ORIGINAL ARTICLE

Spectrum of *Brucella melitensis* Infection: A Retrospective Study from a Tertiary Care Hospital in South India

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Abstract

Background: Brucellosis remains an underdiagnosed zoonotic disease in India due to its nonspecific clinical presentation and limited diagnostic awareness.

Materials and methods: A retrospective analysis of all culture-confirmed brucellosis cases between January 2019 and September 2025 was conducted in a tertiary care hospital in Madurai, Tamil Nadu. Demographic, clinical, laboratory, and outcome data were extracted from the medical records of affected patients.

Results: During the study period, 14 patients with culture-confirmed brucellosis were identified. The median age was 49.5 years, and 57% were male. Blood cultures accounted for 86% of isolates, followed by pus and ascitic fluid. Fever was the most common presenting symptom. Diabetes mellitus was the most frequent comorbidity. Clinical manifestations ranged widely, including epididymo-orchitis, spondylodiscitis, cellulitis, Acute demyelinating encephalomyelitis (ADEM), and complications in chronic liver disease. Treatment regimens varied but predominantly included doxycycline with an aminoglycoside.

Conclusion: *Brucella melitensis* infection demonstrates diverse clinical presentations. Automated identification systems facilitate timely detection. Improved awareness among clinicians is essential for early diagnosis in endemic regions.

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Introduction

Brucellosis is a globally distributed zoonotic infection caused by Gram-negative coccobacilli of the genus *Brucella* and continues to be a significant yet often overlooked public health concern in many developing countries. Among its species, *Brucella melitensis* is primarily associated with sheep and goats and is the most virulent and frequently implicated species in human disease. Transmission occurs through direct animal contact, inhalation of aerosols, or ingestion of unpasteurized dairy products.[1]

Globally, more than 500,000 new cases are reported each year. In several endemic regions, the prevalence exceeds 10 cases per 100,000 population. However, these figures likely underestimate the true burden of disease, as it is estimated that for every confirmed case, up to 26 additional cases go undiagnosed. Reported incidence rates vary widely across endemic areas, ranging from less than 0.01 to over 200 cases per 100,000 individuals.[2,3]

Human brucellosis presents with a broad spectrum of clinical features, including undulating fever, constitutional symptoms, arthritis, hepatosplenomegaly, and focal complications. Due to these nonspecific manifestations, it is often misdiagnosed as tuberculosis, malaria, enteric fever, or viral infections, particularly in low-resource settings. In India, the disease is likely underreported due to limited clinician awareness and inadequate diagnostic capacity.[3]

Automated microbial identification systems such as VITEK 2 Compact have improved the detection of *Brucella* species in clinical laboratories. The current study aims to present a comprehensive analysis of culture-confirmed *B. melitensis* infections at a tertiary care center in South India, focusing on the clinical profile, specimen distribution, comorbidities, and outcomes of affected patients.

Materials and Methods

Study Design and Setting

A retrospective observational study was conducted in the Department of Microbiology at a tertiary care hospital in Madurai, Tamil Nadu, from January 2019 to September 2025.

All patients with clinical specimens that yielded *B. melitensis* on culture and were confirmed by the VITEK 2 compact automated system were included.

Data Collection

Demographic details, clinical presentations, comorbidities, imaging findings, laboratory parameters, treatment regimens, and clinical outcomes were retrieved from patient medical records.

Microbiological Processing

The BACTEC FX40 automated blood culture system was utilized for blood cultures. Body fluids, pus, and sterile site aspirates were inoculated on 5% sheep blood agar and MacConkey agar and incubated at 37°C under aerobic conditions for 48 hours. *Brucella* was differentiated from other Gram-negative organisms based on small, translucent, easily emulsifiable colonies on blood agar (nonpigmented and nonhemolytic), Gram-negative tiny coccobacilli, nonencapsulated, nonmotile, oxidase, catalase, and urease positive. Confirmation of all isolates was made by the VITEK 2 automated system. Antimicrobial susceptibility for *B. melitensis* is not available in the VITEK 2 compact system, hence not reported.

Data Analysis

Data were summarized using descriptive statistics (frequencies, percentages, medians). Analysis was performed using Microsoft Excel.

Results

During the study period, a total of 1,10,455 clinical specimens were processed in the microbiology laboratory, from which 14 (0.012%) isolates of *B. melitensis* were identified using the VITEK 2 compact system (Table 1). The median age of patients was 49.5 years, ranging from 12 to 69 years, with a male predominance (8 males and 6 females). Most isolates (86%) were recovered from blood cultures, while the remaining were obtained from ascitic fluid and pus samples (Fig. 1).

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Table 1: Summary of cases ($n = 14$)

S. no.	*Age/sex*	*Address*	*Sample*	*Diagnosis*	*Comorbidities*	*Outcome*
1	54/F	Duraisamiyapuram, Virudhunagar	Blood	Bronchial asthma—acute exacerbation	T2DM and SHTN for 3 years; bronchial asthma for 10 years	Improved and discharged
2	57/M	Nakkalapatti, Dindigul	Blood	Pyrexia of unknown origin/fever for 2 months, arthralgia, dry cough, and dysuria	T2DM	AMA
3	44/M	Nilakottai, Dindigul	Blood	Fever for 5 days	Newly diagnosed diabetes mellitus	Improved and discharged
4	55/F	Uthrakosamangai, Ramanathapuram	Ascitic fluid	Abdominal distension and pain for 10 days	Decompensated cirrhosis of liver/CTP 7/B/MELD-Na 30	Improved and discharged
5	53/M	Anaipatti, Theni	Blood	Fever for 2 weeks	Chronic liver disease/hepatitis	Improved and discharged
6	43/F	Pramanam Patti, Sivaganga	Blood	LRI (fever and cold for 10 days)	–	Improved and discharged
7	53/M	Poothangudi, Ramanathapuram	Blood	Acute febrile illness/right arm cellulitis/abscess	–	AMA
8	38/M	Atkondan Street, Bodinayakanur, Theni	Blood	Left epididymo-orchitis	Antral gastritis	Improved and discharged
9	69/F	Therasapuram, Tuticorin	Blood	Urinary tract infection	T2DM/coronary artery disease	Improved and discharged
10	12/M	Nambiyoor, Sivaganga	Blood	Acute disseminated encephalomyelitis (ADEM)	–	Improved and discharged
11	41/M	Sugar Mill Road, Madurai	Blood	Fever for 1 week	T2DM	Improved and discharged
12	69/M	Oomachikulam, Madurai	Pus and blood	Paraspinal muscle abscess/ spondylodiscitis D6–D7	–	Improved and discharged
13	48/F	Virudhunagar	Blood	Left infected humerus fracture/ fever for 4 days	DM for 2 years; depression for 3 years	Improved and discharged
14	57/F	Appipalayam, Karur	Blood	Fever for 10 days	T2DM/CAD—unstable angina	AMA

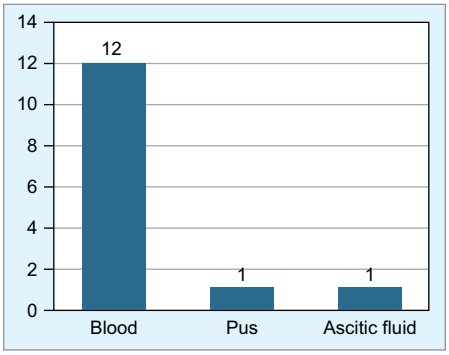

Fig. 1: Sample distribution

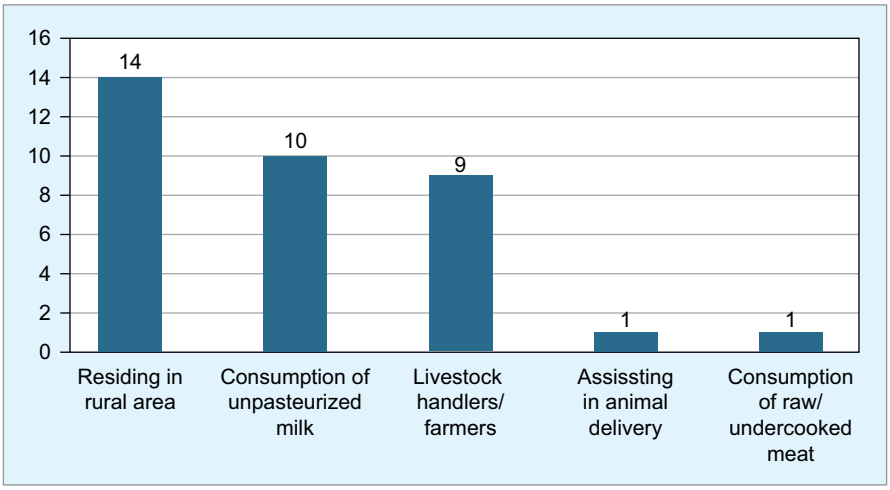

Fig. 2: Distribution of risk factors

In this study, among 14 patients evaluated for potential zoonotic exposure, all individuals (100%) were found to reside in rural areas. A significant proportion, 71.4% of patients, reported consuming unpasteurized milk, a known vehicle for oral transmission of brucellosis. Additionally, 64% were actively engaged in livestock handling or farming, indicating that frequent direct contact with animals is an established route for transmission of zoonotic pathogens such as *B. melitensis*. Less commonly reported behaviors included assisting in animal delivery (14.3%) and consumption of raw or undercooked meat (14.3%), both of which, despite their lower frequency, represent high-risk practices due to potential exposure to infected animal tissues or fluids (Fig. 2).

Clinically, fever was the most frequent presentation across cases, though the manifestations varied widely. Patients presented with diverse clinical syndromes, such as acute febrile illness, pyrexia of unknown origin, lower respiratory tract infection, epididymo-orchitis, cellulitis with abscess formation, chronic humeral osteomyelitis, paraspinal abscess with spondylodiscitis, and neurologic involvement, including acute disseminated encephalomyelitis (ADEM) with optic neuritis. Diabetes mellitus emerged as the most common comorbidity, followed by chronic liver disease, coronary artery disease, and other conditions such as hypertension and depression. Despite the broad spectrum of clinical presentations, most patients

responded well to treatment involving combinations of doxycycline, ceftriaxone, gentamicin, or streptomycin and were discharged in stable condition. Three patients left the hospital against medical advice (AMA) due to financial or personal constraints. No mortality was recorded during the study period.

Discussion

Brucellosis remains an important yet underrecognized zoonotic disease in many low- and middle-income countries (LMICs), including India. In this study, all patients were from rural backgrounds, and a majority reported a history of animal exposure, which reflects the strong epidemiological linkage between livestock contact and human infection. Individuals involved in occupations such as farming, animal husbandry, and handling of livestock are disproportionately affected due to frequent contact with infected animals, contaminated materials, or unpasteurized dairy products. In addition, households living near domestic animals experience a continuous risk of exposure. Socioeconomic limitations, restricted access to healthcare, and lack of disease awareness further contribute to the persistence of brucellosis among marginalized rural communities.[4] A notable demographic finding was the male predominance, consistent with previous literature. Men are more likely to engage in livestock-related work, offering a plausible explanation for their higher exposure risk. Behavioral and occupational patterns among rural populations may therefore cause this disparity. Most patients in our study sought medical attention within 2 months of symptom onset, and the predominant symptoms were fever, cough, and fatigue, which are nonspecific and often overlap with common tropical infections such as tuberculosis, malaria, dengue, enteric fever, and viral illnesses. This nonspecificity remains a major cause of delayed diagnosis, misclassification, and inappropriate empirical treatment.[5] A high proportion of patients had bacteremia, with *B. melitensis* isolated from blood in 86% of cases. Automated blood culture systems significantly improve their detection, as conventional methods often yield false-negative results due to slow growth and low-level circulation. The increased detection of Brucella in our institution over recent years is likely attributable to the implementation of automated blood culture and identification systems, which are more sensitive and consistent than traditional culture techniques, as supported by previous studies.[2,6,7] Among focal presentations, epididymo-orchitis is a well-described urogenital manifestation of brucellosis, reported in 2–14% of patients. Brucella species can cause granulomatous orchitis, typically presenting as acute or chronic unilateral testicular swelling. While epididymo-orchitis commonly develops as part of systemic dissemination following an established diagnosis of brucellosis, it may rarely present as the initial manifestation. In endemic regions, brucellar epididymo-orchitis should therefore be considered in the differential diagnosis of acute scrotal pain to prevent misdiagnosis and unnecessary surgical interventions.[8] Neurobrucellosis is another significant but less common complication and can occur at any stage of the disease. Its presentations include encephalitis, meningoencephalitis, myelitis, radiculopathy, psychiatric symptoms, and cranial nerve involvement. Our pediatric case illustrated this complexity: the child presented with acute left hemiplegia and UMN facial palsy, with MRI findings consistent with ADEM (Fig. 3). Progression of lesions and later optic neuritis indicated aggressive neurological involvement, but the patient improved with timely administration of steroids, intravenous immunoglobulin, and targeted antimicrobial therapy. Similar cases of Brucella-associated ADEM have been reported previously, reinforcing the need for clinicians to consider brucellosis in the differential diagnosis of acute demyelinating syndromes, especially in endemic regions.[9]

One patient presented with spondylodiscitis at the D6–D7 level, accompanied by a paravertebral abscess, a pattern consistent with previous observations that Brucella tends to affect the lower thoracic and lumbar segments (Fig. 4). The clinical course is typically insidious, with back pain as the predominant symptom, and progression to paravertebral or epidural abscess formation may occur due to contiguous spread from the infected disc space. This case also demonstrated the common diagnostic challenge in endemic regions, where brucellar spondylodiscitis is frequently misinterpreted as tuberculous spondylitis because both conditions can produce granulomatous inflammation and share overlapping radiological features. A similar case of Brucella spondylodiscitis with paravertebral abscess has been reported, further highlighting the global occurrence of this complication.[10]

Comorbidities such as diabetes mellitus and chronic liver disease were common in this study. Diabetes-associated immune impairment may predispose individuals to more severe infection, prolonged bacteremia, or focal complications. Similarly, chronic liver disease may alter host immunity and complicate clinical presentation.

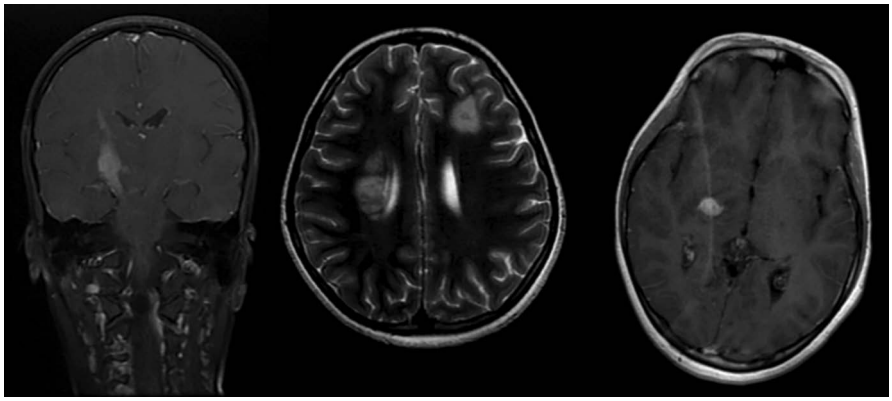

Fig. 3: MRI showing acute demyelinating encephalomyelitis in a 12-year-old male

Fig. 4: MRI showing spondylotic changes and degenerative disk changes in the dorsal and lumbar spine in a 69-year-old male

These observations suggest that clinicians should maintain a high index of suspicion for brucellosis in immunocompromised patients presenting with unexplained fever for a prolonged duration.[11,12] Accurate diagnosis of brucellosis remains challenging. Its nonspecific clinical features and low sensitivity of routine laboratory tests necessitate robust microbiological support. Automated blood culture and identification systems, such as the VITEK 2 Compact used in this study, substantially improve diagnostic accuracy and reduce turnaround time. Early diagnosis is critical, as delayed recognition can lead to complications, chronicity, and relapses.[13] Treatment outcomes in our study were favorable, with most patients responding well to therapy. The commonly used regimen consisted of doxycycline for 6 weeks combined with an aminoglycoside (gentamicin or streptomycin) for the first 2 weeks, aligning with WHO recommendations.[6] In patients with neurological involvement, a triple-drug regimen including doxycycline, aminoglycoside, and rifampicin was employed to ensure adequate central nervous system penetration. Compliance with prolonged therapy remains crucial to prevent relapse, though socioeconomic and logistic barriers led to some patients leaving against medical advice. Overall, this study highlights the continued burden of brucellosis in rural India, the importance of occupational and environmental exposure, and the utility of modern automated diagnostic systems.

Conclusion

Despite India being known for its endemicity for brucellosis by a plethora of case reports, case series, and reporting of isolates in animals, it is unfortunate that it remains a diagnostic challenge. Most of the reports are from a few centers of excellence with well-equipped microbiological laboratories. The disease may be overlooked and misdiagnosed because of the difficulty in diagnosis and the lack of experience with laboratory testing. Awareness and high suspicion among all clinicians and microbiologists are the need of the hour to tackle this zoonotic disease, as no effective vaccine is available. Active collaboration between health and veterinary services should be promoted as a part of the One Health approach to manage this zoonotic disease effectively.

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