1954) found a definite correlation between high temperature and increased incidence of colic. It needs further elucidation why children bearing stones which have been there for months or even years should choose to present in the summer months ?

Although abdominal prin was the commonest presenting symptom it was not observed as the classical renal colic as seen in adult nephrolithiasis. Apart from being vague, the pain lacked lateralization especially in the younger children. This was also reported by Higgins (1954). Absence of colic and haematuria in only a third of the children in this series against a much higher percentage as reported by Bass and Emanuel (1966)" and Churchill et al. (1980) further impeded early detection of renal stone disease in children.

Congential anomalies were detected in 9% cases reported by Paulson et al. (1972), 54% cases by Puga et al. (1977) and 60% cases by Beane et al.(1967). Over 20% children in this study had structural anomalies which could predispose to stone formation. Ghazali, Barratt and Williams (1973) and Myers (1957) found less than one third children with radiographic evidence of congential malformation. The yield in this part could be further increased with mandatory urographic screening of children with evidence of calcification in renal areas or recurrent urinary tract infection.

Metabolic cause for calculogenesis, although imperative, was rewarding in only a small number of cases (7.5%). Malek and Kelalis (1975) reported metabolic etiology in 67% and Churchill et al. (1980) in 12% of cases. Hyperpara- thyroidism which accounts for 5% of renal calculi in adults (Melick and Henneman, 1958) was not found in the children in this part. Paulson et al. (1972) and Scholten, Bakker and Cornil (1973) reported similar absence of hyper-parathyroid disease in their series. All the 3 children with hypercalciuria in this study were idiopathic in nature. No case of cystinuria was seen. More aggressive follow-up of children with active stone disease is important in an attempt to detect more cases of underlying metabolic disease.

Etiology could not be determined in majority (57.5%) of children in the present study. Whereas Paulson

et al. (1972) and Churchill et al. (1980) reported over 75% cases in their series as idiopathic, a finding similar to ours; Daeschner et al. (1960) found the cause of calculogenesis in all but 12.5% cases. Myers (1957) classified 54% of the children in the group of unknown etiology.

Urinary tract infection was seen in 48.25% children which was similar to the study by Noronha, Gregory and Duke (1979). Hodgkinson (1977) and Troup et al. (1972) reported infection in over 60% cases. As observed by others the commonest organism associated with calculous disease was B. Proteus (Malek and Kclalis, 1975; Churchill et al., 1980; Wenzl et al., 1968; Brueziere et al., 1977; Myers, 1957; Ghazali, 1975; Scholten et al., 1973). The hypothesis that urease activity of proteus releases high ammonium concentration leading to precipitation of struvite and consequent rise in pH in turn favours precipitation of apatite, is upheld by most workers. What is not clear is that uncomplicated urinary infection is only rarely a result of urea-splitting organism in children (Ghazali et al., 1973) so what is that unidentified factor which causes a child to form stone when infected with B. Proteus? In female children, E. Coli was the commonest organism isolated in this study. Correlation of this organism with calculous disease is uncertain.

Hodgkinson (1977) observed that stones in children from United States (Wenzl et al., 1968; Benett and Colodny, 1973) and Czechoslovakia (Vendl, 1975) were predominantly of calcium salts, suggesting a metabolic etiology, and those from France (Brueziere, et al., 1977) and Holland (Scholten et al., 1973) contained more magnesium ammonium phosphate, suggesting an infective origin. The observation in this study are similar to those in French and Dutch children. However, the finding that infected stones were seen in younger children and calcium stones in older children is not supported by this series. It was observed that older children with struvite and appatite stones bore proteus organism in their urine predominantly.

Of the 9(11.25%) cases in whom stones recurred after surgery, 4 were those whose stones could not be removed completely. All 4 children had multiple calculi in kidneys with intra-renal pelves. Burtone and Johnstone (1977) observed similar difficulty in complete removal of stag-horn stone even by extended pyelolithotomy. Nephrotomy with or without hypothermia may be the answer to this problem. Five children, however, reported with true stone recurrences. Malek and Kclalis (1975) reported active stone disease with recurrence in 30% cases. Daeschner, Singleton and Curtis (1960) found recurrence in 16.6% and Gaches et al. (1965) in 7% over 23 years follow-up. The children in the present scries were followed-up for only eight years. Another factor, in the context of low recurrence observed in this part, was the 23% loss to follow-up as a sizeable proportion of the drop-outs came from far-flung rural areas. The recurrence rate is likely to increase with longer and more adequate follow-up.

Conclusion

The consequences of nephrolithiasis in infancy and childhood arc serious and only early recognition may prevent the loss of functioning renal tissue. Recurrence after surgery of renal stones is significantly higher than that of lower tract calculi in children. Upper urinary tract calculi is also a manifestation of an underlying correctable disease in a fair proportion of cases. Thus, although renal stones in children constitute only one-fifth of childhood urolithiasis in Pakistan, a higher index of suspicion is warranted for better detection and more meaningful management of the disease.

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References

1. Anderson, D.A. (1962) The nutritional significance of primary bladder stones. Br. J. Urol., 34:160.
2. Anderson, D.A. (1968) The incidence of urinary calculi. Hosp. Med., 2:1024.
3. Anderson, D.A. The historical and geographical difference in the pattern of incidence of urinary stones considered in relation to possible aetiological factors, in Proceedings of the Renal Stone Research Symposium, April 1968. Edited by Hodgkinson, A. and Nordin, B.E.C. London, Chur chill, 1969, pp. 7-31.
4. Aurora, A.L., Ramalingaswami, V. and Gaitonde, P.D. (1964) Bladder stone disease in children in Delhi area. J. Urol., 91:347.
5. Aurora, A.L. Vesical calculus disease of childhood, in idiopathic urinary bladder stone disease. Edited by Van Reen, R. Foegarty International Centre Proceedings No. 37, DHEW Publication No. (NIH), 1977, pp. 215-40.
6. Bass, H.N. and Emanuel, B. (1966) Nephrolithiasis in childhood. J. Urol., 95:749.
7. Beane, H.C., Magoss, I.V., Staubitz, W.J. and Jewctt, T.C. Jr. (1967) Urolithiasis in childhood. J. Urol., 97:537.
8. Benett, A.H. and Colondy, A.H. (1973) Urinary tract calculi in children. J. Urol., 109:318.
9. Brueziere, J., Gueriot, J.C. and Lasfargues, C. (1977) Urinary calculi in children; report of 185 cases. Ann. Nestle, 38:67.
10. Burtone, F.F. and Johnstone, J.H. (1977) Staghorn calculi in children. J. Urol., 118:76.
11. Churchill, D.N., Maloney, CM., Nolan, R., Gault, M.H. and Winsor, G. (1980) Paediatric urolithiasis in the 1970s. J. Urol., 123:237.
12. Daeschner, C.W., Singleton, E.B. and Curtis, J.C. (1960) Urinary tract calculi and ncphrocalcinosis in infants and children. Pediatr., 57:721.
13. Eckstein, H.B. (1961) Endemic urinary lithiasis in Turkish children. Arch. Dis. Child., 36:137.
14. Fujita, K. (1979) Weather and the incidence of urinary stone colic. J. Urol., 121:318.
15. Gaches, C.G.C., Gordon, I.R.S., Shore, D.F. and Roberts, J.B.M. (1975) Urinary lithiasis in childhood in Bristol clinical area. Br. J. Urol., 47:109.
16. Gharib, R.(1970) Lithiasis in the urinary tract of children; general review based on observation in 167 affected Iranian children. Clin. Pediatr., 9:157.
17. Ghazali, S., Barratt, T.M. and Williams, D.I. (1973) Childhood urolithiasis in Britain. Arch. Dis. Child., 48:291.
18. Ghazali, S. (1975) Childhood urolithiasis in United Kingdom and Eire. Br. J. Urol., 47:739.
19. Halstead, S.B. and Valyasevi, A. (1967) Studies of bladder stone disease in Thailand. III. Epidemiological studies in Ubol provence. Am. J. Clin. Nutr., 20:1329.
20. Higgins, C.C. (1954) Panel discussion on urolithiasis. Urol. Survey, 4:2.
21. Hodgkinson, A. (1977) Composition of urinary tract calculi in children of different ages. Br. J. Urol., 49:453.
22. Illahi, M.A. (1967) Urinary calculi-their incidence and distribution in the urinary tract. Medicus, 34:149.
23. Inada, T., Miyazaki, S., Omari, T., Nihira, H. and Hino, T. (1958) Statistical study of urolithiasis in Japan. Urol. Int., 7:150.
24. Khan, F.A. Idiopathic bladder stones in Pakistan: A clinical study of 124 patients, in idiopathic urinary bladder stone disease. Edited by Van Reen, R. Foegarty International Centre Proceeding No. 37, DHEW Publication No. (NIH), 1977, pp. 187-97.
25. Lett, II. (1936) On urinary calculous with special reference to stone in the bladder. Br. J. Urol.,

8:205.
26. Levy, D. and Falk, W. (1957) Urinary calculus disease among Israeli immigrant and Arab children. T. Pediatr., 51:404.
27. Loutfi, A.F., Van Reen, R. and Abdcl-Hamid, G. (1974) Studies on bladder stone disease in Egyptian children. II. Methodology and general aspects of the disease. J. Egyp. Med. Assoc., 57:96.
28. Malek, R.S. and Kelalis, P.P. (1975) Pediatric nephrolithiasis. J. Urol., 113:545.
29. Melick, R.A. and Henneman, P.H. (1958) Clinical and laboratory studies of 207 consecutive patients in a kidney stone clinic. N. Eng. J. Med., 259:307.
30. Myers, N.A.A. (1957) Urolithiasis in childhood. Arch. Dis. Child., 32:48.
31. Noronha, R.F.X., Gregory, J.G. and Duke, J.J. (1979) Urolithiasis in children. J. Urol., 121:478.
32. Paulson, D.F., Glenn, J.F., Hughes, J., Roberts, L.C. and Coppridge, A.J. (1972) Pediatric urolithiasis. T. Urol., 108:811.
33. Prince, C.L., Scardino, P.L. and Wolan, C.T. (1954) The effect of temperature, humidity and dehydration on the formation of renal calculi. J. Urol., 75:209.
34. Puga, F., Paredes, S., Maguire, H., Moiey, A., Izzo, C. and Kumsack, H. (1977) Urinarv lithiasis in children. Ann. Nestle, 38:70.
35. Reiner, R.J., Kroovand, R.L. and Perlmutter, A.D. (1979) Unusual aspects of urinarv calculi in children. J. Urol., 121:480.
36. Rizvi, S.A. (1975) Calculous disease-A survey of 400 patients. JPMA., 25:268.
37. Sadre, M., Bastanfar, M. and Ziai, M. (1973) Urinary calculi in Iran; hospital experience over a 3 year period with special reference to bladder stones in children. Trans. R. Soc. Trop. Med. Hyg., 67:374.
38. Shahjehan, S. and Rahman, M.A. (1971) Studies on the etiology of urolithiasis in Karachi. Am. J. Clin. Nutr., 24:32.
39. Scholten, H.G., Bakker, N.J. and Cornil, C. (1973) Urolithiasis in childhood. J. Urol., 109:744.
40. Teotia, M. and Teotia, S.P.S. (1977) Kidney and bladder stones in India. Postgrad. Med. J., 53:41.
41. Thalut, K., Rizal, A., Brockis, J.G., Bowyer, R.C., Taylor, T.A. and Wisniewski, Z.S. (1976) The endemic bladder stones of Indonesia-Epidemiology and clinical features. Br. J. Urol., 48:617.
42. Troup, C.W., Lawnicki, C.C, Bourne, R.B. and Hodge, N.B. (1972) Renal calculus in children. J. Urol., 107:306.
43. Unakul, S. (1961) Urinary stones in Thialand. Siriraj Hosp. Gazette, 11:199.
44. Vendl, L. (1975) I Hornsteinleiden in kindesalter. Urologe (A), 14:168.
45. Welshman, S.G. and McGeown, M.G. (1976) Urinary citrate excretion in stone-formers and normal controls. Br. J. Urol., 48:7.
46. Wenzl, J.E., Burke, E.C., Stickler, G.B. and Utz, D.C. (1968) Nephrolithiasis and ncphrocalcinosis in children. Pediatrics, 41:57.