Mitt. Österr. Ges. Tropenmed. Parasitol. 8 (1986) 49–55

Department of Paediatric Nephrology and Metabolic Disorders, Kinderklinik, Medizinische Hochschule Hannover

Pathological urine findings in children with Schistosoma haematobium infection: comparison of different age groups

E. Doehring, J. H. H. Ehrich

Indroduction

Several authors have reported on pathological urine findings in schoolchildren infected with urinary schistosomiasis (PUGH et al. 1980; KASSIM and STEK 1983; MOTT et al. 1983). The investigation of this age group seems convenient since children are easily traceable at school and little difficulty is involved in gaining urine samples for examination. However, a more demanding situation is encountered in younger children due to the well known difficulties to obtain urine specimens of sufficient quantity from them. Therefore reports on patients in early infancy with urinary schistosomiasis are scanty in the literature.

Abdel Salam and Ishaac reported on an infected baby seven months old and this was considered the youngest case so far reported (ABDEL SALAM and EHSAN 1978).

It was the aim of the present investigation to determine quantitatively ova output, proteinuria, erythrocyturia and leukocyturia of infants younger than three years of age and compare the results to schoolchildren between six and nine years.

Patients and Methods

Study area and patients

The investigation was performed in Bouansa, an area with S. haematobium monoinfection in the People's Republic of Congo. 38 mothers were invited to present their children younger than three years to the field laboratory for parasitological examination. Age, height and weight were recorded. A complete physical examination was performed and a thick and thin blood film was done. A self-adhesive plastic device (Kinderurinbeutel, Dahlhausen, FRG) was attached to the infants genital area. Mothers were instructed to stay in the vicinity of the laboratory from 9 a.m. until 3 p.m. and deliver every urine passed during that period. Out of 35 infants with an urine output of more than 20 ml, 14 proved to be infected with S. haematobium and were admitted to the study. Furthermore, for comparison 15 schoolchildren with urinary schistosomiasis aged 6 to 9 years were also admitted. Urine samples of study patients were collected on two consecutive days. All patients were treated with Praziquantel (40 mg/kg) and a follow-up took place one month later.

Urine examination

Ova output was assessed by a sensitive filtration technique (FELDMEIER et al. 1979). Erythrocyturia and leukocyturia were quantitatively determined by a Neubauer

chamber. 2 ml of urine were centrifuged and deep frozen at −20° C and proteinuria later determined by the Coomassie blue dye binding test (BRADFORD 1976). A proteinuria of more than 100 mg per liter was considered pathological (EHRICH et al. 1984). An erythrocyturia and leukocyturia of more than 5 and 20 cells per µl were regarded abnormal.

Ultrasound examination

A portable gray scale ultrasound unit was used with a linear scanner of 3.5 MHz. Abdominal ultrasonography including morphometry of parenchymal organs was done. Bladder wall thickness was measured at the dorsal bladder wall when the organ was filled with urine.

Results

Clinical examination revealed no pathological findings except for occasional spleen enlargement. No malaria parasites were found in the blood.

The younger patients had a median age of 22 months and a low intensity of infection with a median of less than one ovum per 10 ml (table 1). This corresponded to a physiological proteinuria (median 50 mg/l) except in patient number 5 who had an ova output of 6 per 10 ml and a proteinconcentration of 110 mg/l. In contrast erythrocyturia was pathological in all patients with a median of 79 cells per µl. Leukocyturia was moderately increased in 9 out of 14 children. No pathological ultrasonographical findings were encountered. 8 patients had a follow-up one month after therapy with Praziquantel. Except for a minimal amount of nonviable ova output in one patient and a borderline erythrocyturia in another patient physiological values were seen.

In contrast, schoolchildren revealed a significantly higher ova output of 91 per 10 ml before therapy (table 2). This was paralleled by a markedly pathological proteinuria, erythrocyturia and leukocyturia. 3 patients exhibited bladder wall thickening and two showed vesical polyps on sonographical examination. One month after therapy the pathological urine findings had reverted to normal except for one patient who persisted to have a pathological erythrocyturia and leukocyturia despite a marked reduction of ova output. For technical reasons ultrasound examination could not be performed at that time.

The ultrasound picture of the bladder in patient number 13 (Figure 1) exhibits a typical finding of an enlarged and irregular bladder wall with a small vesical polyp.

Discussion

The comparison of ova output and pathological urine findings between children of two age groups revealed a markedly lower ova output in the young ones. This is in accordance with WILKINS et EL SAWY (1977) who found an increasing intensity of infection with progressing age. Accordingly proteinuria, erythrocyturia and leukocyturia were significantly lower in children below 3 years of age. However, a most important finding is the fact that despite very low egg excretion, patients under 3 years exhibited microhaematuria and to some minor degree a pathological leukocyturia. In order to identify patients with a median ova output of 1 per 10 ml urine or less, at least three 10 ml urine samples would have to be filtered, if the probability to identify the patients as being infected is to be 95% (DOEHRING et al. 1983). This requires a high amount of

organisational effort in young children who in this study exhibited a comparably low egg output. Since microhaematuria was such a constant finding in our patients, it seems more practical under field conditions to use this as an indicator for S. haematobium infection. The use of test reagent strips may further facilitate the procedure (BRIGGS et al. 1971).

TABLE 1: **Age, ova output, proteinuria, erythrocyturia and leukocyturia in young children before and after therapy of S. haematobium infection. Numbers of all patients indicate medians and 95% confidence limits.**

Nr.	Age in months	Ova output per 10 ml	Proteinuria mg/l	Erythrocyturia per µl	Leukocyturia per µl
Before therapy					
1	29	0.4	30	180	72
2	3	0.8	30	11	11
3	12	1.5	80	180	5
4	25	0.5	20	40	20
5	10	6.3	110	36	12
6	27	1.5	40	35	18
7	24	4.2	40	46	40
8	15	0.9	60	62	49
9	35	0.3	30	180	72
10	17	0.9	50	62	30
11	20	2.5	40	112	42
12	36	0.5	60	96	27
13	34	0.1	50	108	180
14	11	0.6	60	1152	504
$\tilde{X}$	22	0.9	50	79	35
95% CL**	11–29	0.4–1.5	30–60	36–180	11–72
One month post therapy					
1	29	neg.	40	neg.	neg.
2	3	neg.	60	2	1
3	12	neg.	50	neg.	neg.
4	25	–	–	–	–
5	10	neg.	90	5	4
6	27	neg.	40	neg.	11
7	24	neg.	30	neg.	neg.
8	15	–	–	–	–
9	35	0.3*	40	neg.	neg.
10	17	–	–	–	–
11	20	–	–	–	–
12	36	neg.	70	2	2
13	34	–	–	–	–
14	11	–	–	–	–
$\tilde{X}$	22	neg.	45	neg.	1
95% CL**	11–29	neg.–neg.	30–70	neg.–2	neg.–4

* = nonviable ova

** = 95% CL = 95% confidence limits.

TABLE 2:

Age, ova output, proteinuria, erythrocyturia, leukocyturia and ultrasonographical findings in schoolchildren before and after therapy of S. haematobium infection. Numbers of all patients indicate medians and 95% confidence limits.

Before therapy						
Nr.	Age in years	Ova output per 10 ml	Proteinuria mg/l	Erythrocyturia per µl	Leukocyturia per µl	Ultrasound findings
1	9	91	430	66	30	–
2	7	135	140	168	48	–
3	8	12	110	21	18	–
4	9	117	230	1332	neg.	BWT**
5	8	55	120	1358	180	–
6	7	202	310	1620	756	–
7	6	24	80	288	324	–
8	8	30	180	2	neg.	–
9	6	106	1540	432	612	BWT**
10	8	201	1120	552	276	BWT**
11	7	11	30	108	48	–
12	6	105	90	648	3996	–
13	6	125	630	1620	972	Polyp
14	9	21	480	432	180	Polyp
15	9	36	970	324	12	–
$\tilde{X}$	8	91	230	432	180	–
95% CL***	6–8	24–117	110–480	108–1332	18–612	–
One month post therapy						
1	9	–	–	–	–	
2	7	0.6*	60	3	5	
3	8	–	–	–	–	
4	9	0.01*	90	neg.	neg.	
5	8	–	–	–	–	
6	7	–	–	–	–	
7	6	neg.	70	neg.	neg.	
8	8	neg.	50	1	neg.	
9	6	neg.	140	2	1	
10	8	0.6	160	648	864	
11	7	0.5*	130	neg.	neg.	
12	6	–	–	–	–	
13	6	–	–	–	–	
14	9	neg.	70	neg.	neg.	
15	9	–	–	–	–	
$\tilde{X}$	8	0.01*	80	1	neg.	
95% CL**	6–8	neg.–0.6*	50–140	neg.–3	neg.–5	

* = nonviable ova
** = BWT (bladder wall thickening)
*** = 95% CL = 95% confidence limits

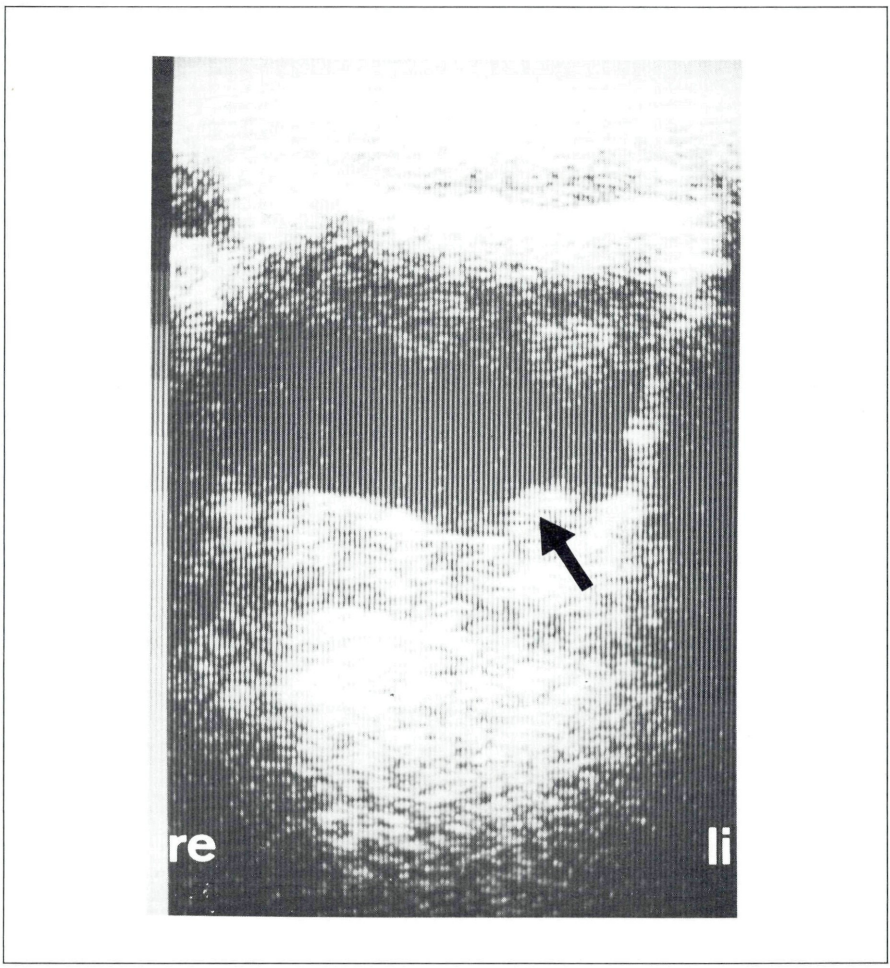

Figure 1: Transverse section through a filled bladder of a schoolboy with urinary schistosomiasis (median ova output 125 per 100 ml urine). The arrow indicates a polypoid lesion. Note also the enlarged and irregular bladder wall.

In other studies erythrocyturia has been shown to be the most sensitive and constant urine abnormality of urinary schistosomiasis (FELDMEIER et al. 1982; KASSIM and STEK 1983; DOEHRING et al. 1985b). Pathological erythrocyturia by itself is not specific for urinary schistosomiasis (DODGE et al. 1976). However, in endemic areas a combination of microhaematuria with physiological proteinuria and some degree of leukocyturia may strongly indicate S. haematobium infection in children under three years of age. On the other hand a normal urine analysis can rule out urinary schistosomiasis with a high degree of certainty. As previously reported for schoolage children (DOEHRING et al. 1984) pathological urine findings also reverted in patients under 3 years of age after antischistosomal treatment.

Ultrasonographical examination of patients with urinary schistosomiasis has recently been reported (BROWNING et al. 1984; DEGREMONT et al. 1985). Lesions in our

patients were confined to the lower urinary tract in schoolage children, whereas no pathological findings were encountered in younger infants. This can most probably be explained by their low intensity of infection.

The prevalence of urinary schistosomiasis in the study area was only 10% (DOEHRING et al. 1985 a). This may well explain the low intensity of infection in infants below three years of age. Since intensity of infection is dependent on the prevalence of the disease in the study area (JORDAN and ROSENFIELD, 1983), it seems worthwhile to conduct a similar study in a region of high prevalence of urinary schistosomiasis. Such an investigation would help to delineate more precisely the age at which morphological abnormalities of the urinary tract due to S. haematobium infection develop.

Summary

14 Congolese children, aged three months to three years and 15 schoolchildren, aged six to nine years with urinary schistosomiasis were investigated by quantitative urine analysis and ultrasonography. Ova output in the young infants was low (median 0.9/10 ml). This was paralleled by a physiological proteinuria. In contrast microhaematuria combined with leukocyturia was a constant finding. Schoolchildren revealed a markedly higher ova output (median 91/10 ml), pathological proteinuria (median 230 mg/l) as well as erythrocyturia and leukocyturia (medians 432 and 180 cells/µl, respectively). Ultrasonographical lesions of the lower urinary tract in them involved bladder wall thickening and vesical polyps, whereas infants below three years showed no morphological abnormalities.

In view of the difficulties in obtaining urine specimens in large quantity from children under three years of age, it is suggested to use microhaematuria as an indicator of infection with urinary schistosomiasis in this age group.

Acknowledgements

This study was supported by Deutsche Forschungsgemeinschaft, grant number Do 288 1-1, Gesellschaft der Freunde der Medizinischen Hochschule and Nordwestdeutsche Gesellschaft für Kinderheilkunde, Federal Republic of Germany. The ultrasound unit has kindly provided by Sonotron Fa. Garching.

References

ABDEL SALAM, E., EHSAN, A. (1978): Cystoscopic picture of Schistosoma haematobium in Egyptian children correlated to intensity of infection. American Journal of Tropical Medicine and Hygiene 27, 774–778.

BRADFORD, M. M. (1976): A rapid and sensitive method for the quantification of microgram quantities of protein utilizing the principle of protein dye binding. Analytical Biochemistry 72, 248–254.

BRIGGS, M., CHADFIELD, M., NUMMERY, D., BRIGGS, M. (1971): Screening with reagent strips. British Medical Journal 3, 433–434.

BROWNING, M. D., SHAKER, I., NAROOZ, G., THOMAS STRICKLAND, G., EL-MASRY, N. A., ABDEL WAHAB, M. N. (1984): Clinical characteristics and response to therapy in Egyptian children infected with Schistosoma haematobium. Journal of Infectious Diseases 149, 998–1004.

DEGREMONT, A., BURKI, A., BURNIER, E., SCHWEIZER, W., MEUDT, R., TANNER, M. (1985): Value of ultrasonography in investigating morbidity due to Schistosoma haematobium infection. Lancet 1, 662–665.

DODGE, W. F., WEST, E. F., SMITH, E. H. et al. (1976): Proteinuria and hematuria in schoolchildren: epidemiology and early natural history. Journal of Pediatrics 88, 327–347.

DOEHRING, E., EHRICH, J. H. H., REIDER, F., DITTRICH, M., SCHMIDT-EHRY, G., BRODEHL, J. (1985a): Morbidity in urinary schistosomiasis: relation between sonographical lesions and pathological urine findings. Tropical Medicine and Parasitology 36, 145–149.

DOEHRING, E., EHRICH, J. H. H., VESTER, U., FELDMEIER, H., POGGENSEE, U., BRODEHL, J. (1985b): Proteinuria, hematuria and leukocyturia in children with mixed urinary and intestinal schistosomiasis. Kidney International 28, 520–525.

DOEHRING, E., FELDMEIER, H., DAFFALLA, A. A. (1983): Day-to-day variation and circadian rhythm of egg excretion in urinary schistosomiasis in the Sudan. Annals of Tropical Medicine and Parasitology 77, 587–594.

DOEHRING, E., FELDMEIER, H., DAFFALLA, A. A., EHRICH, J. H. H., VESTER, U., POGGENSEE, U. (1984): Intermittent chemotherapy with trichlorfon (metrifonate) reverses proteinuria, hematuria and leukocyturia in urinary schistosomiasis: results of a three year field study. Journal of Infectious Diseases 149, 615–620.

EHRICH, J. H. H., FOELLMER, H. G., KRULL, F., WINNEKEN, H. J., WURSTER, U. (1984): Aussagen, Fehlerquellen und Grenzen der Proteindiagnostik im Urin II. Normalwerte und Klassifikation der pathologischen Proteinurien. Monatsschrift für Kinderheilkunde 132, 144–150.

FELDMEIER, H., BIENZLE, U., DIETRICH, M. (1979): Combination of a viability test and a quantification method for Schistosoma haematobium eggs (filtration trypanblue staining technique). Tropical Medicine and Parasitology 30, 417–422.

FELDMEIER, H., DOEHRING, E., DAFFALLA, A. A., DIETRICH, M. (1982): Simultaneous use of a sensitve filtration-technique and reagent strips in urinary schistosomiasis. Transactions of the Royal Society of Tropical Medicine and Hygiene 76, 416–421.

JORDAN, P., ROSENFIELD, P. L. (1983): Schistosomiasis control: past present and future. Annual Review of Public Health 4, 311–334.

KASSIM, O. O., STEK, M. (1983): Bacteriuria and haematuria in infection due to Schistosoma haematobium. Journal of Infectious Diseases 147, 960 (letter).

MOTT, K. E., DIXON, E., OSEI-TUTU, E., ENGLAND, E. C. (1983): Relation between intensity of Schistosoma haematobium infection and clinical haematuria and proteinuria. Lancet 1, 1005–1008.

PUGH, R. N. H., BELL, D. R., GILLES H. M. (1980): Malumfashi endemic diseases research project (XV). The potential medical importance of bilharzia in northern Nigeria: a suggested rapid, cheap and effective solution for control of Schistosoma haematobium infection. Annals of Tropical Medicine and Parasitology 74, 597–613.

WILKINS, H. A., EL SAWY, M. (1977): Schistosoma haematobium egg counts in a Nile delta community. Transactions of the Royal Society of Tropical Medicine and Hygiene 71, 486–489.

ADDRESS FOR CORRESPONDENCE:

Dr. E. Doehring
Dept. of Paediatric Nephrology and Metabolic Disorders
Kinderklinik, Medizinische Hochschule

Konstanty Gutschow Strasse 8
D-3000 Hannover 61, F.R.G.