

STONES IN CHILDREN*

*Sedat Tellaloğlu MD**, Haluk Ander MD****

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In pediatric urolithiasis the incidence and composition of stones and the clinical condition of the patients differs significantly from country to country. Stones in childhood are rather rare in Scandinavian countries, the USA and England, but very frequent in some countries such as Turkey and Thailand. There is also a difference of localization, composition and relation to infection in some countries such as ours where it is endemic.

Generally the rate of stone disease in children is about 2-3%¹. According to Ecstein and Helbig the 2-5 age group is the one most affected², according to Osterhage it is the 2-8 one. With us, 30.2% of cases have been in the 4-6 age group. In a research project carried out in Germany, on 200,000 children up to the age of 12, 91 cases of manifest stone disease were reported⁴. These figures give a stone rate of 0.005%. In a study made in the Hacettepe Children's Hospital, between the years 1958-1960, one in every 51 cases was found to have stone disease⁵. This ratio in different urological clinics ranged from 4.3% - 20.43%^{6,7}.

Out of a total of 1959 stone cases in our hospital 334 were pediatric patients (17%). This means that pediatric stone cases in our country are rather high and urologists in Turkey are familiar with stone disease in children⁸⁻¹⁰. Of these 334 children surgically treated in our department during the last 20 years, the age group was 0-15.

Between the years 1964-1974, 640 stone cases were operated on in our department, of these, 113 were children and 527 were adults, the ratio being approximately 1:5. In the following 10 years 1246 stone operations were carried out and 221 of these were pediatric cases. Although the ratio of children is again approximately 1:5, an increase of operated cases is obvious. During the last two decades 6947 urological operations were performed in our unit. Stone cases in both adults and children accounted for 20.8 %.

The age distribution of our cases is shown in Table I. The majority were in the 4-6 age group.

* From the Department of Urology, Istanbul University Faculty of Medicine, Istanbul.

** Professor of Urology, Istanbul University Faculty of Medicine.

*** Resident in Urology, Istanbul University Faculty of Medicine.



Figure 1
K.U.B film of a patient with both renal and urethral stones.

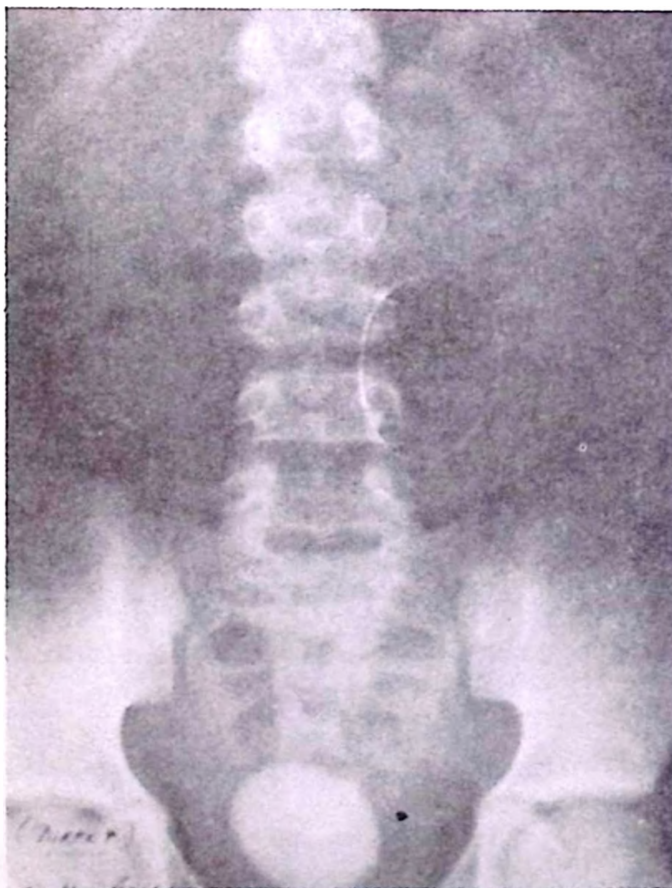


Figure 2
K.U.B film of a huge bladder stone.

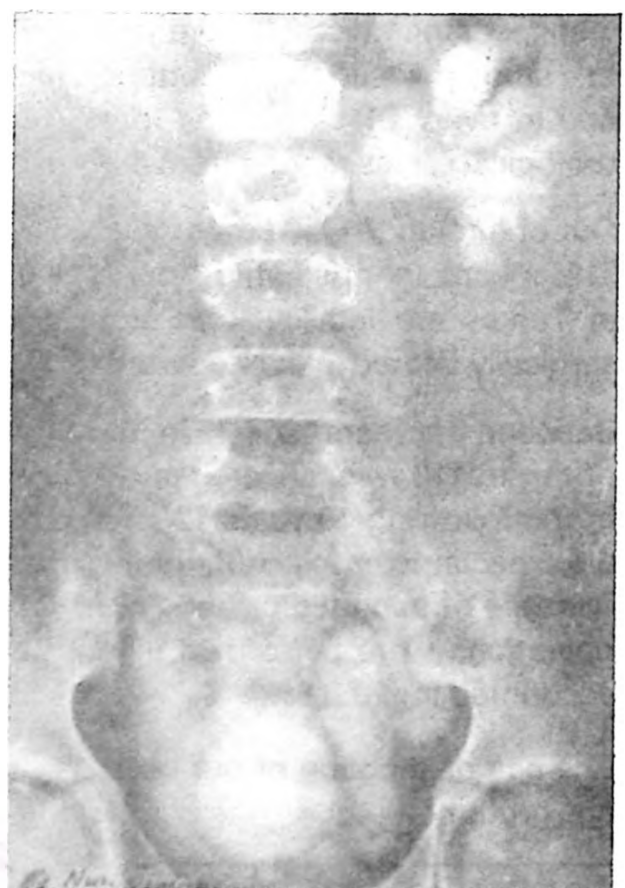


Figure 3
IVP of the same patient.

TABLE I
Age Distribution

0 - 3	58
4 - 6	110
7 - 9	73
10 - 12	51
13 - 15	42

TABLE II
Distribution According to Sex

Male	245
Female	89

Table II shows the distribution according to sex. The majority of cases were males with a percentage of 70%. Table III shows the symptoms at first attendance.

Plain X-rays and IVP investigations were done on patients with the above mentioned symptoms. If there were infection, urine cultures and sensitivity tests were also taken.

Table IV shows the localization of the stones diagnosed as described above.

TABLE III
Symptoms

Hematuria	139
Pain	76
Dysuria	55
Urine retention	31
Nausea and vomiting	12
Fever	16
Developmental disorders	5

TABLE IV
Distribution According to Organs

Kidney	156
Ureter	71
Bladder	57
Urethra	19
Multiple organs	31

Significant infection was discovered in 64.7% of cases. E.coli was the most frequent microorganism. Predisposing factors could only be found in 184 cases. Table V shows the predisposing factors detected with our limited investigatory resources.

Surgical treatment of urolithiasis in children is technically not very different from that of adults. Only bladder stones were treated differently and open surgery was utilized as we do not have special pediatric EHLT or ultrasonic equipment. Although open surgery was performed on these children for bladder stones urethral catheter drainage was not applied. A small incision into the anterior bladder wall was made and after the removal of the stone a catheter of a size appropriate to the age of the



Figure 4

K.U.B film of a pediatric patient with bilateral renal calculus in the horse - shoe kidney.



Figure 5

IVP of the same patient.



Figure 6

K.U.B. film of a patient with non - opaque renal calculus.



Figure 7

IVP of the same patient

TABLE V
Predisposing Factors

Infection	132
Cystinuria	3
Immobilization	3
Neurogenic bladder	5
Ureteral - Pelvic stenosis	15
Aberrant arteries	4
Vesicoureteral reflux	7
Distal ureteral stenosis	5
Ureteral anomalies	2
Horseshoe kidney	8
Undetectable	150

child was passed via the urethra. Meatal or urethral strictures or abnormalities were discarded.

Renal stones were removed in a great majority of cases with the posterior pyelolithotomy technique. Twenty-eight nephrectomies were carried out on cases with non-functioning kidneys with multiple or staghorn calculi. The hypothermic nephrolithotomy technique was utilized in 10 cases and multiple staghorn calculi were removed thus saving the functioning kidneys.

There were 15 cases with uretero-pelvic stenosis, and accessory arteries. In this group, pyeloplasties of the Culp, Anderson and Foley type were performed at the same time.

In a group of cases where reflux was also present, stone removal was carried out initially. Later on, reflux investigations were repeated. Reflux subsided in 5 cases after the renal stone operation. The other two cases were operated on for reflux.

Cystine stones were removed in two cases. Medical treatment for cystinuria was applied later on.

In recent years stones removed have been biochemically analyzed. In the majority of cases the stones were found to be a mixture of calcium, ammonium and oxalate.

In our study infection was found to be the most common predisposing factor (39%).

Unfortunately, investigations for distal tubular acidosis, hyperparathyroidism and disorders of purine metabolism were not possible since detailed research related to these disorders calls for special equipment.

Control of stone recurrence was not possible in the majority of these cases. Only in recent years has there been control in the early post-operative period. A long period of follow-up could only be carried out on 150 cases and in these the stone recurrence rate was seen to be 13%.

Summary

Between the years 1964 and 1984, 334 pediatric stones cases were surgically treated in our clinic. The surgical treatment used is described and figures are given comparing site, cause and recurrence rates. Further figures for pediatric urolithiasis in other countries are referred to for comparison, and figures for pediatric urolithiasis are also compared with those of adult urolithiasis.

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DISCUSSION

Chisholm: This last session seems to fall into 2 parts. First of all, we might just comment on the risk factor and the influence of medical management on this factor. To get the correct balance in this we should have had a physician among us. Still, I don't think there is any serious disagreement really, not even over renal tubular acidosis.

Barlas: From a medical standpoint we really haven't gone very far. Mr. Blandy tells a story about how, 25 years ago, he was in Chicago and a famous stone man gave a

seminar there and he talked about medical prophylaxis and so on. At the end he said, "You put 25 coins in one pocket and transfer these all through the day to the other pocket and drink a glass of water with every coin; that's the only cure." I think we haven't advanced far from that.

Chisholm: That's right, that's 25 years of progress.

Hussien: Is the timing of the water intake, quite apart from the alkalization of the urine, important from the point of view of the dissolution of the cystine stones? And is it necessary for the patient to get up in the middle of the night to take water so that he will always keep the bladder full of urine?

Blandy: I believe it is; there's a natural tendency to make more concentrated urine at night, as you know. Further, it's only logical. If they don't get out of bed to make water at night, then they're not drinking enough water in the evening, and if they get out of bed to make water in the middle of the night then they must drink another glass of water then. That's what I tell them. But I want to tell you a little anecdote about this. I had a patient with cystinuria who had a very delightful wife from Malta. She asked once what the doctor had told him to do. He said "I have to drink 4 liters of water a day." "I'll make sure you drink 8," said his wife. He was soon readmitted to the hospital with water intoxication.

Hussien: What about inhibitors? What about promoters? Are they relevant do you think?

Hargreave: In stone patients? I think the main message from both Professor Blandy and myself is that these types of studies have little clinical impact at the moment and are largely of academic interest. That's not to say they shouldn't be done, and to slightly counter Professor Blandy I think that epidemiological evidence about stones is incredibly interesting. You can go into some countries, hot countries, where there is very little stone formation and you can go into other hot countries where there is a lot of stone formation, and I feel that there are clues there and I feel that the sort of work about protein, fiber intake, etc. may be showing us the way to go, but as yet it has no real impact. But to go back to your question about promoters, I just don't know.

Khalifa: About the case from Sweden. There was no mention of hypercalcuria. You didn't find anything special?

Hargreave: Well, again, I'm not quite sure that we should regard that as a diagnosis. The question about hypercalcuria is that it is an end result of so many different things that it's a question of whether you regard it as a diagnosis or whether you try to split your hypercalciurias up into a proper diagnosis.

Chisholm: Let me ask you this. If you had a stone and you had hypercalciuria you would jolly well take bran because that's about the easiest thing to take isn't it? Yes. These other things aren't so straightforward and I would have thought a shovelful of bran with your wheaties in the morning is easy treatment.

Blandy: Yes. But both chlorothiazide and bran may have an effect which is quite contrary to what is expected in some quarters. If you take chlorothiazide you're supposed to pack the calcium back into the bones, but what it actually does make you do is to pee more often, so you drink more. So it's a way of drinking more fluid, and you know — bless the chlorothiazide people, but there's never been a controlled, prospective, double-blind study to show it made any difference whatever to the numbers of stones that are formed.

Chisholm: That's really the crux, isn't it, to show that it actually has an impact. In Germany, I think, they did a double-blind study.

Blandy: But how long did they follow it up?

Chisholm: Not for very long.

Dajani: That's right. The more you hear about stones, really, the more time is lost and still we are in square number one. I wonder if it would be worthwhile to have an organized research program in different parts of the world where we can study the question from a certain angle with the help of others and really get out some results. For example we could perhaps come to grips with the ethnic problem if we studied it in the Middle East and England and Sweden and so on and included the climate and so on. It would be worthwhile. I know this is being utopistic but perhaps we can convince governments and other bodies, such as academic bodies, to go into it.

Chisholm: I don't think the idea is at all bad. It's the longterm data that're the ones we're talking about. You can do a nice short-term study in one year and you can show that you take a group of people here and a group there and you can show that you can do whatever you want, you can knock down their urinary calcium excretion if you so wish; but the point that Professor Blandy has just raised is, "what's the situation 5 years hence?" It's a bit like cancer studies; unless you really have got a proper follow-up period the data are really not at all strong. From the given evidence you can draw quite false conclusions.

Khalifa: I'm bothered by the fact that there can be stone follow-up for 5 years. But then in the sixth year...

Chisholm: That's what I mean. That is the problem with many of the questions we've asked this morning. There have been too many longitudinal studies.

Wickham: I think any stone follow-up that doesn't go on for at least 10 years is useless.

Smith: I just wondered if I could ask a question related to the temperature, because there is obviously a major difference between the frequency of stones in the United Kingdom and here, and yet even though the temperature in Nigeria is, I guess, not dissimilar to that in Turkey, my recollection from being there and my recollection from reading the literature, is that Nigeria is not a very major stone forming country.

Khalifa: Can I make a suggestion here, being an African, originally. Africa *is* a country of few stones and the reason for this probably lies in the diet, the high fiber diet.

Hargreave: That is the point I was trying to make. There are some hot countries where the incidence of stones is actually surprisingly low.

Chisholm: Well this seems to be an instance of the fiber argument, that the disease pattern is influenced by fiber. There is very probably a relatively low protein intake too.

Blandy: There used to be a theory that stones were due to not enough sodium, do you remember? But now they think that too much sodium also leads to hypercalcuria.

Chisholm: Can we come back to children because I would like to just spend the last few minutes on the last 2 papers and perhaps discuss something about the children.

Özen: I want to ask you about the results of the stone analysis of the children. Our results yielded about 64% calcium oxide for both monohydrate and dihydrate, the infectious stone rate being about 13.9%. Our meat consumption hasn't changed in the last 20 years. Perhaps it became worse after the belt-tightening program. What is the reason, do you think for the change in the crystal structures of Turkey? Is there an explanation? These are the results of a brilliant, reliable technique, the X-ray diffraction technique.

Chisholm: I quite agree, you've got the best technique, but your results are actually in opposition to what we would have all predicted. I would have thought that you were going to tell me that you had a whole lot of infected stones.

Whitaker: Can we just get onto the subject of recurrence of stones in children; I'm not sure that came out terribly clearly. I was certainly brought up to think that if in fact you got an infected stone out completely and you didn't leave anything behind and you treated the patient with an antibiotic so that the infection cleared, and there wasn't any obvious anatomic problem, they really just didn't recur. From my own personal experience which is ridiculously small compared with yours, that certainly is the case. I've hardly had any recurrence except with the odd horseshoe kidneys. As for the rest, really, you get them out and they don't seem to come back. Is that your experience as well?

Remzi: Well, it's unfortunate that we don't have a good follow-up on our patients. If they're free of symptoms they never show up, but I really can't tell you exactly what our recurrence rate is.

Tellaloğlu: Well, we could only follow up 150 cases, out of our series of 334, and we found that in 13% of those there were recurrences.

Whitaker: Did those have any sort of anatomical abnormality? Or metabolic abnormality?

Tellaloğlu: There was no anatomical abnormality, I can say that. But we didn't go into the laboratory side of it. I mean oxaluria or calciuria; I can't give you a figure for that.

Vatandaşlar: I have a question for Dr. Remzi. He showed in his series that there was hydronephrosis in 43% of his cases. I was wondering, is this hydronephrosis secondary to the stones or a primary factor?

Remzi: Secondary, I would say.

Chisholm: Time for one more question. I would like to hear some comments on diarrhea and bladder stones.

Hassan: Yes, this is a theory and I think it is correct. It was developed by a colleague in Mosul, Iraq. Now bladder stones were prevalent, say in England, in the 20's and before. And then they disappeared as the country progressed. Now at that time there was no intravenous fluid therapy and medication was much less developed than now. This colleague and I made a study of this subject. We reviewed the operation lists from the 40's up to 1968, and found that more than half of the operations were for bladder calculi. Then we did a prospective study and found that all the children we operated on were all very young and all of them had diarrhea; and this had been going on not for one or two days but for months. Usually they came from villages and rural places, or places where there was no medical care, and we concluded that diarrhea for a month or more, accompanied by dehydration and accompanied by anal excoriation and possibly some elements of stagnation could be a cause. I'm sorry I moved from that area and we didn't complete the project. However I still hear from this colleague and he tells me that they are continuing to work on it.

Blandy: Well, I think that's most interesting, because my own father-in-law told me when he was a house surgeon at the London Hospital in 1914 that his chief sent for him one day and said, "I want to show these visiting surgeons a boy with a stone in the bladder. Make sure there is one on Monday's lists." To which my father-in-law said, "I'm very sorry sir, there aren't any on your waiting lists." "Don't be silly," was the reply, "we always have stones." "No sir, not anymore." It seemed they really had disappeared. My father-in-law's theory was that stones disappeared from the streets of London with the passage of the horse!

Remzi: In 1980 I published an article entitled "Urolithiasis in Childhood." "I started to work at Hacettepe in 1962, and in those days we had a great number of bladder calculi which gradually decreased until 1970. We put this down to the fact that we were graduating 3 urology residents every year and they were going all over the country. Another possible reason we thought of was that pediatric surgeons were starting to perform this kind of surgery. Or the country was getting better off every year. We really don't know what the answer is.