The Historical Background of Heartwater

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Abstract

Heartwater is a disease of cattle, sheep, goats and some wild ruminants that is caused by a rickettsia, previously known as *Cowdria ruminantium* but recently reclassified as *Ehrlichia ruminantium*, which is transmitted by the bont tick (*Amblyomma*) Typically the disease, which usually results in death, is characterized by high fever, nervous signs, and the accumulation of fluid in the lungs, brain, thoracic cavity and sac around the heart. It is one of the major causes of stock losses in sub-Saharan Africa.

Introduction

The first reference to what probably could have been heartwater was made in South Africa by the Voortrekker pioneer, Louis Trichardt in 1838. On the 9th of March he mentions a fatal disease, "nintas", amongst his sheep, following on a massive tick infestation approximately 3 weeks previously and which is described in his diary on the 17th of February 1838. Almost 50 years later a farmer, John Webb, reported to the Cattle and Sheep Disease Commission in Grahamstown, on a disease, which apparently, by then, was generally known as heartwater. He was of the opinion that the disease was introduced into the Eastern Cape at about the same time that William Bowker found a bont tick on a cow which was imported from Zululand in approximately 1837. The disease was subsequently reported from various parts of South Africa, but due to confusion with other conditions, such as verminosis and pasture deficiencies, all the earlier information regarding the incidence of heartwater cannot be fully relied upon. It will, no doubt, be interesting to study other historical documents of the previous century in order to fill the gaps in our knowledge regarding the possible introductions and spread of the disease in South Africa, or for that matter, in Africa. Confusion with other prevalent diseases with unknown aetiologies at that time will, however, make this a very difficult task.

There is, therefore, still no definite answer to the question whether heartwater is a disease indigenous to the African continent or whether it is an imported one. The resistance to heartwater exhibited by Persian sheep which were introduced into South Africa during 1872 suggested that a possible reason for their resistance could have been previous contact with the disease in their countries of origin. However, heartwater was known in South Africa long before the first importation of Persian sheep and although certain *Amblyomma* species occur on the Asian continent, there is no evidence that the disease exists in that part of the world. To date the occurrence of heartwater has only been confirmed in parts of Africa and on certain Caribbean islands, where it has probably been introduced during the slave trade. Apart from the distribution of 2 American *Amblyomma* species (*A. maculatum* and *A. cajennense*) which were found to be capable of transmitting the disease in the laboratory, the distribution of heartwater, in general, corresponds closely to that of its recognized vectors. All the existing information has been consolidated in the form of a global distribution map by Provost and Bezuidenhout and, although not conclusive, suggests that heartwater is an indigenous disease of Africa.

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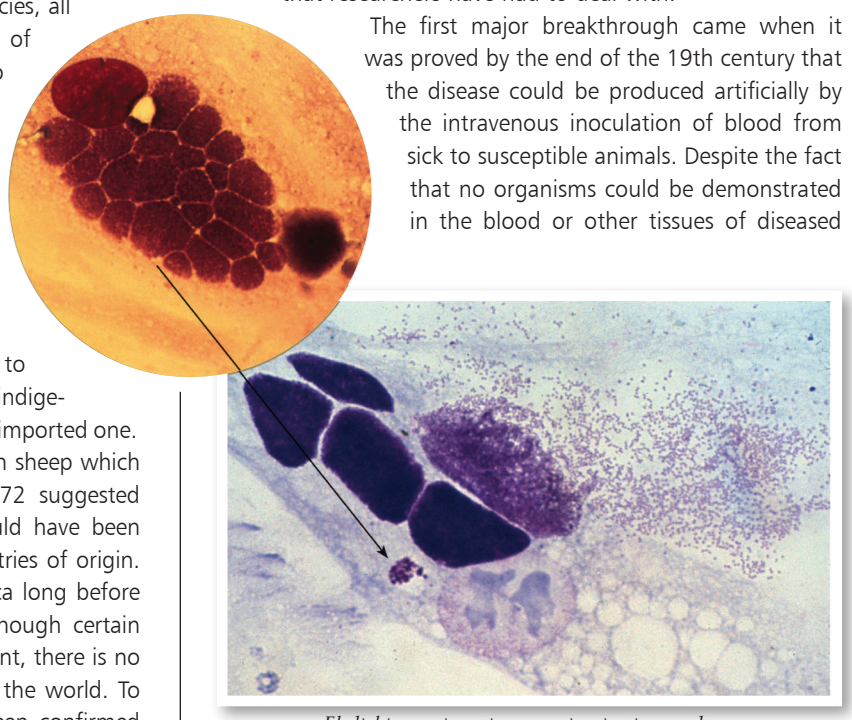
The history of heartwater research is a story of great dedication and perseverance of many workers in this field. Progress has, however, been relatively slow and there have been few significant breakthroughs. The mere fact that research over more than a century has still not provided a satisfactory method of control is a clear indication of the great difficulties that researchers have had to deal with.

The first major breakthrough came when it was proved by the end of the 19th century that the disease could be produced artificially by the intravenous inoculation of blood from sick to susceptible animals. Despite the fact that no organisms could be demonstrated in the blood or other tissues of diseased



Ehrlichia ruminantium growing in tissue culture

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animals, it was concluded that heartwater is caused by a living micro-organism, at that time believed to be a filterable or ultravisible virus. At about the same time the long-standing suspicion that the bont tick (*A. hebraeum*) is the vector of heartwater in South Africa was confirmed. These discoveries made it possible to reproduce heartwater in the laboratory and from then on much attention was given to defining the disease in order to develop some form of control.

One of the most important discoveries was made at Onderstepoort by Cowdry, a visiting rickettsiologist from the Rockefeller Institute for Medical Research in New York. He confirmed the suspicion of Sir Arnold Theiler that heartwater is caused by a rickettsia, by successfully demonstrating the organisms in the tissues of affected animals and in infected ticks. He also named the aetiological agent of heartwater *Rickettsia ruminantium*. The name was later changed to *Cowdria ruminantium*. This discovery also led to the development of an easy and practical method for the diagnosis of the disease, the so-called brain squash technique which is still widely used for the diagnosis of heartwater today.

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Over the years the susceptibility of wild and laboratory animals received much attention, and proof was obtained that the blesbok (*Damaliscus albifrons*), the black wildebeest (*Connochaetes gnu*) and the springbok (*Antidorcas marsupialis*) are susceptible to heartwater, or that they can act as asymptomatic carriers of the disease. Since the earliest days it was realized that animals which recovered from the disease were subsequently immune. Extensive studies on the immunity of heartwater by Neitz and co-workers merit special reference. These studies still form the basis of our knowledge of immunity to heartwater, especially with reference to its duration in sheep. They also provided evidence that circulating organisms are detectable in the peripheral circulation of immune sheep following reinfection, irrespective of whether a demonstrable reaction is produced or not.

A major breakthrough with regard to the control of heartwater was the discovery by Neitz of an effective chemotherapeutic agent, the sulphonamide drug "Uleron", against the disease. Subsequently other drugs, especially the tetracyclines, were also found to be effective and together they have saved the lives of many animals naturally or artificially infected with heartwater. Between 1945 and 1970 relatively little new information on the disease became available. During this time a blood vaccine was developed at the Veterinary Research Institute at Onderstepoort which at present is still the only commercial vaccine available against heartwater. Since 1970 a number of findings have stimulated new interest in heartwater research.

Very important was the discovery by Du Plessis and Kümm of an isolate of *Cowdria* which is highly pathogenic for mice. Initially its identity was, because of its somewhat atypical immuno- and pathogenicity, viewed with some suspicion but nevertheless led to the development of a usable serological test. More recent techniques and information that have become available during research on this organism have later led to the isolation of other, more typical murinotropic *Cowdria* isolates. The discovery of heartwater on certain islands in the Caribbean, and the threat of its possible introduction onto the American mainland, has led to the establishment of international research teams. This, no doubt, has already been and will continue to be a source of future information on heartwater.

The successful *in vitro* cultivation of *C. ruminantium* by Bezuidenhout and co-workers was another milestone in heartwater research. It opened many new avenues which led to improved diagnostic and serological methods and hopefully will one day lead to the development of a practical and safe method of immunization. Since this breakthrough a wealth of information on many aspects of the disease and its causative organism has recently become available and was reviewed by Allsopp, Bezuidenhout and Prozesky. The most recent revision of the order Rickettsiales abolishes the genus *Cowdria* in favour of *Ehrlichia* and the causative agent of heartwater is now called *Ehrlichia ruminantium*.

Acknowledgement

Previously published in the *Journal of the South African Veterinary Association*; Vol 80, No 4 (2009), 208-209. doi: 10.4102/jsava.v80i4.208

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