Brucellosis outbreak in cattle in Kenya and surveillance in Britain

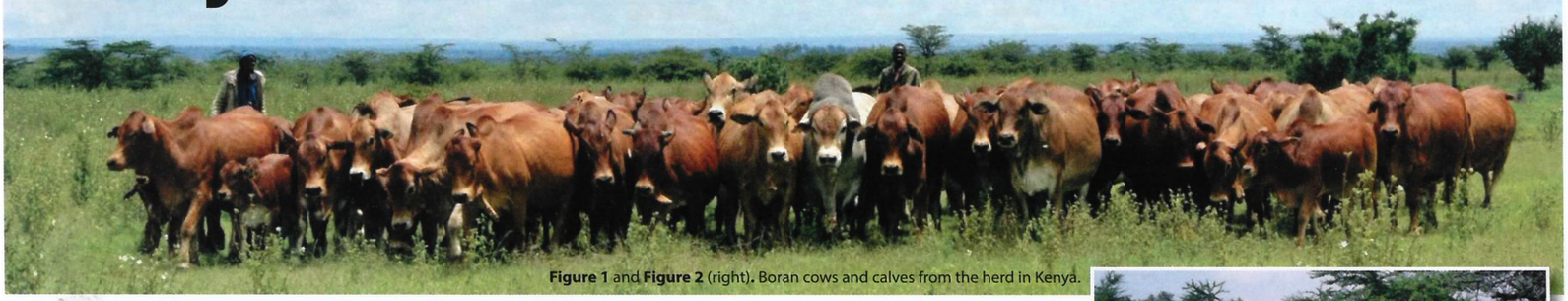

Figure 1 and **Figure 2** (right). Boran cows and calves from the herd in Kenya.

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discuss the diagnosis and management of a cattle disease in Kenya and the need for vigilance in the UK

ABSTRACT

Brucellosis is a worldwide zoonotic disease causing reproductive disease in livestock. It can have serious economic consequences for farmers and cause debilitating disease in people. An outbreak of bovine brucellosis in a Kenyan herd is described, including clinical signs, diagnosis and control, illustrating the potential costly effects of an outbreak. The disease in humans in developing countries is probably under-diagnosed because it is mistaken for diseases such as malaria. While it is absent from Great Britain, surveillance for the disease is under threat because of reduced reporting of abortions in cattle by farmers, and vets are urged to encourage reporting by their clients.

Keywords: brucellosis, abortion, zoonosis, surveillance, diagnosis

BRUCELLOSIS is a significant zoonotic disease in many countries, although it is absent from Great Britain and Ireland (Northern Ireland is in the process of attaining officially *Brucella*-free status and has not had an outbreak for three years). The last outbreak in Great Britain was in 2004 in a suckler herd in Cornwall, although the source was never determined. Brucellosis is endemic in Kenya and much of Africa.

This article documents a recent outbreak of brucellosis in a cattle herd in Kenya that was diagnosed by a UK practitioner. While the disease has been eradicated from Great Britain, the possibility it could be reintroduced remains and ongoing surveillance is important.

There are a number of species of *Brucella* and these have differing host affinities (for example, cattle are mainly affected by *Brucella abortus* and sheep and goats by *Brucella melitensis*, although not exclusively).

In animals, clinical signs primarily involve the reproductive tract and include abortion and infertility. Spread is mainly by contact with infected animals, but fomite spread is also theoretically possible. Infected cattle usually abort once after infection, but shed the organism in milk and uterine discharge in subsequent pregnancies (World Organisation for Animal Health, 2009).

> *Brucellosis was first confirmed in the herd in the late 1970s following an abortion storm. For the next 15 years, all heifers were vaccinated with S19 vaccine at about 20 months of age before going to bull.*

Infection in humans is commonly by the consumption of infected, unpasteurised dairy products or through contact with abortion/calving material. Symptoms can be severe and include undulant fever, night sweating, neurological complications and osteomyelitis. In countries where brucellosis is endemic, vets are commonly infected.

Kenyan outbreak

Background

The Kenyan outbreak occurred in a 400-cow beef herd of pure-bred Boran cattle (**Figures 1** and **2**) on an 8,000-acre cattle ranch in Laikipia County, Kenya run by author David Aggett's brother. The herd calves all year round to natural service, is stocked at about one head per eight acres in groups of about 80 cows, and no supplementary feeding is undertaken.

Four years previously, the farm purchased around 100 breeding cows from another farm that was selling up – no testing or screening for any disease was undertaken. On average, one to two breeding bulls are purchased each year and these are not screened either.

Abortion

Brucellosis was first confirmed in the herd in the late 1970s following an abortion storm. For the following 15 years, all heifers were vaccinated with S19 vaccine at about 20 months of age before going to bull. Adult cows were not vaccinated. The abortion problem was rapidly controlled and, until two years ago, the abortion rate was lower than two per cent each year.

In 2012, the abortion rate increased to five per cent. In 2013, 13 per cent of cows aborted (51 cows of all ages and heifers aborted mostly third trimester foetuses) and 48 cows aborted in 2014 – easily accounting for the largest proportion of losses on the farm, although leopards, lions and hyenas also played a role (**Table 1**).

The aborting cows were not unwell, although some retained cleansing for several days. A large proportion of cows became pregnant again after aborting, but a smaller proportion did not and were culled. Most cows that got back in calf after aborting had a normal calving.

Diagnosis

Unfortunately, there is limited commercial veterinary laboratory testing in Kenya, and, due to foot-and-mouth disease and other diseases, it is very difficult to export bloods for testing.

Given the history of late-term abortions affecting all ages of cows, variable recovery from abortion, relatively recent purchase of untested cattle and previous history of brucellosis in this herd, it was thought brucellosis was the most likely reason for this abortion problem.

Rose bengal antigen was sourced from the Animal and Plant Health Agency (APHA) and 10 cows, which had aborted in the past four months, were blood-sampled.

The rose bengal test (RBT) was undertaken on farm in October 2014. Serum was removed after 24 hours and, using a pipette, a drop of serum was placed on a white tile followed by a drop of antigen. It was mixed before the tile was gently rocked manually for a minute and observed for agglutination. No positive or negative controls were used. Of the 10 cows tested, seven gave a positive result (agglutination – **Figure 3**).

The abortion outbreak in this herd was almost certainly due to brucellosis (presumed *B abortus*) – the pattern of late abortions and relatively recent purchase of untested cows (and bulls) as well as the positive RBTs on seven out of 10 cows was deemed sufficient evidence to institute a control plan.

However, no controls were used when performing the RBT, no confirmatory serum agglutination/micro-complement fixation/ELISA tests were performed on positive RBTs, there was no confirmatory culture from aborted foetuses or placenta and no other abortifacients were tested for.

Given the constraints of further testing in this part of the world, pragmatic decisions needed to be made. The RBT is very sensitive, but occasionally can give false-positive results, in common with other serological tests for brucellosis. It is considered adequate as a screening test for detecting infected herds in control schemes as antibodies persist once cattle are infected (OIE, 2009).

It seems likely the purchase of the 100 cows approximately four years previously was the source of introduction as it is unlikely infection could have persisted from the 1970s without frequent abortion outbreaks. The regular purchase of bulls is another minor risk factor (*B abortus* may be shed in the semen, although sexual spread is not common; Millar and Stack, 2012).

Control plan

B abortus S19 vaccine was purchased from South Africa and all heifers due to go to bull the following 12 months were vaccinated in December 2014. All the breeding cows, irrespective of stage of pregnancy, were also vaccinated with a 10th of the normal dose (0.5ml not 5ml). This approach was taken because the vaccine can induce abortion (Olsen and Tatum, 2010). Three cows aborted after vaccination, but no marked rise in abortion had been noted (no abortions at the time of writing). Unfortunately, the S19 vaccine induces antibodies and subsequent serological testing will not be able to distinguish infected cattle from those vaccinated and not infected.

> *Malaria is considered the main cause of systemic illness in humans in this area and a case of brucellosis could be mistaken for malaria.*

Cattle are brought to the spray race for tick control once a week so vaccination had been carried out at this time (**Figures 4** and **5**).

In the event of an outbreak in Britain, culling of infected stock would be undertaken and vaccine would not be used. Vaccination with S19 was used as part of the eradication strategy in the 1970s and 1980s.

Zoonotic considerations

Brucellosis remains a serious zoonotic disease in many countries around the world

Table 1. Stock losses (including abortions) on farm in 2014 (400-cow herd)

Age category	Brucellosis (presumed)	Leopard	Lion	Hyena	Tick-borne disease	Other*	**Total (2014)**	Total (2013)
Pre-term (abortions)	48						**48**	51
Pre-weaned		2				10	**12**	16
Post-weaned/ adult		2	3	1	4	3	**13**	20

* 1. Pre-weaned: blackleg, premature birth, "goi goi" – Swahili for weak/ill thriven.
2. Post-weaned/adult: three-day sickness, bloat, dystocia, unknown.

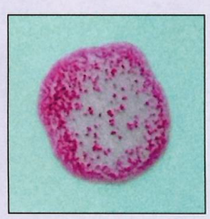


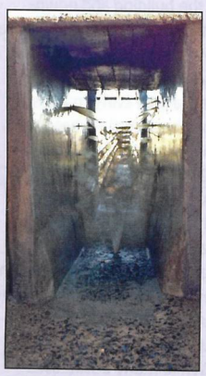
Figure 3. Positive rose bengal test agglutination carried out on one of the 10 cows.

> *Under-reporting has implications for the surveillance for brucellosis in Great Britain and it is with this in mind that practitioners are urged to encourage their farmers to report abortions to their local APHA office.*

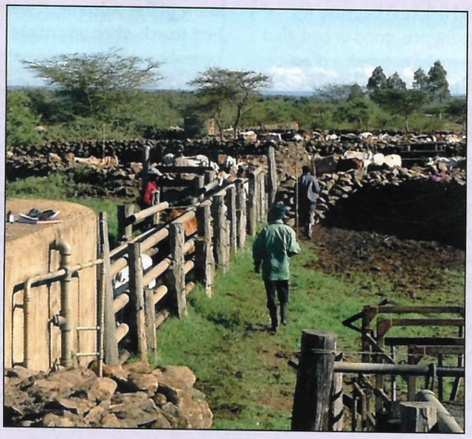
– causing serious disease in humans as well as economic problems. Staff working with cattle, particularly those assisting calvings, are at risk; however, in this herd, assisted calvings had been very rare (about one cow every two years). Milk consumption is the main risk factor as herders do milk cows by hand for their own consumption and have been warned of the risks of doing so. Malaria is considered the main cause of systemic illness in humans in this area and a case of brucellosis could be mistaken for malaria.

Non-zoonotic diseases such as malaria and typhoid fever are over-diagnosed in developing countries with relative under-diagnosing of zoonotic diseases because symptoms of both types are non-specific and include fever, headache, fatigue and joint or muscle aches (Halliday et al, 2015).

It is hoped initiatives such as Zoonoses and Emerging Livestock Systems (ZELS) – a research project with £20.5m funding – will reduce the prevalence of diseases such as brucellosis in emerging economies (BBSRC, 2012).



Figures 4 and **5**. The spray race and yard (below) for cattle vaccination.



Many zoonoses in developing countries also cause abortion in livestock, suggesting a one health approach linking research on abortion in farmed animals to research on common human health syndromes in the tropics could have great benefit (Halliday et al, 2015). In other words, abortion outbreaks like this one could act as signals for disease in humans other than the more commonly diagnosed (often incorrectly) non-zoonotic diseases.

Conclusion

This outbreak illustrates how brucellosis can be introduced to a herd through the purchase of infected cattle (and how there can be a delay in diagnosis). It took four years from the introduction of the assumed infected animals until a diagnosis was made.

In the outbreak in Cornwall in 2004 it was thought infection entered the herd up to two years earlier. Such an outbreak can be costly, primarily because of the high abortion rate, but also because of subsequent effects on fertility in affected cows. Human illness is of major concern in such an outbreak and, in developing countries, brucellosis is under-diagnosed in humans because of similar symptoms to those of non-zoonotic diseases such as malaria.

Surveillance in Great Britain

Surveillance to ensure Great Britain remains free of brucellosis includes screening aborted cattle (reporting abortions to the local APHA office is mandatory), quarterly bulk milk tank serology and screening of imported cattle.

All suckler cow abortions will be authorised by the APHA for an investigation, although, because of bulk milk testing, only a proportion of aborting dairy cows are authorised. These are those that satisfy at least one criteria of a check list including no previous normal calving in the herd; for example, a heifer or recently purchased cow. If more than one cow has aborted in the previous month it will also be authorised for investigation. Abortion submissions of other species to APHA laboratories are also screened for brucellosis.

Unfortunately, on-farm investigations of aborted cows for brucellosis are down significantly in England and Wales – at least 65 per cent since 2006 in the first quarter (AHVLA, *Emerging Threats, Cattle*, quarterly report, Q1, 2014). This under-reporting has implications for the surveillance for brucellosis in Great Britain and it is with this in mind that practitioners are urged to encourage their farmers to report abortions to their local APHA office. At the very least, it is another way of engaging with farmers in challenging times.

A common complaint by farmers is, even if they do report abortions, they are not investigated, but the criteria are adhered to by those administrative staff receiving the reports. Remember, if there is more than one abortion within the last month in a dairy herd, an investigation will not be refused. This will enable further investigation of an abortion problem by the submission of maternal bloods and/or fetal specimens for diagnostic testing for diseases other than brucellosis.

Acknowledgement

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References

Animal Health and Veterinary Laboratories Agency (2014). *Emerging Threats: Cattle*, quarterly report Q1 2014, webarchive.nationalarchives.gov.uk/20140707141401/http://www.defra.gov.uk/ahvla-en/files/pub-survrep-c0114.pdf

Biotechnology and Biological Sciences Research Council (2012). Zoonoses and Emerging Livestock Systems (ZELS): Reducing the risk to livestock and people, www.bbsrc.ac.uk/funding/opportunities/2012/zoonoses-emerging-livestock-systems.aspx

Halliday J E et al (2015). Endemic zoonoses in the tropics: a public health problem hiding in plain sight, *Veterinary Record* **176**(9): 220-225.

Millar M and Stack J (2012). Brucellosis – what every practitioner should know, *In Practice* **34**(9): 532-539.

World Organisation for Animal Health (2009) Bovine Brucellosis, www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.04.03_BOVINE_BRUCELL.pdf, accessed 11/01/2015.

Olsen S and Tatum F (2010). Bovine brucellosis, *Vet Clin North Am. Food Anim Pract* **26**(1): 15-27, table of contents.

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