CONTROL / PREVENTION

Tick control has long been advocated as a means of controlling heartwater. Even after the infected blood-based vaccine was developed, tick control was still advocated as a supplementary or alternative means of control. Tick control can be either intensive or strategic, but intensive tick control has largely fallen into disuse. The main disadvantage is that animals may lose all immunity to tick-borne diseases because of the lack of a natural challenge. Strategic tick control implies the control of tick numbers so that natural infection of livestock occurs and high levels of immunity are maintained. The aim is to achieve an epidemiologically stable situation with respect to heartwater by the regulation of the numbers of ticks present so as to prevent the debilitating effects of severe tick infestations. Economic studies have demonstrated that strategic tick control is both a more economical and a more practical option for limiting losses from heartwater and other tick-borne diseases.

Several drugs have been used to treat animals suffering from heartwater but the tetracyclines, especially oxytetracycline, are the most widely used. Short-acting formulations of oxytetracycline are most commonly used at a dosage rate of 10 to 20 mg/kg body weight, either administered intramuscularly as a single dose, or half the calculated dose is given intravenously and the other half intramuscularly. This treatment is usually repeated 24 hours later. A long-acting oxytetracycline preparation has been shown to be equally effective. Doxycycline has been used successfully at a dose rate of 2 mg/kg body weight in the treatment of experimentally-induced heartwater in sheep.

When treatment with tetracycline is instituted during the incubation period of heartwater in cattle (before approximately eight days after infection) the course of the disease is usually altered; animals usually develop no fever or other clinical signs, except that, in a few, a low-grade transient febrile response will result. In these animals no, or at best only a partial, immunity develops. Treatment of sheep and goats during the incubation period may also give rise to a delayed febrile reaction (it may be as long as 20 to 25 days after infection compared to the more usual nine to ten days in untreated animals), and the reaction may be so severe that additional treatment is required. Supportive therapy in clinical cases of heartwater is often inefficient because of the poor understanding of the pathogenesis of the disease. Various anti-inflammatory agents have been used.
Routine oxytetracycline injections may be used to protect susceptible animals against heartwater when they are introduced into an endemic area. In goats it is advocated that short-acting oxytetracyclines be administered at a dosage rate of 3 mg/kg body weight on days 10, 20, 30, 45 and 60 after their introduction, and that the animals should not be dipped until day 60. Injections of a long-acting oxytetracycline in cattle are sufficient to protect them from contracting heartwater, while at the same time allowing them to develop a natural immunity. The dosage is 10 to 20 mg/kg body weight given on days 7, 14 and 21, or days 7, 12 and 17, or even on days 7 and 14. The animals should be kept under close scrutiny and given appropriate treatment if they do develop overt disease. The success of this regimen depends upon the animals becoming naturally infected during the time that they are protected by the drug. Slow-release treatment with doxycycline has also been advocated, in the form of a tablet implanted behind the ear. In practice this is most often used as part of an immunization-and-treatment regimen.

The only vaccine currently commercially available is a cryopreserved preparation of blood from a sheep infected with virulent *E. ruminantium* organisms of the Ball 3 strain. The blood is injected intravenously in animals to be immunized, the rectal temperature is monitored daily, and antimicrobial treatment is administered at the proper time. The infective blood must be preserved on dry ice or in liquid nitrogen and thawed shortly before inoculation, and the whole procedure must be supervised by trained staff. The duration of immunity is uncertain, and because live organisms are involved the procedure cannot be used in non-endemic areas. The procedure is used successfully to protect susceptible animals against the disease, especially when they are first introduced into endemic areas, or if they are particularly valuable.

The Ball 3 strain, which was originally isolated in the Limpopo Province of South Africa, was chosen as the vaccine stock because it produces an early temperature rise several days before any other serious clinical signs appear. This makes it relatively easy to decide when to treat. Unfortunately the Ball 3 vaccine does not protect against all the isolates circulating in the field. Although the Welgevonden isolate offers a wider spectrum of cross-protection than other strains, its virulence makes it difficult to control and therefore unsuitable for an infection and treatment immunization procedure.

Immunization of calves under the age of one month and lambs and kids younger than seven days old does not generally result in clinical disease, but the animals develop immunity. While it is advisable to monitor their rectal temperatures twice daily for a period after immunization, as is advised in the case of older animals, this is still the method with the lowest risk of losses due to fatal heartwater reactions after inoculation.

In the absence of periodic stimulation of the immune system, resulting from the bites of infected ticks, the duration of immunity after immunization varies greatly between different domestic animal species, and also perhaps between individuals within species. In sheep, the immunity may wane after six months, but in some cases it may remain sufficient to protect animals against a fatal outcome for at least four years. The duration of immunity in goats following immunization is poorly documented. In Angora goats the degree of immunity seems to depend largely on the time at which the animals are treated therapeutically during the reaction subsequent to the immunization. The duration of immunity in cattle after immunization in the absence of challenge appears to be approximately two years.
After the vaccine is administered to the animal a definite fever usually develops which, if not treated, may be fatal. Inoculated animals are treated early in the course of the disease, but if treatment is effected too early no immunity will result. It is advisable to immunize individuals or small groups of animals because large groups present serious management difficulties.

Starting on the day following vaccination, the rectal temperature of each animal is recorded daily. On the first day of the temperature reaction the rectal temperature will usually be 1 °C or more above the average. This can be expected nine to 14 days after inoculation in the case of small stock and 14 to 18 days in cattle. A rise in the early morning rectal temperature to above 39,5 °C in cattle and goats, and 40 °C in sheep, is usually regarded as an immunization reaction.

It is not necessary to treat as early as the first day of the reaction, except in rare cases where, after a sudden rise of 1,5 °C or more, a temperature of 41,5 °C is reached. Treatment should be given only if the temperature on the second day of the reaction equals or surpasses that on the first day. Should the temperature on the second day be lower than the previous day, there are two possibilities, i.e. the animal is either resistant or partially immune, in which case the temperature on the third day will again be lower than on the first day and treatment would be unnecessary. Occasionally the temperature on the third day is much higher than on the second day and even higher than on the first day. If this occurs the animals should be treated immediately.

Treatment consists of an intramuscular injection of tetracycline at 10 mg/kg body weight, and short or long-acting formulations can be used. The recording of temperatures must be continued after treatment and if the temperature 48 hours after treatment equals or surpasses that on the day of treatment, a second treatment should be given. A high temperature within 24 hours after treatment can be ignored, unless the animal shows other clinical signs such as listlessness and lack of appetite, in which case it should be treated a second time without delay.

Relapses of vaccine-induced heartwater may occur after treatment. It is therefore advisable to monitor the rectal temperatures, especially of valuable animals, for an additional period of two weeks after the last treatment.

The block method of immunization, also known as ‘systematic treatment’, is widely practised in South Africa, especially when immunizing large numbers of kids and lambs. In this method the vaccine is administered and this is followed by treatment as described above on a predetermined day without recording daily rectal temperatures. Treatment is recommended on the following days, assuming that vaccination has taken place on day 0: exotic Bos taurus cattle breeds and their crosses, day 14; indigenous Bos indicus cattle breeds and their crosses, day 16; sheep and Angora goats, day 11; Boer and crossbreed goats, day 12. Care must be taken, however, as the procedure has some disadvantages. In older animals durable immunity only follows after the animal has developed a febrile reaction. Treatment performed too early in the incubation period results in failure to develop immunity and if treatment is given too late heavy mortalities can result.
The doxycycline implant method entails that animals are inoculated and at the same time doxycycline tablets are implanted under the skin, usually behind the ear, using a special applicator. Slow release of the active ingredient means that the animal does not become clinically ill, but at the same time develops immunity. Since the animal is handled only once and daily temperatures are not recorded, this method is suitable for the immunization of large numbers of animals at one time. As the dosage is critical, the body weight of the treated animals must be known, since an inadequate amount of the antimicrobial drug will not prevent fatal heartwater, while an excess will prevent the subsequent development of immunity.