

Ultrasonography in Schistosomiasis in Africa

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Approximately 50 publications have become available in the international literature on ultrasonography in schistosomiasis in Africa. Geographically these cover Congo, Egypt, Kenya, Mali, Mauritius, Niger, Senegal, Sudan, Tanzania and East African Islands as well as Zimbabwe. Further studies are ongoing in many countries, such as Burundi, Ghana, Madagascar and Uganda.

*It was shown that ultrasonography is useful in the detection of morbidity induced by schistosomiasis on an individual basis and on the community level. There is indication for varying morbidity patterns in different African foci. Post-treatment monitoring has provided evidence for reversibility of pathological lesions induced by *Schistosoma* (*S.*) *haematobium* and *S. mansoni*, even though evidence for reversibility of periportal fibrosis in adults is not yet satisfactorily substantiated. A standardized set of criteria for ultrasonographical observations has been worked out and is presently in the process of being refined. It is thus hoped that standardization will contribute to render studies in different endemic settings comparable on a global basis.*

Key words: schistosomiasis - ultrasound - Africa - morbidity - epidemiology

Around 50 publications in the international literature have described the experience of various authors using ultrasonography for the detection of morbidity induced by *Schistosoma* (*S.*) *mansoni* and *S. haematobium* in Africa. Except for one report (Odongo-Aginya et al. 1994) *S. intercalatum* has not been covered adequately. The time-period covered by these reports roughly encompasses ten years. The present paper summarizes these publications under two particular aspects: the contribution of ultrasonography towards a better *in vivo* description of schistosomiasis related morbidity, and new insights into the epidemiology of this disease in Africa. Previous review papers have covered selected aspects of ultrasound application in schistosomiasis in Africa (Houston 1991, Macpherson 1992, Abdel-Wahab & Strickland 1993, Strickland & Abdel-Wahab 1993).

An early account of work with ultrasound in patients with *S. mansoni* infection was given in 1978 (Abdel-Wahab et al. 1978), but not published in the international literature. Characteristic periportal echogenicities were described, which corresponded to "Symmers' clay pipe stem fibrosis" (Symmers 1904). Increasing portal vein diameter correlated to advanced disease status. In October 1990 sonographers, schistosomiasis experts, WHO officials and epidemiologists from all over the world met to discuss the application of ultrasonography with respect to schistosomiasis (Hatz et al. 1992, WHO, unpublished document 1991). Besides reviewing the experience gained

so far, the Working Group agreed upon recommending a unified classification-system. A consensus was agreed upon on the classification of *S. haematobium* related lesions. Concerning *S. mansoni* infection the proposed classification basically followed the staging system of Abdel-Wahab et al. (1989, 1992a).

EGYPT

With respect to *S. mansoni* infection hospital studies and field investigations have been published (Abdel-Wahab et al. 1990, 1993). Hospitalized patients had a remarkably high rate of advanced hepatosplenic schistosomiasis. In contrast schoolchildren under field conditions had predominantly mild periportal thickening. The patency of shunts in the postsurgery period were extensively assessed by Bessa et al. (1987).

Among other techniques ultrasound was part of a field study of patients with *S. haematobium* infection (Browning et al. 1984). Two recent papers concentrated on the standardization of *S. haematobium* related lesions in a hospital setting and under field conditions (Abdel-Wahab et al. 1992b, Nafeh et al. 1992). Periportal thickening was detected in schoolchildren with *S. haematobium* mono-infection, but a causal association between the two phenomena has not been confirmed from Sudan (Eltoum et al. 1993).

SUDAN

Studies in Sudan are remarkable for the first application of ultrasonography in *S. mansoni* in-

ected patients under field conditions (Homeida et al. 1988 b, c, Doehring-Schwerdtfeger et al. 1990). Two different systems of morbidity classification (Homeida et al. 1988 a, b, Doehring-Schwerdtfeger et al. 1989) have demonstrated high morbidity of children and adults in Gezira Province of Central Sudan (Homeida et al. 1988b, Doehring-Schwerdtfeger et al. 1990). Between 13% and 18% of the complete community in two villages had signs of periportal fibrosis, while in schoolchildren, this rate reached almost 40%. Clinical examination was of limited value as an indicator of periportal fibrosis (Doehring-Schwerdtfeger et al. 1992 b). A hospital based study indicated high diagnostic accuracy of ultrasound in advanced cases of *S. mansoni* infection when compared with liver biopsy (Homeida et al. 1988 a). This was later confirmed in Egypt as well (Abdel-Wahab et al. 1989). Ultrasound parameters were useful to indicate the risk of upper gastroesophageal bleeding (Richter et al. 1992a).

Antischistosomal treatment with praziquantel was followed by reversibility of periportal thickening (Mohamed-Ali et al. 1991, Homeida et al. 1991, Doehring-Schwerdtfeger et al. 1992a). These observations, however, need further confirmation in other endemic foci. Renal function and morphology on ultrasound in children under field conditions and 58 hospitalized adults was largely normal (Elsheikh et al. 1989, Kaiser et al. 1989), as opposed to the experience in South America, where glomerulonephritis occurs more frequently (Andrade & Rocha 1979). Cor pulmonale due to *S. mansoni* infection did not occur in patients investigated in Wad Medani Teaching Hospital with echocardiography (Richter et al. 1990). Similar ultrasound findings were found in Sudanese and Brazilian patients using the "Managil-classification" (Richter et al. 1992b), but using this classification inter-observer variance in early stages of periportal fibrosis was in the range of 20% (Doehring-Schwerdtfeger et al. 1992c).

TANZANIA AND EAST AFRICAN ISLANDS

The value of ultrasonography in *S. haematobium* infection in comparison with radiological techniques and cystoscopy was assessed by Degremont et al. (1985) and Burki et al. (1986) in Tanzania. Both imaging techniques were comparable in their sensitivity and specificity to detect *S. haematobium* induced morbidity of the urinary tract. The prevalence of *S. haematobium* infection in 231 schoolchildren was 62% and 29% of these had congestive changes of the kidneys (Degremont et al. 1985). Bladder lesions were even more prevalent (i.e. 68%). There was a clear correlation between abnormalities of the urinary tract and schistosomiasis.

Hatz et al. (1990 b) evaluated ultrasound within the framework of Primary Health Care Services. They considered ultrasound as cost-effective except for the initial investment (around 15.000 US Dollars) and appropriate for research purposes, but not for individual patient care in endemic areas.

CONGO

Morphological aspects of the urinary tract in *S. haematobium* infection have been provided by Dittrich and Doehring (1986). 54% of *S. haematobium* infected patients had bladder abnormalities and 23% revealed urinary tract obstruction. Urinary egg excretion correlated with the degree of pathological involvement and high proteinuria was an indicator of bladder wall enlargement and vesical pseudopolyps (Doehring et al. 1985a). As early as three months after therapy with praziquantel lesions of the lower urinary tract, but not upper urinary tract, were reversible (Doehring et al. 1985b). Reversibility of pathological lesions was more pronounced one year after treatment (Doehring et al. 1986). Similar results have been provided from Tanzania (Hatz et al. 1990a) and Niger (Devidas et al. 1989). Reversibility of minor lesions was found within six months.

ZIMBABWE

Ultrasound screening of sugar cane workers (Ndamba et al. 1991) and of village populations in *S. mansoni* endemic areas (Houston et al. 1993) revealed considerable prevalence rates of hepatosplenic morbidity, including severe stages with signs of portal hypertension. Young individuals had significantly less morbidity, a finding that is in accordance with results from southern Zimbabwe (H. Friis, personal communication). Patients investigated in hospital because of bleeding from oesophageal varices exhibited typical sonographical images of late stage hepatosplenic schistosomiasis in a substantial proportion of cases (Davidson et al. 1991).

WEST AFRICA

S. mansoni induced morbidity in several foci in Mali was found to be limited (Kardorff et al. 1994). In villages of high prevalence, but only mild intensity of infection, there was no significant correlation between *S. mansoni* infection and periportal thickening, portal vein diameter or liver- and spleen sizes. In another village with higher intensity of infection an increase of prevalence of periportal thickening and portal vein diameter in individuals with *S. mansoni* infection was detected. However, cases with severe morbidity or portal hypertension were not detected in Mali at all, even in individuals with high intensity of infection. *S. haematobium* related morbidity in several foci in Mali was highly prevalent and severe and re-

sponded well to antischistosomal treatment with praziquantel (Kardorff et al. unpublished).

An epidemic outbreak of *S. mansoni* infection occurred around Richard Toll in the Senegal River Basin (Talla et al. 1990) and ultrasound was used to assess the development of morbidity within this epidemiological setting (Rouquet et al. 1993). The study was performed roughly three years after the infection had become endemic in Richard Toll. In this very special epidemiological circumstances, a large proportion of the population exhibited extremely high egg output (Stelma et al. 1993, Kardorff et al. unpublished), but hepatosplenic morbidity was limited and predominantly mild (Rouquet et al. 1993).

Experience in Niger was largely confined to *S. haematobium* and contributed towards further clarification of pathological lesions by cystoscopy and histology (Heurtrier et al. 1986, Devidas et al. 1988). Field studies contributed towards the usefulness of ultrasound in the description of morbidity induced by *S. haematobium* (Lamothe et al. 1988) and its post-treatment development (Devidas et al. 1989).

OUTLOOK

Ultrasonography has been established as a valuable tool for the detection and quantification of schistosomiasis related morbidity and for follow-up of lesions after treatment. By use of portable ultrasound machines, it became possible to conduct screening studies of the population of endemic areas in order to establish prevalence rates of hepatosplenic lesions and urinary tract abnormalities. Research in several African countries presently concentrates on the detailed analysis of morbidity patterns in various geographical areas. As seen from the details given above, differences in *S. mansoni* related morbidity seem to emerge, despite comparable parasitological and epidemiological conditions between suspected "high morbidity" regions (e.g. Egypt, Sudan, Zimbabwe) and other countries, where severe hepatosplenic morbidity has not been found (mainly West Africa). At the same time, efforts are being undertaken to further validate the Cairo classification and to standardize methodology. Furthermore efforts are under way to delineate the extent of inter- and intra-observer variance of morbidity recording.

Concerning *S. haematobium*, studies use ultrasound mainly to follow up treatment and to establish adequate time intervals for morbidity control. This will not only supply health services with invaluable informations necessary to modify health care strategies, but will also improve our understanding of the development of organ lesions induced by schistosomiasis. In addition to the mentioned countries ultrasound activities are also car-

ried out in Ghana, Uganda, Burundi and Madagascar. These studies will further contribute towards the overall picture of schistosomiasis morbidity in Africa.

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