THE INCIDENCE OF BILHARZIA IN THE DURBAN AREA*

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The World Health Organization,[1] reviewing the problem of bilharziasis, commented: 'In recent years the prevalence of bilharziasis has shown an increase—an increase that is largely of man's own making, because, by the construction of dams, irrigation systems and other water conservation works in his attempts to relieve the problem of feeding the world's ever-growing population, he is creating the very conditions that favour the spread of the disease'.

For a proper perspective of the epidemiology, some concept of the incidence of the disease must be attained. Though an over-all survey of the incidence of bilharzia in Natal has not been conducted, numerous workers have, from time to time, reported on incidence rates in Natal.

Kay-Sharp[2] examined urine samples of Indian school children from the Natal coastal regions and reported the following incidence rates for *S. haematobium*: Stanger 13·3%, St. Aiden (Durban) 7·0%, Depot Road (Durban) 3·1%, Umgeni (Durban) 10·0%. Dormer[3] examined African school children on the Natal coast and reported an over-all incidence of 10·5% active bilharzia. The highest incidence was recorded in a school in the Umkomaas area (39·6%).

Freedman and Elsdon-Dew,[4] from a single urine examination, discovered an infection rate of over 50% in African boys between 10 and 15 years old in Durban. Later Elsdon-Dew[5] believed that these figures were too low and that the probable incidence was nearer 100%.

Stools examined from hospital patients with dysentery showed ova of *S. mansoni* in 0·8% of Africans and 1·4% of Indians.[6] In a further study of intestinal parasites in different African socio-economic groups in Durban, Elsdon-Dew[7,8] demonstrated an incidence of *S. mansoni* of up to 1·8%.

Bates and Alberto,[9] from Durban, reported on the incidence of *S. mansoni* as found in routine stool examination of hospital patients: Whites 1%, Africans 1% and Indians 3%. Powell *et al.*[10] noted that the incidence of *S. mansoni* infections in Africans with acute amoebic dysentery was 3%, in bacillary dysentery 8% and in a control group 2%. Employing rectal biopsies, Schneider[11] reported that the incidence of *S. mansoni* in African and Indian hospital patients (King George V Hospital, Durban) was 11% and 15% respectively.

PRESENT STUDY

The aim of the present study was to assess the incidence of bilharzia in the African and Indian population in and around Durban.

The survey was carried out in 3 groups: (1) in autopsy material; (2) in school children; (3) in hospital out-patients. I felt that correlation of the results of 3 differing approaches would give a better estimate of the incidence in the area.

*Based on a thesis 'The clinico-pathological manifestations of schistosomiasis in the African and the Indian in Durban', approved for the degree of Doctor of Medicine in the University of Natal.

1. The Incidence of Schistosomiasis in Autopsy Material

Material and Methods

The bladder and rectum were removed from autopsies performed on the age group 2 - 65 years at the King Edward VIII Hospital during the year 1963. The majority of these (700) were routine hospital examinations and the remaining 200 were medico-legal autopsies on cases dying from unnatural causes. The inclusion of the latter group may offset the 'selection' inherent in hospital material.

The race and sex distribution of the autopsy cases is shown in Table I.

TABLE I. SEX AND RACE OF AUTOPSIES EXAMINED

Race	*Male*	*Female*	*Total*
African	492	330	823
Indian	52	25	77
Total	544	355	900

The bladder and rectum were subjected to 3 methods of examination:

(*i*) *The direct 'squash'-slide method.* Fresh snips of tissue from the bladder and rectal mucosa were crushed between 2 microscopic slides separately and examined microscopically.

(*ii*) *Histology.* A specimen from the bladder and one from the rectum was taken separately and fixed in formol-saline, sectioned and stained by haematoxylin and eosin (H & E).

(*iii*) *Digestion technique.* 20 G each of the remainder of the bladder and rectum were digested overnight in 10% caustic potash at 60°C and the centrifuged deposit examined the following morning for schistosome ova. The quantitative results will be reported elsewhere.

Results

The relative efficiency of the three methods employed may be gauged from Table II. The digestion method gave the best results, thus confirming the finding of previous workers.[12,13] Moreover, it has the added advantage in that quantitative results are obtained, i.e. the egg load of the tissue can be determined.

TABLE II. INCIDENCE OF BILHARZIASIS AS DETERMINED BY 3 DIFFERENT METHODS IN 900 AUTOPSIES

Method	*Bladder +ve*		*Rectum +ve*		*Composite* +ve*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Snip	217	24	165	18	268	30
Histology ..	185	21	98	11	211	23
Digestion ..	237	26	178	20	277	31

*Positive result either from rectum or bladder and combining *S. haematobium* and *S. mansoni*.

The 'snip' method gave results not very different from that of the digestion technique. It has the advantage of being an extremely simple procedure and by far the least time-consum-

ing. However, no quantitative analysis of the egg load is possible.

The histological technique is the least efficient due to the inadequate sampling (approximately 3 mg. as against 20 G for digestion). Moreover, it is difficult to identify the species of ova in sections. It does have the advantage, however, of revealing the nature of any pathology.

The incidence of the different schistosome species is shown in Table III. From Table III it is apparent that the incidence

TABLE III. INCIDENCE OF *S. haematobium*, *S. mansoni* AND *S. mattheei* AS DETERMINED BY TWO METHODS IN 900 AUTOPSIES*

Type	Snip		Digestion	
	No.	%	No.	%
S. haematobium	231	26	249	28
S. mansoni (total)	58	6	58	6
S. mansoni (pure)	37	4	28	3
S. mansoni and *S. haematobium* (double)	21	2	30	3
S. mattheei	7	1	20	2
Total +ve (all types)	268	30	277	31

*Combining rectal and vesical results.

of all types of schistosomiasis was 31%; 28% had *S. haematobium* infections; 3% had double infections (*S. haematobium* and *S. mansoni*), and only 2% had *S. mattheei* infections.

Age, sex and race incidence. The incidence of all types of bilharziasis according to race, sex and age are tabulated in Tables IV - VI.

In 25 Indian female autopsies 3 were found to have bilharzial infection. Of these, 2 had *S. haematobium*, 1 *S. haematobium* and *S. mansoni*, and 1 *S. mansoni* and *S. mattheei*.

TABLE IV. AGE INCIDENCE OF BILHARZIASIS IN 494 AFRICAN MALE AUTOPSIES

Ages	Total in age group		S. haematobium		S. mansoni		S. mattheei		Total +ve	
	No.	%	No.	%	No.	%	No.	%	No.	%
2– 9	65	13·2	4	6·2	0	0	1	1·5	4	6·15
10–19	32	6·5	14	43·7	7(3)*	22	2	6·3	17	53·1
20–29	72	14·6	28	39·0	4	0·6	0	0	28	39·0
30–39	101	20·4	38	37·6	12(6)	12·0	5	5	44	44·0
40–50	163	33·0	57	35·0	11(7)	6·7	5	3·1	64	39·0
50+	60	12·3	8	13·3	4(2)	6·6	0	0	10	16·3
Over-all total	493	—	149	30·1	38(18)	7·7(3·6)	13	2·6	167	33·8

*Figures in parentheses refer to pure *S. mansoni* infections

TABLE V. AGE INCIDENCE OF BILHARZIASIS IN 330 AFRICAN FEMALE AUTOPSIES

Ages	Total in age group		S. haematobium		S. mansoni		S. mattheei		Total +ve	
	No.	%	No.	%	No.	%	No.	%	No.	%
2– 9	70	21·2	7	10	1	1·4	0	0	7	10
10–19	31	9·4	10	32·2	1(1)*	3·2	0	0	11	35·4
20–29	42	12·7	12	28·6	2(1)	4·8	1	2·4	13	30·1
30–39	68	20·6	24	35·6	3(1)	4·4	0	0	25	36·8
40–50	79	24·0	21	26·6	2(1)	2·5	3	3·8	22	27·8
50+	40	12·1	7	17·5	1(1)	2·5	1	2·5	8	20·0
Over-all total	330	—	81	24·5	10(5)	3(1·5)	5	1·5	86	26

*Figures in parentheses refer to pure *S. mansoni* infections.

TABLE VI. AGE INCIDENCE OF BILHARZIASIS IN 52 INDIAN MALE AUTOPSIES

Ages	Total in age group		S. haematobium		S. mansoni		S. mattheei		Total +ve	
	No.	%	No.	%	No.	%	No.	%	No.	%
2– 9	6	12	0	0	0	0	0	—	0	0
10–19	10	19	4	40	1(1)*	10	0	—	5	50
20–29	9	17	5	56	3(1)	33	0	—	6	67
30–39	10	19	2	20	0	0	1(1)	—	3	30
40–50	10	19	5	50	1	10	0	—	5	50
50+	7	14	1	14	3(3)	43	0	—	4	57
Over-all total	52	—	17	32·7	8(5)	15·4	1	—	23	44·2

*Figures in parentheses refer to pure *S. mansoni* infections.

It will be noted from the tables that there were insufficient Indian autopsies to allow comparison with the breakdown of the African group.

From the tables it is apparent that the highest incidence of bilharziasis in the African is in the 2nd decade. The infection thereafter maintains a constant rate in the 3rd - 6th decades. In the Indian males, however, the highest incidence is apparently in the 3rd decade and is maintained at a fairly high level thereafter.

The tables show that 30% of African males, 33% of Indian males and 24·5% of African females harbour *S. haematobium*.

From the autopsy studies, 7·7% of African males were infected with *S. mansoni* (3·6% pure *S. mansoni* infection) compared with 15·4% (9·6% pure *S. mansoni*) in the Indian group. Only 3% (1·5% pure infections) of the African females harboured *S. mansoni* infection.

From this study it would appear that *S. haematobium* infection is almost 4 times as common as *S. mansoni* infection in the local Indian and African male populations and 8 times as common in the African female. Indian males were infected with *S. mansoni* twice as often as African males.

These studies also demonstrate the relative rarity of *S. mattheei* infections in the local population. In no instance was there a pure *S. mattheei* infection—it was always associated with *S. haematobium*.

2. Incidence of S. haematobium in School Children

The World Health Organization Expert Committee on Bilharziasis[14] decided for numerous reasons that children of school-going age constituted the best material for the comparison of infection rates.

Material and Methods

In each of 2 widely separated areas of Durban a pair of schools, one Indian and one African, in proximity to one another, were selected so as to compare the two social groups under similar exposure. Urine specimens from 819 children were examined. Ages ranged from 6 to 16 years.

The results are tabulated in Tables VII and VIII. The overall incidence of *S. haematobium* infection in the 819 school children examined was 23·5%. However, the varying rates in different areas demonstrates the focal endemicity of the

TABLE VII. INCIDENCE OF *S. haematobium* IN AFRICAN SCHOOL CHILDREN

School	Male			Female			Total		
	Total	No. +ve	%	Total	No. +ve	%	No.	No. +ve	%
Stormville, Redhill	87	11	12·6	87	8	9·2	174	19	11
Marantha, Umhlatuzana	113	80	70·8	86	54	62·7	199	134	67
Total	200	91	45·5	173	62	35·8	373	153	41

TABLE VIII. INCIDENCE OF *S. haematobium* IN INDIAN SCHOOL CHILDREN

Total	Male			Female			Total		
	Total	No. +ve	%	Total	No. +ve	%	No.	No. +ve	%
Redhill	138	2	1·4	108	3	2·8	246	5	2
Umhlatuzana	100	30	30·0	100	5	5·0	200	35	17·5
Total	238	32	13·4	208	8	3·8	446	40	9

disease. In an area of high endemicity, like Umhlatuzana, the incidence in the African group (male and female) was 67%; while in the Stormville group the incidence in a similar age group was only 11%. This trend is also shown by the Indian group; the Umhlatuzana group (male and female) having an incidence of 17·5% but only 2% in the Redhill area.

It is also apparent from the tables that there is little difference between the male and female rates in African children. By contrast, there is a marked difference in the sex incidence in Indian children. Whereas 30% of the boys were infected in Umhlatuzana, only 5% of the girls from the same school showed infection with *S. haematobium*.

African school children had the higher incidence (41%)—being almost 5 times that of the Indian group.

3. Incidence of S. haematobium Infections in Medical Outpatients

Material and Methods

The results of the examination of 2,200 urine specimens by the laboratory attached to the King Edward VIII Hospital outpatient department were analysed. Of these, 688 were from Indian and 1,512 from African patients. The ages ranged from 2 to 75 years in both sexes.

Choice of specimens. As the majority of patients presented with 'medical complaints', a midstream specimen of urine was usually requested by the physician-in-charge for examination. A certain unknown number of patients, however, presented with terminal haematuria as their main complaint, and in these cases, presumably a terminal specimen of urine was examined. Bennie,[15] Gerritsen *et al.*[16] and Stimmel and Scott[17] have demonstrated that the early afternoon specimen was most likely to reveal ova of *S. haematobium*. More recently, Jordaan[18] and Onori[19] have confirmed these observations. As the ideal specimen was not examined in a high proportion of these cases, it is probable that the incidence of bilharzia is higher than that indicated in this study. This should be borne in mind in the interpretation of the results.

Results

The results are tabulated in Table IX. The incidence of *S. haematobium* revealed is almost equal in the 2 racial groups and does not differ much from that shown by digestion of autopsy material, or from the single urine examination of school children of the same racial groups.

TABLE IX. INCIDENCE OF *S. haematobium* IN ROUTINE OUTPATIENT URINE SPECIMENS

Race	Total no. examined	*S. haematobium* No.	*S. haematobium* %
African	1,512	387	25·6
Indian	688	169	24·6
Total	2,200	556	25·3

Comparison of Methods

The results obtained from all the methods applied are compared in Table X, from which it is apparent that the over-all incidence of *S. haematobium* in the local African and Indian populations, as ascertained by any method, is of the order of 25%. Surprisingly, all methods gave very similar results.

TABLE X. INCIDENCE OF *S. haematobium* INFECTIONS IN THE DURBAN AREA: AFRICANS AND INDIANS DISCOVERED BY VARIOUS METHODS

Method of examination	African			Indian			Total		
	No. examined	No. +ve	%	No. examined	No. +ve	%	No. examined	No. +ve	%
Postmortem bladder and rectal snip	—	—	—	—	—	—	900	231	26
Postmortem histology	—	—	—	—	—	—	900	211	23
Postmortem digestion	823	230	28	77	21	27·3	900	249	28
Urine examination (schools)	373	153	41	446	40	9·0	819	193	23·5
Urine examination (outpatients at King Edward VIII Hospital)	1,512	387	25·6	688	169	24·6	2,200	556	25·3

Incidence of S. mansoni. Mass survey to determine the prevalence of *S. mansoni* infections is difficult. It was not possible to undertake a general population survey either by stool examination or by rectal-snip methods.

However, it is believed that a sufficiently large group has been sampled by the autopsy digestion technique and the results tabulated in Tables IV - VI are fairly representative of the population.

Incidence of Double Infections Revealed by Rectal Biopsy

Rectal snips were done on patients who presented initially with terminal haematuria and where urine examinations were positive for *S. haematobium*.

A child's proctoscope was inserted into the rectum (in adults and children) and a snip of mucosa, no larger than a rice grain, was obtained by means of a punch biopsy under direct vision. This was squashed between 2 microscope slides, bound with adhesive strapping, and examined immediately under the microscope.

A total of 225 patients were examined by this method, of which 75 were Indian and 150 African patients. The large majority were males. The results are tabulated in Table XI, which shows that *S. mansoni* was detected in 20% of the patients harbouring *S. haematobium*.

TABLE XI. RECTAL BIOPSY RESULTS OF 225 PATIENTS WITH *S. haematobium* INFECTIONS

Race	Total examined	*S. mansoni* +ve No.	*S. mansoni* +ve %	*S. haematobium* +ve No.	*S. haematobium* +ve %
Indian	75	20	23	48	64
African	150	25	17	117	78
Total	225	45	20	165	73·3

In the autopsy study, 12% of the 249 cases with *S. haematobium* infection harboured *S. mansoni* as well (Tables IV - VI).

An interesting finding in the clinical study was that in proven *S. haematobium* infection (ova recovered in urine) approximately 75% had rectal involvement with *S. haematobium*. It also demonstrated that rectal biopsy as a means of diagnosis of *S. haematobium* infections is only 75% accurate. From postmortem studies on 249 cases of *S. haematobium* infection, the parasite was found in rectal material in only 51·5% (128).

DISCUSSION

From the results obtained, it is apparent that the over-all incidence of *S. haematobium* infections in the Durban African and Indian population is of the order of 30%, while that of *S. mansoni* is not higher than 10%.

The focal endemic nature of the disease is demonstrated by the high incidence of *S. haematobium* in school children in one area (67%) while in another area the incidence was as low as 2%.

The over-all incidence quoted contrasts with the opinion of Elsdon-Dew[5] that approximately 100% of the population are probably infected with *S. haematobium* and that at least a quarter of a million are infected with *S. mansoni*.[20]

According to the results demonstrated in this study, the Durban area falls in the 'endemic' area as defined by Manson-Bahr,[21] unlike the hyperendemic areas of Egypt,[22] Mozambique[23] and Rhodesia.[12]

The incidence of *S. mansoni* in Durban (10%) is also considerably lower than that cited by Pitchford[24] (1954, 41·9 - 77·6%), Azar *et al.*[25] (1958, 61%) and Schneider[11] (1958, 32·7%) for the Transvaal lowveld.

From the findings in this study, *S. haematobium* is almost 3 times as common as *S. mansoni* infections. This is contrary to the finding of Cosnett[26] that ova of *S. mansoni* were found in stool as commonly as ova of *S. haematobium* in urine of patients in King Edward VIII Hospital.

The incidence of *S. haematobium* in the 2 racial groups in Durban is approximately equal. The over-all incidence

in the autopsy material and that in the outpatient group is similar. There is, however, a marked racial difference in the school-going age group (41% for Africans, 9% for Indians).

Whereas the incidence of bilharziasis is higher in the African male compared with the African female in autopsy material, no such difference exists in African school children. However, there is a marked sex difference in Indian school children, bilharzia being 6 times as common in boys as in girls in the same school. Prates and Gillman[23] found only a slight preponderance of males compared with females in Mozambique, while Mousa[22] stated that the rate of infection was definitely higher in Egyptian male peasants.

The age incidence of *S. haematobium* infections in autopsy material was found to be highest in the second decade, which is in agreement with the reports of Mousa[22] and Prates and Gillman.[23] However, in contrast to the reports of these authors that the infection rate decreases considerably thereafter, I found that the rate of infection was maintained at a high level up to the fifth and sixth decades.

Both autopsy results and the rectal biopsy findings in clinical patients confirm the experience of previous observers that rectal biopsy is a simple and efficient procedure for the diagnosis of *S. mansoni* infections and that approximately 75% of *S. haematobium* infections can be similarly detected.

The autopsy results revealed the minor problem of zoonosis—*S. mattheei* being present in 2% of cases. However, in no instance was there a pure *S. mattheei* infection, this parasite always being associated with *S. haematobium* infections.

SUMMARY

1. The incidence of *S. haematobium* infection in the local African and Indian population was assessed using 3 methods: (*a*) autopsy digestion technique in 900 consecutive postmortems (also comparing snip and histology results), (*b*) single urine examination of 819 school children in the age group 6 - 16 years, and (*c*) analysis of urine examination results of 2,200 medical outpatients. The efficacy of the various methods was demonstrated. The incidence of *S. haematobium* infection was of the order of 30%.

2. The incidence of *S. mansoni* was established by: (*a*) autopsy digestion technique and rectal snips in 900 consecutive postmortems, showing an incidence of 6%, and (*b*) rectal biopsies performed on 275 clinical patients with *S. haematobium* infection, with an incidence of 20%. It is believed that the probable incidence is of the order of 10%.

3. *S. mattheei* was found in 2% of the autopsy cases.

4. Whereas only 12% of *S. haematobium* infections had concomitant *S. mansoni* infections in autopsies, double infections were found in 20% of 225 clinical cases with *S. haematobium* infection.

5. The race and sex incidence of schistosomiasis in the local population was demonstrated.

6. These results were compared with those quoted by other local workers.

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HAND INFECTIONS: MANAGEMENT AND RESULTS BASED ON A NEW CLASSIFICATION*

A STUDY OF MORE THAN 1,000 CASES

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In the pre-war, pre-antibiotic era, hand infections caused a great deal of concern, since the dreaded spread of infections, against which surgeons could do very little, often resulted in extensive disability and even mortality.

Iselin[1] reports that in Zurich, between 1920 - 1930, 'wounds of the fingers accounted for the greatest mortality (17 deaths) and compound fractures of the femur took second place with 7 deaths'.

Because of this over-riding fear of spreading the infection, a system of indirect incisions for drainage was developed. These incisions traversed healthy tissues, endan-

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