# The tuberculin skin test

Bovine TB is a slowly developing disease caused by the bacterium *Mycobacterium bovis* (*M. bovis*). Identifying infected cattle requires the use of diagnostic tests, as it is rare for cattle to show any clinical signs until the later stages of infection. The tuberculin skin test or SICCT (single intradermal comparative cervical tuberculin test), is the primary test for TB in the UK.

How does the test work?

The skin test involves injecting two different types of *tuberculin* (purified fragments of dead mycobacteria) into the skin of the neck to trigger a localised allergic reaction. The skin test is carried out on two days (**Day 1 = injection of tuberculin, Day 2 = reading of the test**), three days (72 ± 4 hours) apart. This gives TB-infected animals enough time to react to the tuberculin injection, producing a swelling or lump [1].

Avian tuberculin: made from *Mycobacterium avium*, which infects birds. Used alongside bovine tuberculin to distinguish between cattle infected with *M. bovis* and those which react to other environmental mycobacteria.
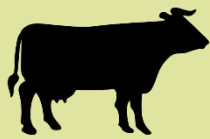
Bovine tuberculin: made from *M. bovis.* Triggers an immune response in cattle infected with *M. bovis* or similar *Mycobacteria.* Contains specific antigens (molecules which trigger an immune response) not present in environmental mycobacteria.

Cattle that have bovine TB tend to show a greater reaction to bovine tuberculin than avian tuberculin

The test result

The test can be interpreted at either the **'Standard'** or the **'Severe'** interpretation, depending on the disease history of the herd, or other circumstances. Based on the difference in skin thickness measurements and test interpretation the test can have one of three results

- **'Clear'** (negative result)
- **'Fail'** (reactor or positive result)
- **'Inconclusive reactor' (IR)** greater reaction to bovine than avian tuberculin, but not enough to be classified as a reactor.

How accurate is the skin test?

The accuracy of a test is usually measured in terms of **'sensitivity'** (probability that an infected animal is correctly identified) and **'specificity'** (probability that an uninfected animal is correctly identified). At **standard interpretation** the skin test has an average **specificity of 99.98%** [2]. Test sensitivity is more variable and is within the range of **50-80%** [3-4] (or potentially higher) at standard interpretation, depending on the stage/severity of infection and other factors [3,4]. A sensitivity of 80% means that 20% of infected cattle would be missed by the test. Research estimates **that 25-50% of recurrent TB breakdowns are due to infected cattle not being detected by the skin test**, so that they remain within the herd [5].

The test may miss some infected animals

The test may miss 1 in 5 infected cattle tested (or more) meaning that they remain within the herd, leading to further infection.

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False +ve results are rare

The test has a specificity of 99.98%. This means an average of one false positive result for every 5,000 uninfected cattle tested.

1 in 5,000

Does severe interpretation improve test accuracy?

The severe interpretation *increases the sensitivity* of the test by roughly 1-10% [3,4] (so more likely to detect infected animals), but it is also *lowers the specificity* [2,4] (resulting in more false positive results), which is why it is not used in routine testing.

A good herd test?

The more infected animals in a herd the greater chance that at least one of them will be detected. This makes the skin test a much better test at detecting infected herds, even though all infected animals in a herd will not always be identified. However, the identification of a single reactor will lead to restrictions and further testing that may identify further infected cattle.

Why does the skin test miss some animals?

No diagnostic test is perfect. T**he skin test may not detect all infected animals.** Reasons for this include:

- **Johne's disease** –infection with the bacteria which causes Johne's disease may interfere with the test, meaning that TB infected cattle are not detected.

- **The test is not performed correctly**– human error or bad technique may mean that infected animals are not identified.

- **Overwhelming infection with *M. bovis*** – cattle in the very advanced stages of TB may react poorly to bovine tuberculin

'Non Visible Lesion' (NVL) reactors

Approximately 60% (3 in 5) of skin test reactors show no visible/typical signs of TB in their organs at meat inspection in the slaughterhouse [6]. These are known as '*Non-visible Lesion*' reactors and is due to the relatively insensitivity of meat inspection in detecting small (sometimes microscopic) localised TB lesions, rather than a failure of the skin test.

The very high specificity of the skin test means that the vast majority of skin test reactors detected in areas of high and medium TB prevalence will be infected, regardless of whether they have visible lesions or not.

Where can I find more info?

For more information on testing and other TB topics visit www.tbhub.co.uk. This sheet was produced as a part of a Knowledge exchange project funded by NERC. For more info contact a.robertson@exeter.ac.uk or visit www.tbknowledgeexchange.co.uk.

Studies referenced

1. **de la Rua-Domenech et al. (2006)** Res. Vet. Sci.
2. **Goodchild *et al.* (2015)** Veterinary Record.
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