THE USE OF EXERCISE TEST IN ASSESSMENT OF CARDIO PULMONARY FUNCTION IN BILHARZIAL INFESTATION

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Thesis

Submitted in Partial Fulfilment of the Requirement for the Degree of

M.D. (Chest Diseases)

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ACKNOWLEDGEMENTS

This work has been suggested and supervised by Professor M. Y. El-Gammal for whom I am most grateful for his suggestions, guidance and generous advice which made the work possible.

I would like also to express my thanks and appreciation to Professor S. A. El-Warraki for his kind help and guidance.

I feel indebted to Professor S. M. Shoeb for his supervision and for the staff of the Chest Section for their cooperation.

C O N T E N T S

INTRODUCTION

Lung involvement in schistosomiasis is essentially an obliterative disorder of the pulmonary vessels, which occurs as a result of multiple and repeated embolization of the pulmonary arterioles by the ova of the parasite.(87) The pulmonary vascular lesion tends to be more massive in cases with hepatosplenic schistosomiasis in which ova and worms can reach the pulmonary circulation via the newly developed collaterals.(87) In a minority of cases with hepatosplenic schistosomiasis, marked restriction of the vascular bed occurs; this gives rise to raised pulmonary artery pressure with consequent hypertrophy and failure of the right ventricle, i.e. schistosomal cor pulmonale.(87)

In such an obliterative vascular disorder, study of the ventilation-perfusion relationship and the gas exchange is important in assessment of the extent of pulmonary involvement. In countries where the disease is endemic the methods used should be simple, reliable and suited to the requirement of clinical practice as well as field surveys.

The aim of the present work is to present methods for assessment of the extent of the pulmonary involvement by schistosomiasis by measurements of the resting and steady state ventilation-perfusion relationship as well as the gas exchange and the ventilatory response to exercise.

" REVIEW OF THE LITERATURE "

- PATHOLOGY
- CLINICAL AND RADIOLOGICAL MANIFESTATIONS
- HAEMODYNAMICS AND FUNCTIONS STUDIES
- ELECTRO-CARDIOGRAPHY CHANGES

Bilharz 1892, was the first to discover an adult bisexual worm in the mesenteric veins[6]. In 1893 Manson's[66] discovery of two types of ova suggested the presence of two species of worms which were later described by Sambon, 1908.[83] The intermediate host of the parasite which is a snail, was described by Leiper 1916.[62] Faust and Maleny 1924, reported that cercariae reach the cutaneous venules of man by their digestive action on the skin.[44] Via the venous system, these cercariae reach the right side of the heart and pulmonary capillaries to the left heart and the systemic circulation to end this journey in the mesenteric or hepatic arteries. In the portal veins they grow rapidly into the adult worm; this migrates against the blood stream of the portal blood to the mesenteric venules in the case mansoni and the venules around the wall of the bladder in the case of haematobium; in both these destinations, they copulate and ovipose.[44]

From this natural habitat schistosoma ova or worms can reach the lungs. In haematobium infestation, the route of these worms or ova to the lungs is via the internal iliac veins and the inferior vena cava.[87] In mansoni infestation, the route is via the porta-systemic collaterals which

develop after liver involvement by fibrosis.[87] Sometimes at an earlier stage of infiltration of the liver by mansoni ova, these get directly shunted through the hepatic sinusoids to the hepatic veins from which they reach the lungs by the systemic route, Gelfond[50], and Mann[65].

PATHOLOGY OF CARDIO-PULMONARY SCHISTOSOMIASIS

Schistosoma ova were first discovered in the lungs by Belleli 1885[10]. Adult worms were next described by Symmer 1905[92]. In 1928, Sorour[90] reported on pulmonary schistosomiasis as a common autopsy finding in Egyptians. He described small fibrous nodules associated with the schistosoma ova in the lungs which resemble the tubercle caused by koch's bacilli and hence the term schistosomal tubercle was introduced. The pulmonary vessels showed endothelial proliferation of the intima (bilharzial atheroma) which contains abundant capillaries. In 1932 Azmy and Effat[7], described two cases of bilharzial hepatosplenomegaly showing cardiac enlargement with gross dilatation of the pulmonary artery together with clinical evidence of bronchitis and emphysema. Autopsy of one of those two cases showed deposition of ova in the lungs with end-arteritis obliterans of the small pulmonary vessels; the main pulmonary trunk was dilated and showed atheroma; the right side of the heart was dilated, the bladder showed schistosomal lesions and the liver was cirrhotic. Similar cases were subsequently reported by Clark and Greaf in Puerto Rico[17] and by Day in Egypt[30].

The most important contribution was introduced by Shaw and Ghareeb 1938[87]. Their material consisted of 282 cases of schistosomiasis of which 94 cases had ova in the lungs, these ova were of the mansoni type in 30.6% and of the haematobium type in 58.3 %. The relative increase in the incidence of haematobium pulmonary infection was due to the direct access of the haematobium ova to the systemic circulation while mansoni ova can reach the lungs only via an anastomosis between the portal and systemic circulation. The ova are impacted in the arterioles accompaning the respiratory bronchioles. These arterioles measure 50 micron in diameter - a size which is smaller than the ovum. Once the ovum reaches the arteriole, it adheres to its wall and is then extravasated outside the blood vessel. The mechanism of this process of extravasation of the ova was postulated by Fairley[40] to be a pure mechanical process initiated by the spine of the ovum helped by contraction of the wall of the blood vessel as well as the force of the blood stream. This is denied by Shaw and Ghareeb[87] since no haemorrhages were reported by them in the vicinity of the blood vessels involved. They believed that ova get out of the blood vessel by a process which is toxic but

not mechanical, the toxic substance produced by the ova causes necrotizing arteriolitis which helps their extravasation. Lung involvement after the ova get out of the blood vessel was described by the same authors to consist of the following types :

1- Parenchymatous tubercles :

These consist of granulomatous reaction in the form of tubercles which sometimes conglomerate to be seen pressing on the neighbouring respiratory bronchioli, Weinberg(97).

2- Arteriolar lesions :

These may be focal or widespread. There is intimal proliferation which will eventually result in obstruction of the pulmonary circulation and subsequent development of pulmonary hypertension. The involved vessels shows intimal thickening and narrowing of the lumen. Characteristically new blood vessels and spaces are formed in the walls of the arterioles which were given the name, "angiomatoids" which are commonly seen in an advanced stage of pulmonary bilharziasis. Ellwi 1968(37), stated that the so called angiomatoids of Shaw and Ghareeb are most probably broncho-pulmonary shunts.

Lesions caused by the adult worms were reported to occur in the arteries but not in the veins. This formed 10.5 % of all cases with pulmonary schistosoma infection. Worms are arrested as rider emboli at the bifurcation of the blood vessels. While these worms survive in the venous blood of the portal circulation they die rapidly in the venous blood of the pulmonary circulation. While alive, no structural change is produced, whereas when they are dead they become highly toxic causing necrosis of the artery as well as an acute focal necrotizing pneumonia which later resolves and the worm becomes calcified and finally enveloped in scar tissue.

Few observations are worthy of being mentioned in the work of Shaw and Ghareeb.

1- Although pulmonary schistosomiasis is more common in haematobium infection, vascular lesions are more common in mansoni infection.

2- Most of the pulmonary lesions were accompanied by hepatosplenomegaly and liver cirrhosis, yet some cases of vascular lesions were seen with haematobium infection without the presence of hepatosplenomegaly.

3- A mixed lung infection with the two species of ova was reported.

4- Shaw and Ghareeb did not meet with cases showing endobronchitis obliterans or interstitial pneumonia as described previously by Sorour.(90)

The other forms of parenchymatous schistosoma lesions were described in Egypt :

1- A case of a localised schistosoma granuloma of the lung simulating a tumour was described in 1953 by Mallah and Hashem(64). Exploratory thoracotomy was carried out, and as the condition was judged to be carcinoma at operation, pneumonectomy was performed; on pathological examination of the rounded specimen it turned out to be a case of schistosoma.

2- Another case was reported by Abdel Hakeem and Elwi(2), which presented as a right upper lobe pneumonic consolidation of which the aetiology could not be discovered. Examination of the resected lobe proved the lesion to be infested with schistosoma ova and granulation tissue.

De-Faria 1954[41], in a study of 130 necropsies in Brazil reported that the deposition of ova in the walls of the pulmonary arteries produce arterio-venous aneurysms and act as a route for ova or worms to pass to the pulmonary veins.

In all the previously reported literature there had been no mention of actual involvement of the bronchi by schistosoma ova. Warraki and Elwi[95] reported on schistosomiasis of the lung in 3 cases which showed perivascular and peribronchial infiltration with granulation tissue. Although the lungs were heavily infested with schistosomiasis in these cases, yet serial sections althrough the bronchial system failed to reveal any schistosomal lesion in the bronchi. A further observation by Warraki[96] was that the bronchial walls of these schistosomal cases showed scanty blood supply which was attributed to be due to the great involvement of their bronchial arterial supply in the development of arterio-venous shunts. This scanty blood supply may explain why the bronchial system in these cases is particularly susceptible to bronchial infection which is a common clinical association in cases of schistosomal hepatosplenomegaly.

El-Helaly, 1954[63] failed to find ova in bronchial biopsies obtained from 4 cases of schistosomal hepatosplenomegaly; at the same time pathological changes characteristic of chronic bronchitis were encountered in these cases.

Shoeb et al.[89] obtained bronchoscopic bronchial biopsies from 26 cases of hepatosplenic schistosomiasis. In none was there any evidence of schistosomal involvement of the specimen. Similarly, examination of fluid after bronchial lavage in those 26 cases failed to show any ova. Daily examination of sputum specimens from 96 schistosoma hepatosplenomegalic cases for 14 consecutive days by both direct smear and hydroxide digestion method revealed no ova except in one case. Dark bodies simulating ova appeared once in the sputum of 2 other cases ; several other reports on the other hand, confirm the presence of ova in the sputum. Ova in sputum were reported by Nour El-din and El-Baz, 1954[73] in 22 cases out of 64 of urinary or intestinal schistosomiasis. Talaat 1954[93] found schistosoma ova in the sputum of 12 out of 20 cases of visceral schistosomiasis. Farid et al. 1959[43] spotted ova in 4 out of 15 cases of schistosomal cor pulmonale. Sami et al. 1960[85] found schistosoma ova in the sputum of 3 cases of broncho-pulmonary schistosomiasis out of 29.