

5000 YEARS OF SCHISTOSOMIASIS IN EGYPT

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The evolution of disease is one of medicine's most challenging questions. This paper considers the epidemiology of schistosomiasis in Egypt over a 5000 year period. Evidence from mummies demonstrates the presence of this disease in ancient Egypt, and several diagnostic laboratory methods are currently being developed and used to examine the palaeopathology of schistosomiasis in the mummies. This data will be compared with information being gathered about the disease in Egypt today. An Egyptian Mummy Tissue Bank, currently being established at Manchester University Museum, will provide a unique and important research for the current project, and also for future studies on the evolution of other diseases.

Key words: Palcopathology, snails, egyptian mummies.

Comprender la evolución de las enfermedades es uno de los más grandes desafíos de la medicina. Este trabajo considera la epidemiología de schistosomiasis en Egipto a través de un periodo de 5000 años. La evidencia de las momias demuestra la presencia de la enfermedad en Egipto antiguo, por lo que actualmente se están desarrollando y usando varios métodos de diagnóstico de laboratorio para examinar la paleopatología de schistosomiasis en las momias. Estos datos serán comparados con la información que hoy se está obteniendo acerca de la enfermedad en Egipto. Actualmente, un Banco de Tejidos de Momias Egipcias, establecido en el Museo de la Universidad de Manchester proveerá un recurso único e importante para este proyecto, y para estudios futuros sobre la evolución de otras enfermedades.

Palabras claves: Paleopatología, caracoles, momias egipcias.

Since it was established in 1973, the Manchester Egyptian Mummy Project (David 1979; David 1997) has developed a multidisciplinary methodology for studying Egyptian mummified remains, and has pioneered the use of virtually nondestructive techniques of investigation, particularly endoscopy (Tapp and Wildsmith 1986). An International Egyptian Mummy Databank was initiated at Manchester, to collect information about mummies held in collections worldwide (Pettitt and Fildes 1986). In 1995, the Manchester Mummy Project and Medical Service Corporation International of Arlington, Virginia, USA, began a joint study of the epidemiology of schistosomiasis in ancient and modern Egypt. The aims of the project are to use modern laboratory techniques to detect the disease in mummies; to compare this information with the epidemiology of the disease in Egypt today; and to describe the epidemiologic evolution of schistosomiasis within Egypt, over a 5000 year timespan. Data on schistosomiasis in mummies will be compared with information which has been collected about the disease in Egypt today, through the Schistosomiasis Research Project (SRP), a \$40 million research programme of ten year's duration. This was funded by the Government of Egypt and the US Agency for International Development, and involved scientists from universities in Egypt and

the U.S.A. The SRP was designed by Medical Service Corporation International, with the objectives of identifying the current epidemiologic patterns of schistosomiasis and developing better methods of preventing, diagnosing and treating the disease (Contis and David 1996). The current Manchester study is funded by the Leverhulme Trust and the Kay Hinckley Fund for Egyptology.

Material and Methods

In this study, it will be necessary to include as large a population sample as possible. Through SRP, there will be access to 100,000 modern case studies in Egypt, and from ancient times, tissue samples will be obtained from mummies within various socio-economic groups. In the Pharaonic Period (c. 2686 BC to 332 BC), mummification was available to the upper and, increasingly, to the middle classes, and during the Graeco-Roman Period (332 BC to AD 641), it was extended to all who could afford the procedure. Also, the bodies of the peasants, buried in shallow graves at the edge of the desert, were often naturally preserved due to climatic and environmental conditions, and therefore these will provide additional tissue samples for this study.

Two of the key features of the project are (1) the establishment of the International Ancient Eyp-

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tian Mummy Tissue Bank, and (2) the development of scientific techniques to diagnose the disease in mummies.

The International Egyptian Mummy Tissue Bank

This key resource has recently been developed at the University of Manchester, England, to collect tissue samples from Egyptian mummies held in museums and other institutions world wide. An international database of approximately 8000 entries has been compiled, consisting of names and addresses of organisations who could be potential donors; to date, there has been an enthusiastic and positive response from most institutions holding major or minor collections. The information on the database is being stored on Microsoft Access which will allow computerised records to be kept. A card index system has been devised and hard copy records will also be kept (Lambert, at press). The Tissue Bank will enable more extensive palaeopathological studies to be carried out, initially on schistosomiasis, and later, on other diseases, than on any previous projects.

Techniques used to diagnose *Schistosomiasis* in Mummies

In previous palaeopathological studies, a range of diagnostic techniques have been used to identify schistosomiasis in mummies (Ruffer 1910; Nash 1982; Deelder et al. 1989; Deelder et al. 1990; Miller et al. 1992; Miller et al. 1993; Millet et al. 1980). These have included non-invasive x-ray examination of tissue to identify the classic pathological calcifications that are secondary to chronic schistosomiasis infection in liver (*Schistosoma mansoni*) and in kidney and bladder (*S. haematobium*); direct microscopy examination of milligram quantities of rehydrated tissue to detect the presence and confirm the species of schistosome eggs; and the use of the ELISA (enzyme-linked immunosorbent assay) methodology to detect the presence of circulating anodic antigen (CAA). Currently, the Manchester Project has developed immunocytochemistry as an additional diagnostic tool which has been successfully applied to infected ancient and modern tissues (Rutherford 1997). Proposed DNA studies may also reveal the presence in mummies of the parasite that causes this disease.

Results

It is intended that this study will lay the foundation for future epidemiologic projects in the Nile Valley, in which data from modern case studies can be compared with palaeopathological evidence. In turn, this will enable the history of disease in Egypt to be considered within a wider context.

International Egyptian Mummy Tissue Bank

This will become a major resource for scientists to study early examples of specific diseases, and to develop new epidemiologic projects. The Schistosomiasis Project

It will be possible to examine the pattern of this disease over 5000 years, with reference to geographical, chronological, environmental and social factors. The incidence of the disease in males and females in antiquity will also be considered, and will be compared with modern data. Any evidence regarding the evolution of the schistosome, and any changes in its DNA that are preserved over this period, will also be studied.

Discussion

Today, schistosomiasis is a chronic debilitating disease that afflicts 200-300 million people in 79 countries. It has a major impact on an agricultural workforce and on national economic productivity. Probably 20 million people have the disease in Egypt. Water development schemes (dam building and irrigation systems) have created new breeding sites for the snails which serve as the intermediate hosts for the parasite.

There has been discussion (Jonckheere 1944) as to whether the ancient Egyptians diagnosed and recorded the disease. In the Medical Papyri, there are many references to "worms" and the "verminous" theory of disease, which regarded the worm as the occupier and destroyer of the body, was an important element in medical theory. One affliction - the 'aaa' - disease - is mentioned 50 times in the papyri and some scholars have identified it with schistosomiasis. However, others dispute this claim, on the grounds that the Egyptians almost certainly would not have performed autopsies

within a short enough timespan and in sufficient detail to enable this parasite to be identified; and because it would probably not have been visible to the naked eye.

Nevertheless, despite the ambiguity of the literary sources, there is convincing palaeopathological evidence for the presence of this disease in mummies, confirming that schistosomiasis has existed continuously in Egypt for at least 5000 years. It is because of the substantially unchanged population and environmental conditions of Egypt, and the excellent state of the preserved tissue found on the mummies that scientists can undertake this first palaeoepidemiologic study of a specific disease over a 5.000 year period.

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Conclusion

A comparison of the data on schistosomiasis from ancient and modern Egypt will provide valuable information about the geographical, environmental and social factors that have influenced the pattern of this disease over 5000 years. The study may also indicate how the parasite and the disease have adapted successfully over that period. It is envisaged that this study will lay the foundation for similar palaeoepidemiologic projects on other diseases, moving the subject forward from investigations of individual or small groups of mummies to more comprehensive assessments of disease patterns and their influence on society.