Quarantine requirements for the importation of black rhinoceros from Zimbabwe into Australia

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SUMMARY: The proposal by the Zoological Parks Board of New South Wales to import 10 southern black rhinoceros (*Diceros bicornis*) from Zimbabwe as part of an international project for conservation of the species presented the Australian Quarantine and Inspection Service (AQIS) with a unique challenge. This importation is, at least in the modern era, the first importation of live herbivores from the African continent.

Many of the serious animal diseases in the world are endemic in parts of Africa. Knowledge of which of these diseases infect wild species and may be transmitted from the wild species to domesticated species, is limited.

This paper describes the strategies adopted by AQIS to facilitate the importation of rhinoceros while maintaining protection of Australian consumers, rural industries, domestic livestock and fauna against the entry and spread of unwanted pests and diseases.

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Introduction

The pressure on the black rhinoceros (*Diceros bicornis*) population and the part played by Australia in the conservation of this species are described in the accompanying paper by Kelly *et al* (1995).

A major role of Australian Quarantine and Inspection Service (AQIS) is to minimise the risk of introducing exotic and unwanted pests and diseases to Australia without undue hindrance to the importation of animals and animal products (Anon 1988). The black rhinoceros program presented particular challenges because of the need to import animals direct from Africa and because so little is known about the disease status of free-living rhinoceros. Many of the more serious diseases of mammals are known to occur on the African continent, and Australia has not allowed the direct importation of live herbivores from that region for at least 60 years. It was decided that the use of Australia's high security animal quarantine station on the Cocos Islands provided the only practical mechanism for the safe importation of these animals from Africa.

Developing Quarantine Requirements for Importation

AQIS was first approached about the importation of black rhinoceros from Zimbabwe late in 1989. After a preliminary risk analysis, a draft protocol of conditions for importation was developed as a basis for discussion and circulated to the veterinary services of the States and Territories and AQIS' scientific advisors in January 1990.

Animal quarantine policy in Australia is developed in consultation with all States and Territories, appropriate scientific organisations and advisors, peak rural industry bodies and, in the case of zoo imports, the zoo community, on a routine basis.

Import risk analysis is used by AQIS in the evaluation of import proposals. The components of this are:

- risk assessment, which may be followed by risk management;
- evaluation of veterinary services; and
- zoning and regionalisation of countries or groups of countries.

The Office International des Epizooties (OIE) has published recommended rules for trade in animals and animal products (Anon 1992), including a section on import risk analysis to promote standardisation of methodologies internationally for open, objective, scientifically-based quarantine decision making.

Risk assessment is the process of identifying and estimating the risks associated with the importation of a commodity and evaluating the consequences of taking those risks for disease introduction. In this instance that meant identifying the diseases and disease agents of quarantine concern that might be carried and transmitted to other animals by rhinoceros originating from Zimbabwe, estimating the risk of entry of each disease agent into Australia, and estimating the probability of exposure of susceptible species in Australia.

A decision is then made whether or not the application of risk management (implementation of risk reduction methods) would reduce identified risks to levels acceptable to the importing country. One of the great difficulties in quarantine decision making is reaching agreement on what is an *acceptable* level of risk especially when the group placed at risk by an importation is not the group likely to benefit from the proposal. Risk/benefit analysis is applied where possible but benefit can be hard to define and value judgements must be made as not all risks and benefits are quantifiable. AQIS took the view that this project had very worthwhile conservation and social values. There was support for this view from almost all whom AQIS consulted.

The probability of entry of each disease agent is a product of the *country factor,* which includes the prevalence of the disease in the exporting country (Zimbabwe), and the *commodity factor*, which is an estimate of the probability of the agent being present in the commodity (the rhinoceros) at the time of import. It is influenced, *inter alia,* by the number of animals or animal import units being imported. An evaluation of the veterinary services of the exporting country is an integral part of the estimation of the country factor. Two other factors are important, the first is the *risk reduction factor,* which is the extent to which quarantine and other measures minimise inherent risk factors. The second is the *domestic exposure factor,* which is the potential for susceptible Australian animals to come into contact with pathogens introduced by the imported commodity.

To establish the diseases of quarantine concern, AQIS considered the OIE List A and List B diseases in the OIE International Animal Health Code (Anon 1992) and other diseases that are exotic to Australia or unwanted for other reasons, for example, diseases that are subject to official or industry control programs or have zoonotic potential. To estimate country and commodity factors, the list resulting from this process is then evaluated by reference to OIE statistical data, literature searches, consultation with the veterinary administration of the exporting country and with scientific experts world-wide.

On the basis of the scientific data available, it was assumed, as a starting point, that rhinoceros may be able to carry and transmit any of the disease agents that are known to infect perissodactyls, and some of the agents that infect other mammals. For example, foot-and-mouth disease is generally a disease of artiodactyls but is also recorded in elephants; bluetongue is a disease of ruminants but antibody is often found in rhinoceros.

At least 11 of the 15 diseases on the OIE List A are known to occur in Africa. By contrast, Australia has only one, bluetongue, although low virulence, lentogenic strains of Newcastle disease virus, and some strains of porcine enteroviruses, do occur. Not all of these 11 diseases on List A are found in Zimbabwe; rinderpest has not been reported since 1898 and pleuropheumonia was last seen in 1904. Further, not all would be carried by rhinoceros. It was concluded, after applying the processes described above, and after considering responses to the first draft protocol, that the List A diseases of concern in this project were foot-and-mouth disease, lumpy skin disease, Rift Valley fever, bluetongue and African horse sickness.

Applying the risk assessment methodology to the diseases on the OIE List B resulted in heartwater, leptospirosis, bovine tuberculosis, theileriosis, trypanosomiasis, equine influenza and equine piroplasmosis being given further consideration. Many List B diseases do not occur in Zimbabwe or are known or reasonably assumed not to occur in rhinoceros. Dourine, epizootic lymphangitis and glanders have not been seen in Zimbabwe since 1920, 1919 and 1911, respectively.

OIE Lists A and B diseases do not include external or gastrointestinal parasites of large animals *per se* though they do obviously include a number of tick-borne and other insect transmitted diseases. Measures are routinely taken in animal importations to exclude animal parasites from entry into Australia. Treatments against external parasites have the added advantage of reducing the risk of introducing insect-borne diseases.

Having identified the risks, AQIS then had to consider risk management options, which might be applied to reduce the risk of entry of disease agents and/or to reduce the risk of exposure of susceptible animals to these agents after importation. Risk reduction methods used in the importation of live animals include quarantine isolation, certified history of non-exposure to disease, clinical observation and examination, diagnostic testing, vaccination and treatments. A combination of these is normally used to minimise disease risk.

After nearly three years of extensive consultation with Zimbabwe veterinary services, wildlife veterinarians world-wide, laboratory experts in Australia, Africa and Edinburgh, scientists in the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Australian States and industry and several draft protocols, quarantine requirements for the importation of black rhinoceros from Zimbabwe were finalised in October 1992.

The final protocol included the following general requirements:

- certification of area or country freedom from foot-and-mouth disease, rinderpest, epizootic lymphangitis and glanders,
- a minimum of 45 days isolation in pre-export quarantine (PEQ) during which the animals remain free from clinical signs of infectious and contagious disease, undergo tests for specified diseases with acceptable results and be treated for internal and external parasites,
- examination within 48 hours before export for health and fitness to travel, and
- a minimum of 60 days quarantine at the Cocos Islands Animal Quarantine Station (CIAQS) during which testing of the rhinoceros is conducted at least 14 days after arrival at CIAQS and sentinel animals are inoculated with blood from the rhinoceros and monitored for infection clinically, by blood smear and by specified serological tests 14 and 28 days after inoculation.

Approaches to Diseases of Concern

The approach taken for each of the diseases identified during the process of risk assessment was as follows:

Foot-and-mouth disease (FMD) – Certification of no evidence of FMD within 50 km of any premises on which the rhinoceros were located during the 6 months before export was required. The rhinoceros were subject to test (ELISA) for serotypes SAT1, SAT2 and SAT3 with negative results during PEQ and again during quarantine at CIAQS (CIQ). FMD serogroups O, A and C were not tested for because Zimbabwe has long been free from these serotypes.

Lumpy skin disease – No specific testing requirement was imposed. As the disease has not been reported in rhinoceros and insecticide treatments during PEQ for mosquito control and tick eradication were considered likely to reduce risk of exposure, continued freedom from clinical signs was regarded as sufficient.

Rift Valley fever (RVF) – The draft protocols had included serological testing. In fact three reactors to testing conducted at the time of capture in July 1992 were removed from the program. The test was omitted from the final requirements on the basis that the infective period is very short and therefore antibody testing is an inappropriate way of determining active infection. Fogging of the PEQ premises with insecticide at 3-day intervals during the last 14 days was required to control mosquitoes and reduce the possibility of transmission.

Bluetongue – testing by agar gel immunodiffusion or ELISA was required during PEQ and again during CIQ. Low titre reactors were not to be rejected because (a) the likelihood of rhinoceros being viraemic was thought to be very low due to time of year, the probable short duration of viraemia and the use of insecticides during PEQ, and (b) inoculation and testing of sentinel sheep and cattle during CIQ was accepted as the most sensitive indicator of the bluetongue status of the rhinoceros. The prolonged drought in Zimbabwe, which continued up to and after the time of export, was considered to have reduced further the chance of recent transmission of bluetongue virus.

African horse sickness – Testing (ELISA) was required during PEQ and again during CIQ. The use of insecticides during PEQ, the time of year and the drought conditions were all considered to have reduced the chance of the rhinoceros becoming infected before export.

Heartwater (Cowdria ruminantium)– Heartwater was one of the major concerns because a high prevalence of antibody had been reported in rhinoceros from some parts of Africa. Testing by indirect fluorescent antibody test (IFAT) in accordance with diagnostic techniques recommended by the OIE was initially stipulated. Advice from the Department of Veterinary Services, Zimbabwe, was that, at least in Zimbabwe, testing by western blot gave results of superior sensitivity but had low specificity. The issue of specificity probably related to cross-reactions between *Cowdria* and *Ehrlichia*. This meant negative western blot test results strongly support no exposure to heartwater or cross-reacting agents. AQS accepted use of that test during PEQ. Any reactors to the test were to be checked by DNA probes using polymerase chain reaction (PCR) techniques.

Experts at the Onderstepoort Veterinary Research Institute suggested sheep inoculation was far preferable to cattle inoculation for heartwater detection (FT Potgeiter personal communication). This was contrary to earlier advice, which was that there would be no significant species difference. It was then decided that sheep, as well as cattle, would be included in the inoculation program. Testing of sera collected during CIQ and testing of inoculated sentinels for sero-conversion were to be done at the Centre for Tropical Veterinary Medicine (CTVM), Edinburgh, where the IFAT or an ELISA was to be used. It was assumed that frequent tick treatments would further reduce the risks of transmission during PEQ.

TABLE 1
Summary of tests performed on rhinoceros in pre-export quarantine in Zimbabwe

Disease	Test	Result
African horse sickness	ELISA	all negative at 1:4, No. 4 reacted at 1:2 considered negative
Babesiosis	IFAT	all negative
Trypanosomiasis	Antigen ELISA	all negative *T congolense, T brucei;* No. 7 positive *T vivax*, rest negative
Bluetongue	c ELISA	No 7 positive at 1:20, rest negative at 1:20
Heartwater	Western blot	all negative
Foot-and-mouth disease	ELISA	all negative (SAT 1, 2, 3)
Bovine tuberculosis	comparative intradermal	all negative (1 reactor to avian tuberculin - No. 2)

Leptospirosis – Testing was not required. On the advice of Department of Veterinary Services, Zimbabwe, the rhinoceros were vaccinated using a multivalent vaccine.

Bovine tuberculosis – Based on assurances from the Department of Veterinary Services, Zimbabwe, that the prevalence of bovine tuberculosis in Zimbabwe was very low and that no evidence of the disease had been seen in rhinoceros, and on the remote risk of transmission from the rhinoceros to other animals after import, AQIS initially decided not to test. There was also concern that test reactions would be hard to interpret as the specificity of most available tests was unknown for species other than cattle. Finally, because of Australia's impending freedom status for this disease, it was decided to test using the comparative intradermal tuberculin test in the base of the external pinna. This technique had been used with apparent success in South Africa. Certification that bovine tuberculosis had not been reported in rhinoceros in the area of origin during the three years before export was also required.

Theileriosis – There was considerable concern when the rhinoceros were reported to be positive on blood smear and to have low titre antibody reactions to serological tests for theileriosis conducted at about the time of capture.The common view of all experts was that the theileria were almost certainly specific to rhinoceros or, at least, were not of the *Theileria parva* group, but the definitive work had not been done. Greater assurance was required.

At the recommendation of local experts, 4 splenectomised calves were inoculated with rhinoceros blood and monitored clinically (daily temperature recording), and by blood smear and serological testing, for 28 days before the start of PEQ. This procedure served as a de-facto test for other haemoparasites and gave greater confidence that the rhinoceros were also free from trypanosomes and babesia. No evidence of haemoparasites was detected in the calves. On this basis, the requirement for serological testing for theileriosis during PEQ was deleted. However, for added assurance, CTVM was requested to test both rhinoceros and sentinels during CIQ and blood smears were examined at CIAQS.

Trypanosomiasis – Trypanosomiasis, particularly due to *Trypanosoma brucei*, has been reported in rhinoceros after capture and relocation in Kenya. Equivocal reactions to testing for *T vivax* and *T congolense* in some animals at the time of capture caused some concern. Consequently, a requirement for inoculation of sheep to test for *T vivax* and mice to test for *T brucei* as well as cattle during CIQ, and subsequent examination of blood smears (buffy coat), was added. Testing (ELISA or IFAT) of the rhinoceros was required during CIQ. An antigen-capture ELISA was used in Zimbabwe although sensitivity and specificity of this test had not been well established and false positives were known to occur. Antibody testing of rhinoceros and sentinels was conducted at CTVM during CIQ.

Equine influenza – Early in the program consideration was given to requiring either a test or vaccination. Equine influenza has not been reported in Zimbabwe. Black rhinoceros are relatively solitary animals in the wild. Equine influenza has a short incubation period and a short infective period. It was eventually agreed that the periods of isolation in quarantine and the requirement for freedom from clinical signs of disease would effectively eliminate any risk and no specific requirement was imposed.

Equine piroplasmosis – Testing (IFAT) during PEQ and again during CIQ was required.

Quarantine before Export

An AQIS veterinarian travelled to Zimbabwe about 10 days before export to oversee the final stages of PEQ, and to make final judgements on the eligibility of animals for export, taking into consideration test results, condition of the animals and arrangements for transport, and to accompany the shipment to Cocos.

Testing according to the protocol had been carried out after capture of animals in June 1992. Included were serological tests for theileriosis and RVF, which were deleted from the final conditions, and an ELISA for tuberculosis, which was replaced by intradermal tuberculin testing in PEQ.

There were some low titre reactions to the ELISA for tuberculosis. The animal that gave the highest reading had also reacted to tests for *T vivax* and *T congolense*. It was subsequently removed because it was not well. It later died, probably of the haemolytic anaemia syndrome that has been associated with a number of deaths in captured rhinoceros.

The official PEQ test was conducted on blood or serum drawn from the remaining ten rhinoceros (No. 1 to 10) on 19 October 1992. Tuberculin testing was also carried out at that time.

Results of tests are summarised in Table 1.

AQIS accepted local assurances that a reaction at 1:2 in the ELISA for African horse sickness did not indicate infection and allowed shipment of rhinoceros No. 4 to Cocos Islands. However, because this animal had reacted at this titre in three consecutive tests, more information and advice were sought in case this, or any other animal, was to react to testing while at CIAQS. It was decided that sub-inoculation of horses and intra-cerebral inoculation of mice would be the preferred method to check the virological status of serological reactors. This would be done at the Australian Animal Health Laboratory (AAHL), Geelong.

The quarantine requirements had stipulated that the animals be tested for trypanosomiasis *(T brucei, T vivax, T congolense)* by ELISA or IFAT during PEQ and again during CIQ. As the rhinoceros had been captured in a tsetse fly area, it was thought probable a number of them would have shown antibody. This would have given an indication of past exposure but may have told little about current infection status.

Although results of the official PEQ test were as tabulated above, testing for trypanosomiasis had been performed on the rhinoceros on at least two previous occasions. Rhinoceros No. 1 gave a low positive reading to *T congolense* in June/July 1992 but was negative at subsequent tests. Rhinoceros No. 7 gave a low positive reading for *T vivax* in July, an increased optical density in September and was again positive at the PEQ test. She was subsequently rejected from the shipment. Rhinoceros No 8 gave a low positive reading for *T vivax* in September after a negative reading in July but was negative again at the official PEQ test. Another rhinoceros not listed in Table 1 was positive for both *T congolense* and *T vivax in* June/July but had been removed from the program soon after.

Further advice on trypanosomiasis had been sought from local experts and from experts at the CTVM. After consideration of this advice and the test results, AQIS concluded that:

- it was unlikely that any rhinoceros, with the possible exception of No. 7, was infected with trypanosomes;
- in any event, infection with *T congolense* or *T brucei* would almost certainly be of no consequence as transmission from the rhinoceros to other animals would not occur in the absence of tsetse flies;
- *T vivax* was of concern because of the possibility of transmission by biting flies, although this had not been observed in the field in Zimbabwe;
- sheep as well as cattle should be inoculated during CIQ because these are a more sensitive indicator of *T vivax* infection; and
- the rhinoceros *may* prove to be negative on antibody assay, suggesting that the antigen detection ELISA was yielding false positive results, because the only tsetse fly species known to feed on rhinoceros was not found in Zimbabwe (AG Luckins, CTVM, personal communication).

Further consultations with Dr Potgeiter raised some doubts on the grounds for AQIS' conclusion that the rhinoceros theileria were not of the parva group. It was agreed that it was unlikely. Dr Potgeiter believed that the sub-inoculation of splenectomised calves was a most insensitive indicator of theileria infection though useful for trypanosomiasis and babesiosis. Tick transmission studies, or isolation of the organism and DNA sequencing using PCRs and comparison with known theileria species, was required to be certain the rhinoceros were not carrying *T parva. Rhipicephalus appendiculatus* and *R zambeziensis* are the known vectors of *T parva. R sanguineus* is the only species of Rhipicephalus in Australia and, although present in Africa, is not recorded as a vector of theileria.

This advice about the insensitivity of the calf inoculation tests was subsequently confirmed by other experts. This prompted further investigation of theileriosis risks. From further advice AQIS concluded that:

- it was most unlikely that the theileria infecting the rhinoceros were *T parva*;
- the theileria were probably specific to rhinoceros;
- they were not *T annulata*, which does not occur in the region and probably not *T mutans* or *T taurotragi*, which, it is believed, would have established infections in the inoculated splenectomised calves;
- intensive tick control during PEQ, conditions of quarantine during CIQ, the tick situation at Western Plains Zoo (WPZ) and the design of the rhinoceros facilities at WPZ, all militated against any possible transmission of theileria from the rhinoceros to other animals in Australia; and
- delay of the shipment because of the theileria infection could not be justified.

There were a number of low titre (1:5 to 1:20) reactions to the bluetongue test. It had been expected that some or all of the rhinoceros would have detectable antibody. AQIS had decided that the timing of export from Zimbabwe, and the frequent use of insecticides during PEQ would make it most unlikely that the animals were viraemic at the time of export. Two months quarantine at CIAQS in the absence of competent vectors would further reduce the chances of introducing viraemic animals to mainland Australia. It had also been agreed that the testing program with cattle and sheep would provide a very sensitive test to detect whether or not the rhinoceros were infected.

All the animals were negative to the western blot test for heartwater at the PEQ test.

No rhinoceros showed antibodies to foot-and-mouth disease and AQIS was satisfied this was a true indication of their status.

The negative results to the comparative intradermal test for tuberculosis supported local assurances regarding the prevalence of bovine tuberculosis in Zimbabwe. Although details of sensitivity and specificity of tuberculin testing of rhinoceros are not certain, experiences in the Kruger National Park in South Africa, in the relocation of animals where bovine tuberculosis is endemic in wildlife, and in the USA in importing this species from Africa, would suggest the test is sensitive. Increases in skin thickness in excess of 10 mm have been recorded.

As reported earlier, the condition of rhinoceros No. 7 and 8 had been causing some concern during PEQ. Animal No. 7 was immobilised for examination and treatment on 23 November. No clinical abnormality was detected. The results of biochemical tests of samples of blood seemed to confirm inappetence. She was treated with an anabolic and was brighter and had an improved appetite in the following week. The clinical history of these two animals made the decision to reject rhinoceros No 7 from the shipment, because of reactions to the test for trypanosomiasis, more acceptable.

Transport from Zimbabwe to Cocos Islands

The 9 rhinoceros eligible for shipment to the CIAQS were loaded without significant mishap on 30 November 1992. The transport crates had been fumigated with methyl bromide some days before loading to meet Australian plant quarantine requirements. The aircraft holds were disinfected before loading and were disinsected under AQIS supervision before and during the flight to the Cocos Islands.

Quarantine and Testing at the Cocos Islands Animal Quarantine Station

The CIAQS is operated as a high security quarantine station and no animals other than the rhinoceros and the sentinels necessary for the program were permitted in the station during the quarantine.

Fourteen days after arrival on the Cocos Islands, the rhinoceros were immobilised and blood samples collected for serological testing and for inoculation into sentinel cattle, sheep and mice in accordance with the importation protocol.

In the tests undertaken at AAHL, all rhinoceros were negative for antibodies to foot-and-mouth disease, all had antibody to bluetongue virus and one, No. 4, the animal that had showed a low titre reaction in the PEQ test, was positive in the ELISA for African horse sickness (AHS). This result was interpreted with caution because the cut-off point for this assay for AHS had not been well established for rhinoceros.

It was decided to try to clarify the status of the AHS reactor by attempting virus isolation. Fresh blood samples were collected and inoculated intra-cerebrally into mice, into embryonated eggs, and into two sentinel horses, within the high security area of AAHL. No evidence of AHS virus infection was found and the horses remained sero-negative at 18 days after inoculation. As rhinoceros No 4 was one of the higher titre reactors to bluetongue, the egg inoculation served as a further check on her bluetongue status. On the basis of these negative results, the animal was cleared for entry into Australia.

All rhinoceros were negative to the test for piroplasmosis. All rhinoceros were also negative for trypanosomiasis, heartwater and for *T parva* and *T annulata*. All sentinel cattle and sheep were negative for trypanosomiasis, heartwater, theileriosis and bluetongue.

One rhinoceros died during CIQ (Kelly *et al* 1995). A necropsy was carried out and specimens submitted to AAHL for examination for evidence of diseases of concern. No such evidence was found. Death was attributed to the acute haemolytic anaemia syndrome of captured black rhinoceros (Miller and Boever 1992).

The remaining 8 rhinoceros remained healthy during CIQ. All inoculated sentinel animals remained free from evidence of infectious or contagious disease.

The 8 rhinoceros were judged to be eligible for entry into Australia.

Transport from Cocos Islands to Western Plains Zoo

Loading at Cocos Islands, transport by air freighter to Canberra and trucking to the Western Plains Zoo proceeded smoothly (Kelly *et al* 1995). The animals were unloaded into the specially designed facility constructed at the Zoo. The facility, which provided for the secure confinement of the animals remote from other zoo animals and all domestic livestock, had been previously inspected and approved by AQIS.

Conclusions

The successful importation of these rhinoceros provides an example of how modern methods of risk analysis, quarantine procedure and diagnostic technology can be adapted to make safe international movement of wild animals possible. The consultative mechanisms required to address the concerns of wildlife authorities, rural organisations and the scientific community also provided access to the multiplicity of skills required to develop the quarantine protocols and to make them work.

Australia has conservative quarantine policies to help maintain its animal health status. Experience with farm animals is that a template approach can be developed for each disease and readily incorporated into protocols for the same species from a number of countries of similar health status in respect of that disease. The wide range of zoo and wildlife species is such that each protocol has to be developed specially to address the special features of that species.

We hope that this work will contribute to the future international movement of wild animals and assist in the preservation and welfare of the black rhinoceros.

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Field trials of drugs to treat bovine mastitis

Well-conducted clinical mastitis trials represent an invaluable, albeit difficult and expensive, effort to evaluate efficacy and tolerance under usual circumstances of use. YH Schukken and HA Deluyker (1995) *J Vet Pharmacol Therap* **18**:274-283, described the design and statistical analysis of these trials. They discussed general and specific issues, selection of subjects, sample size, treatment administration, evaluation of cure, and analysis and reporting of results.

Trials for evaluation of clinical mastitis therapeutics require a substantial effort in order to ensure that the study design and statistical analysis address the questions which need addressing and that the study is implemented as it was designed. The benefit is that the data generated are very valuable as they address efficacy and tolerance under normal circumstances of use.

Deformity of the epiglottis in 4 horses

The most frequently reported deformity of the epiglottis in horses is hypoplasia. RC Whitton and NJ Kannegieter (1995) *Equine Vet Educ* **7**:127-130, described 4 cases of epiglottic deformity, other than hypoplasia. Three cases were not associated with inflammatory lesions, while in the fourth case the epiglottic deformity persisted once the inflammation resolved.

These cases demonstrate that epiglottic abnormalities can be associated with respiratory noise and poor performance in racehorses. If active inflammation is present, anti-inflammatory therapy may give good results. If significant structural deformity of the epiglottis is present, surgical intervention may be required and the specific technique used should be based on resting and treadmill endoscopy findings. The prognosis for future return to full athletic function must be considered guarded.