

## Tuberculosis; The Tale of a Detective and a Potential Bioterrorist

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On the cold dusty morning of Monday 17th January 2022., around 9:30am, I was at Central (CA) Amosun, Ibadan, Oyo state, Nigeria, where I currently work as a veterinary meat inspector as part of the mandatory National Youth Service Corp (NYSC) scheme in Nigeria.

On that morning during my routine meat inspection, I caught a glimpse of a butcher with a black large plastic washing bowl, whisking away offal's from slaughtered eviscerated cattle I was yet to inspect. You would wonder why he was evading inspection of the offal's? on sighting the white overall usually worn by meat inspectors, the fear of seizure of the offal's (organs) which he knew was clearly unhealthy for human consumption, made him take to his heels.

My detective instincts, public health inclination, adrenaline surge and athleticism all culminated in a chase synonymous to that of a detective and a criminal mastermind. I tracked this butcher and finally caught up with him. On inspection of the contents in the plastic bowl, I found lesions (tubercles: firm, yellowish-white, greyish nodules) suggestive of chronic tuberculosis in all lobes of the lungs. Like a remorseful convicted felon the butcher resulted in begging me not to condemn the diseased organs.

With the help of my colleagues and some DVM IV students from the University of Ibadan on professional field practice at the abattoir, the diseased organ (Figure 1) was confiscated.

This short story of my experience is almost an everyday scenario at CA. The absence of meaningful compensation, border control and sometimes malicious intent of butchers to deliberately sell diseased offal's to unsuspecting members of the public have made



**Figure 1:** TB infected lungs.

them potential bioterrorists, likewise turned veterinary meat inspectors' detectives. Complete lobes of diseased lungs can be cut into over 200 pieces and can be used to potentially feed over 200 unsuspecting individuals. An average of 4 infected organs (majorly lungs and liver) are confiscated in everyday at CA. However, a large proportion/number of these diseased organs make it to the market due to the veterinary department being understaffed.

### What is Tuberculosis (TB)?

The first recorded cases describing TB, was recorded 3300 and 2300 years ago, were found in India and China, respectively [1,2].

Tuberculosis (TB) is infectious usually starting insidiously and developing into a chronic disease of man and animals (zoonotic) caused by strains of the *Mycobacterium tuberculosis* complex.

(MTC). The MTC includes *Mycobacterium tuberculosis*, *M. africanum*, *M. bovis*, *M. microti*, *M. canettii*, *M. caprae*, *M. pinnipedii*, *M. suricattae*, *M. mungi*, *M. dassie*, and *M. oryx* [3].



**Figure 2:** Bronchial lymph node with lesions suggestive of TB.



**Figure 3:** TB infected liver.

Histologically, *Mycobacteria* are non-motile, Gram-Positive non-spore forming, rod shaped, catalase positive bacteria.

TB is a chronic disease characterized by gross pathology named tubercles (firm, yellowish-white or greyish nodule) found in the lungs and lymph nodes. However, it occasionally affects other organs and tissues such as the liver, spleen, pleura, mammary glands, gastrointestinal and urogenital tracts. Lesions can also be present in the thymus, ovaries testis, small and large intestines [4].

A whopping sum of 1.5 million people were casualties from TB in 2020, 214 000 of them are people infected with Human immunodeficiency Virus. TB is the second leading infectious killer after COVID-19 and the thirteenth leading cause of death in the world. An estimate of 10 million people fell ill with TB worldwide, 5.6 million men, 3.3 million women and 1.1 million children in 2020. TB is often overlooked in children and adolescents by health workers this makes it difficult to diagnose and treat. TB is a multiracial disease that can affect all age groups. However, TB is curable and preventable [5].

### Transmission

The disease is transmitted by contact between infected domestic animal, wild animals and humans. The typical route of infection is by inhalation of infected droplets which are expelled from the lungs by coughing in humans and animals. Infection can also occur from direct contact with an open wound. Ingestion raw (unpasteurized) milk and other dairy products from infected cow can lead to infection in humans and calves.

TB is an insidious disease the course is slow and takes several months or years to reach the terminal stage. Consequently, an infected animal can be a carrier of the disease and shed the within a herd before the appearance of classical clinical signs. Hence, passage of undetected infected domestic animals is a major way of spreading the disease, especially in nomadic cattle herds of west Africa.

### Clinical signs and symptoms

In humans, symptoms include coughing for three or more weeks, hemoptysis, chest pain, fatigue, emaciation, pyrexia, night perspiration and anorexia.

In animals, clinical signs are neither visible nor easily detectable in the early stages of TB. However, the chronic phase can be linked with progressive emaciation, lethargy, anorexia, pyrexia, pneumonia with a chronic moist cough. The lymph nodes may also be enlarged. Lymphomegaly, especially of the head and neck as well as discharging lymph node abscesses are important.

### Diagnosis

In Africa and developing countries around the world, most laboratories rely on sputum microscopy using Zeihl-Neilsen (ZN) acid fast stain, as a cornerstone for diagnosis of tuberculosis.

### Ante-mortem Diagnosis

Clinical signs, Tuberculin Test, Enzyme-Linked Immunosorbent Assay (ELISA), Interferon Gamma Assays (Bovigam®).

### Post-mortem Diagnosis

Histopathological diagnosis, Bacterial Isolation and *Mycobacterial* Culture, Polymerase Chain Reaction (PCR) and Molecular Typing, Genomic Deletion Typing and Spoligotyping.

## Treatment

The standard medication for antibiotic sensitive isolates consists of two months of isoniazid, rifampicin, ethambutol, Streptomycin and pyrazinamide, followed by 4 months of isoniazid and rifampicin [6]. *Mycobacterium bovis* is resistant to pyrazinamide [7].

## Control

The control of infectious diseases involves two related strategic goals: the isolation of focal areas to prevent disease spread, and control or eradication within these centers. For disease control in domesticated animals, quarantine of newly acquired herds of animals or groups of herds is important [8], where in comprehensive tests will be carried out and affected animals will be treated or culled. This strategy has been proven successful in the eradication and control of *Mycobacterium bovis* (bovine tuberculosis or Tb) in many parts of the world.

Regular field tests for tuberculosis disease control in domesticated animals helps to prevent transmission of this disease beyond the herd. The slaughter of diseased animals removes the infection from within the herd hence, test-and-slaughter policy is a gold standard of bovine TB control, it is the basis for international bovine tuberculosis control and eradication programs using Tuberculin Skin Test (TST) to detect affected animal [9-11], that may shed the infective organism. Test and slaughter policy combined with herd isolation and vaccination has been proven to be very effective in the control and eradication of bovine TB [8].

The test and slaughter policy may be of significance in the developed countries because of the effective and compulsory reporting of *M. bovis* infection of all animals, quarantine of infected herds, testing of animals in-contact with suspected or confirmed cases of bovine TB, movement restrictions on cattle herds in TB endemic areas and also of cattle herds not yet tested for TB [12,13]. However, the World Health Organization (W.H.O) has proposed that the test-and-segregation program, a modified form of the test-and-slaughter policy, will be more significant in developing countries, where the test-and-slaughter policy is usually impracticable because of the endemicity of TB in the cattle population. Measures are taken to segregate positive reactors slaughter them [14]. Farm management Operations such as proper cleaning and disinfection are important to reduce intra-herd or inter-herd spread of TB, this will ultimately reduce the risks of exposure and transmission of bovine TB infection to humans [15]. Algeria, Burkina Faso, Cameroon,

Morocco, Namibia and South Africa are the only African countries with strict test-and-slaughter policy as a control measure also bovine.

TB is a notifiable disease in these countries [16,17], and this policy has successfully reduced the prevalence of bovine TB.

The Federal Ministry of Agriculture oversees the control of bovine TB in Nigeria. However, test and slaughter policy as stated in the Animal Disease (Control) Decree of 1988 has not been implemented in recent years. This is due to socio-economic challenges such as high cost of sustainable testing and slaughter, and the absence of subsequent compensation to the farmers.

Procedures to minimize wildlife reservoir hosts population density can decrease animal TB transmission, the invention and administration of TB vaccines for wildlife reservoirs [18], will reduce effects in situations where the test-and-slaughter policy is totally non-viable. Pasteurization of milk and milk products are of practical significance in bovine TB eradication initiatives [18]. Vaccination is not very effective, the contemporary TB vaccine, *M. bovis* BCG provides minimal protection against pulmonary TB in cattle and man.

## Recommendations

- Government at all levels should make compensation available to butchers.
- There should be provision for TB testing at the various land borders and at every Animal disease Control post by Veterinary Officers.
- More Veterinarians should be employed by the state government.
- Public enlightenment campaigns should be organized by governmental and nongovernmental organizations to create awareness concerning the deadly nature of Tuberculosis.
- TB surveillance and reporting should be adhered to strictly.
- Personal protective equipment should be made compulsory for all abattoir workers to reduce exposure to infection.
- A health insurance policy and routine medical check-ups should be carried out for abattoir workers.
- Illegal Abattoirs should be shut down immediately.

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