


# Cervical *Brucella* Spondylitis: A Case Report on Diagnosis and Surgical Management

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**Background:** *Brucellosis* is a zoonotic disease that can affect various organs, including the spine. Cervical spondylitis caused by *Brucella* is rare but can lead to significant morbidity if not diagnosed and treated promptly.

**Case Presentation:** We report a case of a 46-year-old female who presented with intermittent high fever and intractable neck, shoulder, and back pain for two months. She was diagnosed with *Brucella* cervical spondylitis based on clinical manifestations, Rose-Bengal Plate Agglutination Test (RBPT, positive), and cervical MRI findings. She was treated with a combination of antibiotics for at least two weeks, followed by surgical intervention including abscess clearance, partial vertebral resection, and titanium mesh bone fusion. Real-time Polymerase Chain Reaction (RT-PCR) confirmed the presence of sheep *Brucella* DNA. The patient recovered well postoperatively with significant pain reduction and restoration of full mobility in the right upper limb.

**Conclusion:** This case highlights the diagnostic value of RT-PCR and tissue biopsy in cervical brucellosis spondylitis. Our study found that anterior cervical subtotal corpectomy can restore cervical stability, clear abscess, and relieve spinal cord compression on the basis of drug treatment, with good clinical results.

**Keywords:** *Brucellosis*, cervical spondylitis, anterior cervical subtotal corpectomy, RT-PCR, gam staining, case report

## Background

*Brucellosis* is a zoonotic systemic infectious disease caused by *B. melitensis* infection, which is mainly prevalent in pastoral areas of Northern China. The global annual incidence of human brucellosis has recently been estimated at approximately 2.1 million cases, indicating that the disease remains a significant public health concern, particularly in resource-limited settings.<sup>1</sup> This high incidence underscores the need for accurate diagnosis and effective management strategies. Brucellosis spondylitis (BS) accounts for 2%~60% of brucellosis.<sup>2-4</sup> It is easy to invade spinal column and intervertebral discs. Clinical brucellosis spondylitis is more common in lumbar spine or thoracolumbar spine. Cervical brucellosis spondylitis (CBS) is extremely rare.<sup>5</sup> Moreover, there are few reports on this disease in domestic and foreign literatures. The bacteria destroy intervertebral discs and vertebral bodies, causing cervical instability, while the inflammatory granulation tissue and abscess of the disease can compress the spinal cord, causing sensory and motor dysfunction of limbs, and even paraplegia.<sup>6,7</sup> Pain is the most common symptom in patients with brucellosis.<sup>8</sup> Although spondylitis associated with brucellosis is relatively infrequent, cervical spondylitis is an exceptionally rare manifestation. Cervical spondylitis is a severe complication of brucellosis, potentially leading to persistent pain, neurological deficits, and even paralysis if left undiagnosed and untreated. More importantly, due to the abuse of nonsteroidal anti-inflammatory drugs and antibiotics in China, the typical wave fever phenomenon in patients with brucellosis spondylitis is relatively rare, which brings greater challenges to the diagnosis of the disease.<sup>5,8</sup>

Real-time Polymerase Chain Reaction (RT-PCR) is a highly sensitive and specific molecular diagnostic technique that enables rapid and accurate detection and identification of pathogens. Compared to traditional bacterial culture and

biochemical identification methods, RT-PCR is more convenient, faster, and has been widely adopted for diagnosing various infectious diseases.<sup>9</sup> In the context of brucellosis, RT-PCR not only detects *Brucella* nucleic acids in clinical samples but also facilitates species differentiation, providing crucial information to guide targeted treatment strategies. While antimicrobial therapy is the mainstay of treatment for brucellosis,<sup>10</sup> severe cases of cervical spondylitis often necessitate surgical intervention to eradicate the infectious foci and alleviate spinal cord compression symptoms that may not be adequately addressed by medical management alone. Surgery aims to debride the infectious lesions, decompress neural structures, and restore spinal stability, thereby halting disease progression and promoting patient recovery.<sup>11</sup>

This report presents a rare case of brucellosis-associated cervical spondylitis. Through this case, we aim to highlight the pivotal roles of RT-PCR and surgical intervention in the diagnosis and management of this condition. Additionally, we seek to raise awareness among clinicians about this uncommon yet severe complication, ultimately enhancing diagnostic and therapeutic approaches.

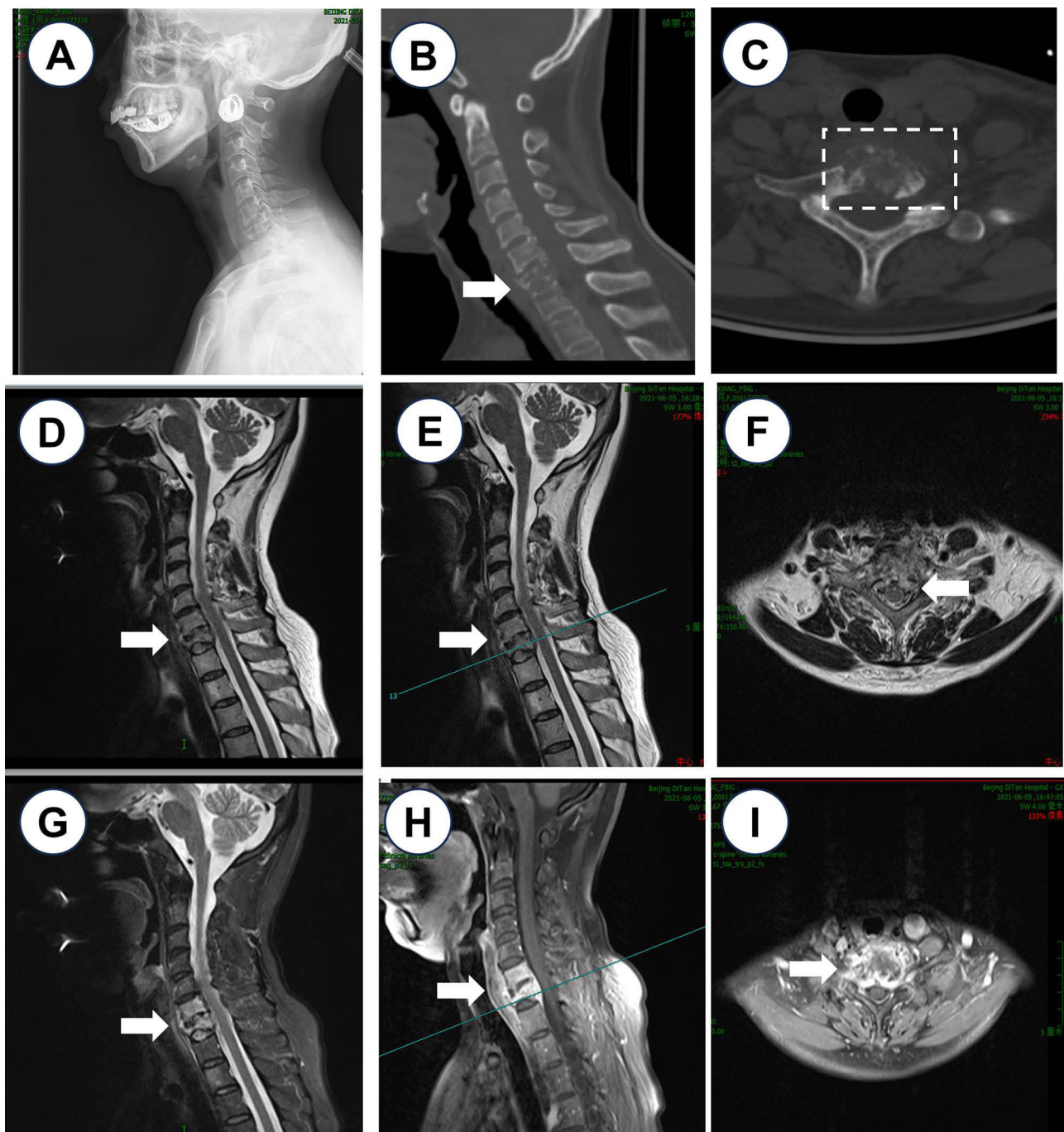
## Case Presentation

A 46-year-old female from Hulunbeir City, Inner Mongolia, presented with a two-month history of intermittent high fever (up to 40.1°C) accompanied by persistent neck, shoulder, and back pain. Despite having no direct contact with cattle, sheep, dogs, or consumption of raw meat and dairy products, her symptoms persisted. She reported a weight loss of 2.5 kg, normal bowel habits, and poor sleep due to pain, without any signs of fatigue or night sweats. Upon her initial consultation at our hospital Orthopedics Outpatient Department on June 1, 2021, she was admitted for suspected cervical brucellosis spondylitis. Physical examination revealed significant tenderness at the C7 spinous process and paravertebral areas, limited cervical spine mobility, and radiating pain to the right upper limb. Neurological examination showed reduced right triceps tendon reflex and a muscle strength of grade 3 in the right upper limb. Diagnostic tests were performed to clarify her condition. The Rose Bengal plate agglutination test was positive, suggesting brucellosis. Concurrently, tuberculosis screening via T-SPOT showed increased spots of interferon alpha and beta, and a positive PPD test, though tuberculosis antibodies were negative, and no acid-fast bacilli were detected in sputum smears. Initial investigations showed leukopenia (WBC 4.57x10<sup>9</sup>/L) with relative neutrophilia (51.3%), and anemia with a hemoglobin level of 103 g/L. Inflammatory markers were mildly elevated (CRP 0.5 mg/L, ESR 7mm/hr). Imaging studies, including X-rays, CT, and MRI scans of the cervical spine, demonstrated destructive spondylitis at the C7 vertebral level with paravertebral abscess formation (Figure 1). Based on these findings, a diagnosis of *Brucella* cervical spondylitis was confirmed.

Treatment began with a two-week regimen of antibiotics, including doxycycline, rifampin, levofloxacin, and ceftazidime-sulbactam. Surgical intervention was deemed necessary due to the persistence of symptoms and imaging findings. The patient underwent anterior cervical debridement and decompression, C7 subtotal corpectomy, and titanium mesh bone graft fusion, with a cervical titanium plate for internal fixation (Figure 2). The surgery involved meticulous removal of the infected tissue and decompression of the cervical spine. Postoperative care included continued antibiotic therapy, nourishment for nerve recovery, and precautions to prevent esophageal and respiratory complications. Pathology from intraoperative samples confirmed extensive *Brucella* involvement via Gram staining and RT-PCR, while tuberculosis was excluded (Figure 3). Follow-up at six months showed significant improvement in pain, recovery of muscle strength to grade 5 in the right upper limb (Figure 4), and normalization of inflammatory markers.

## Discussion

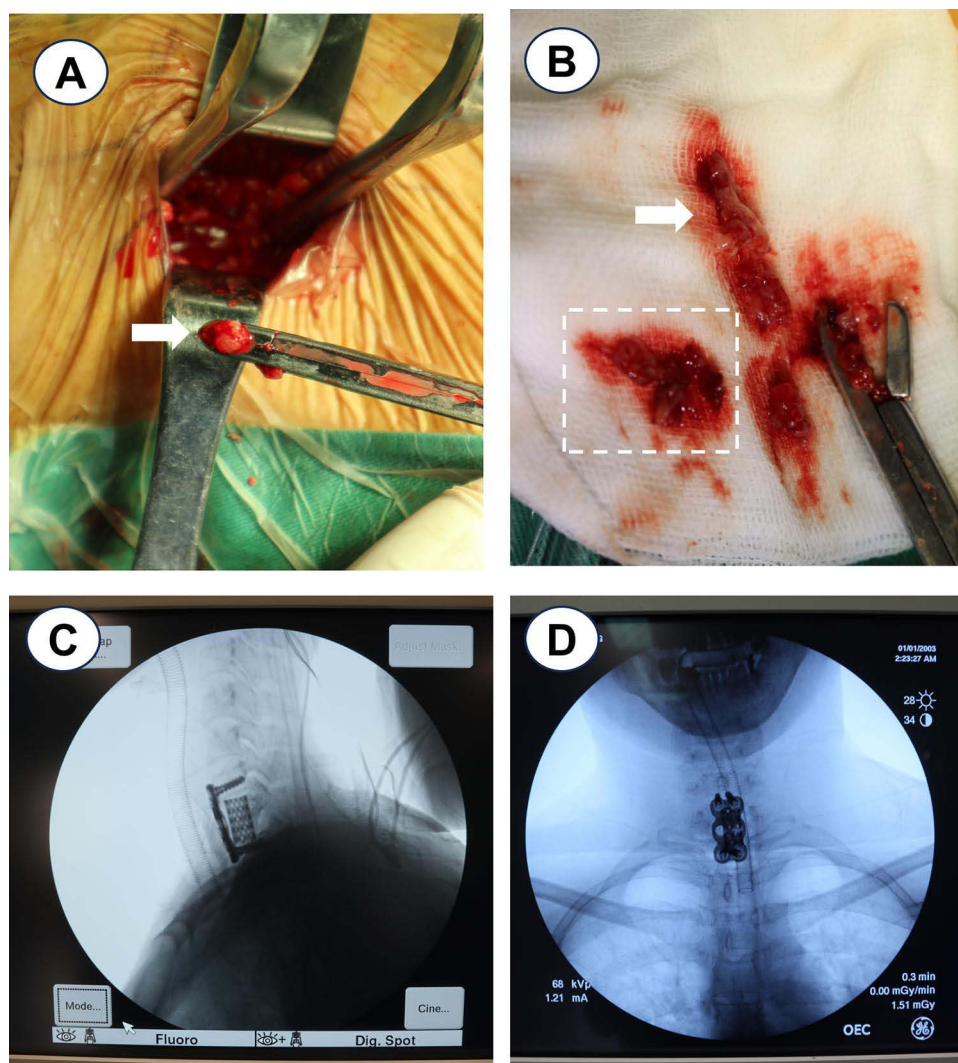
This case study presents a 46-year-old female patient with intermittent fever, neck, shoulder, and back pain persisting for two months. Laboratory tests revealed a positive Rose Bengal agglutination test, indicating brucellosis infection. Cervical spine MRI demonstrated signs of cervical spondylitis, such as spinal cord compression and abscess formation. RT-PCR detected *Brucella* melitensis DNA from the surgical specimen, and tissue biopsy confirmed the infectious lesion. The patient underwent anterior cervical corpectomy to remove the abscess, resect part of the vertebral body, and install a titanium mesh for fusion. Postoperatively, her pain was alleviated, and right upper limb mobility was restored. The key findings of this study center around the effective utilization of RT-PCR in the rapid and accurate diagnosis of brucellosis cervical spondylitis. Through this advanced molecular technique, we were able to confirm the presence of *Brucella* DNA



**Figure 1** Results of cervical X-ray (A), CT (B and C) and MRI (D–I) on June 1, 2021 in our hospital. Lesion areas are labelled by white arrows and dashed boxes. CT results showed MRI results showing partial absorption of abscess without significant aggravation compared to MRI on April 27 ((D and E) is cervical sagittal, (F) is cervical horizontal, T1WI; (G and H) is cervical sagittal, (I) is cervical horizontal, T2WI).

in the patient's cervical tissue samples, providing unequivocal evidence of the infection. In this case, surgical intervention was necessary due to the severity of the patient's condition. We adopted an anterior cervical subtotal corpectomy approach, which proved effective in restoring cervical stability, clearing abscesses, and relieving spinal cord compression. Postoperatively, the patient showed significant improvement in pain reduction and mobility restoration. This surgical approach not only addressed the immediate symptoms but also prevented potential long-term neurological complications. The success of the surgical intervention underscores the importance of timely and aggressive surgical management in severe cases of brucellosis cervical spondylitis.

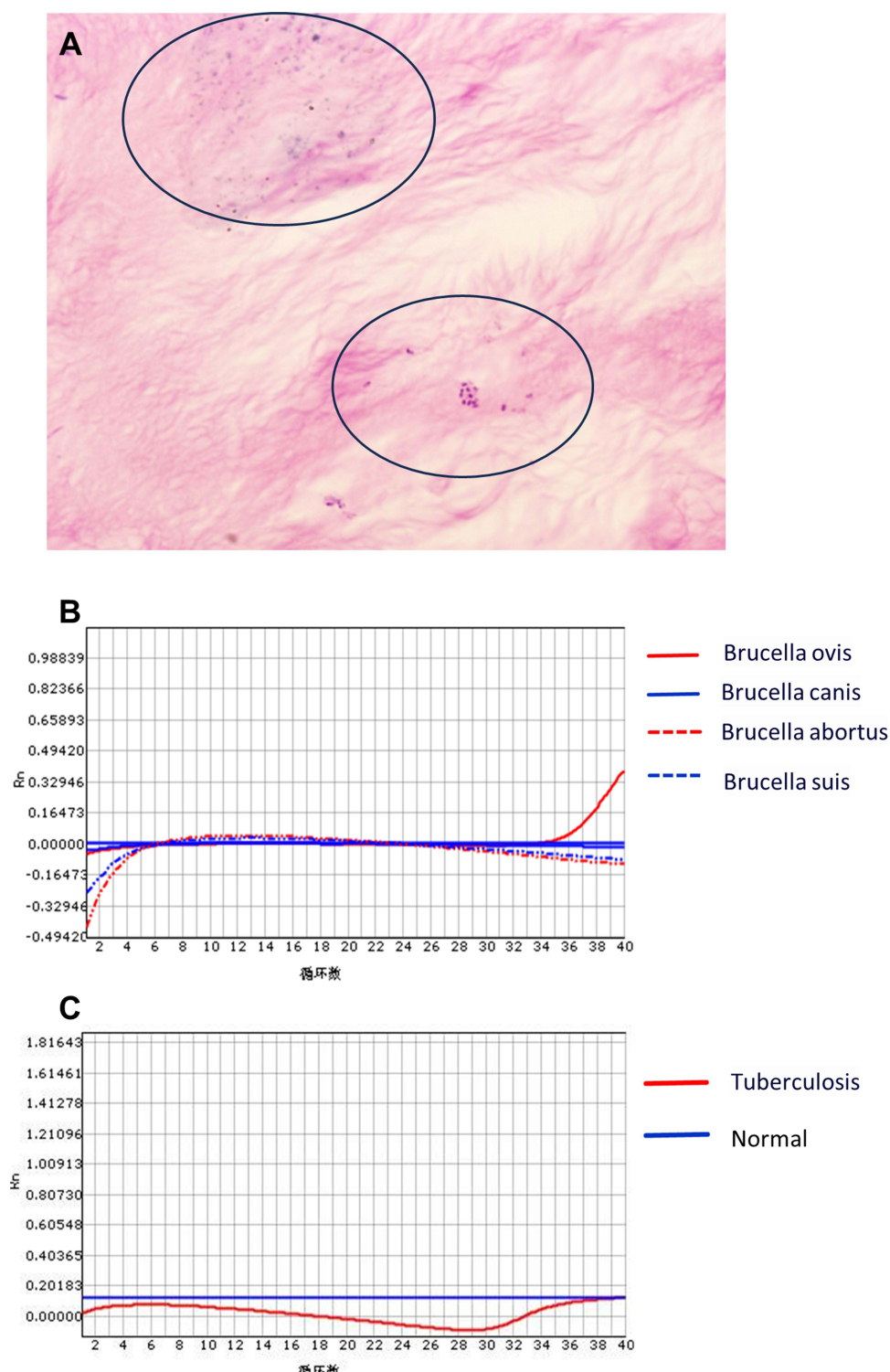




**Figure 2** (A) Abscesses at C6, C7 and T1 were cleared; (B) Pathological samples of abscesses were taken during the operation; (C and D) Subtotal resection was performed on C7, titanium mesh filled with appropriate artificial bone, 2 screws were inserted at C6 and T1 respectively, and appropriate titanium plate fixation was selected. Lesion areas are labelled by white arrows and dashed boxes.

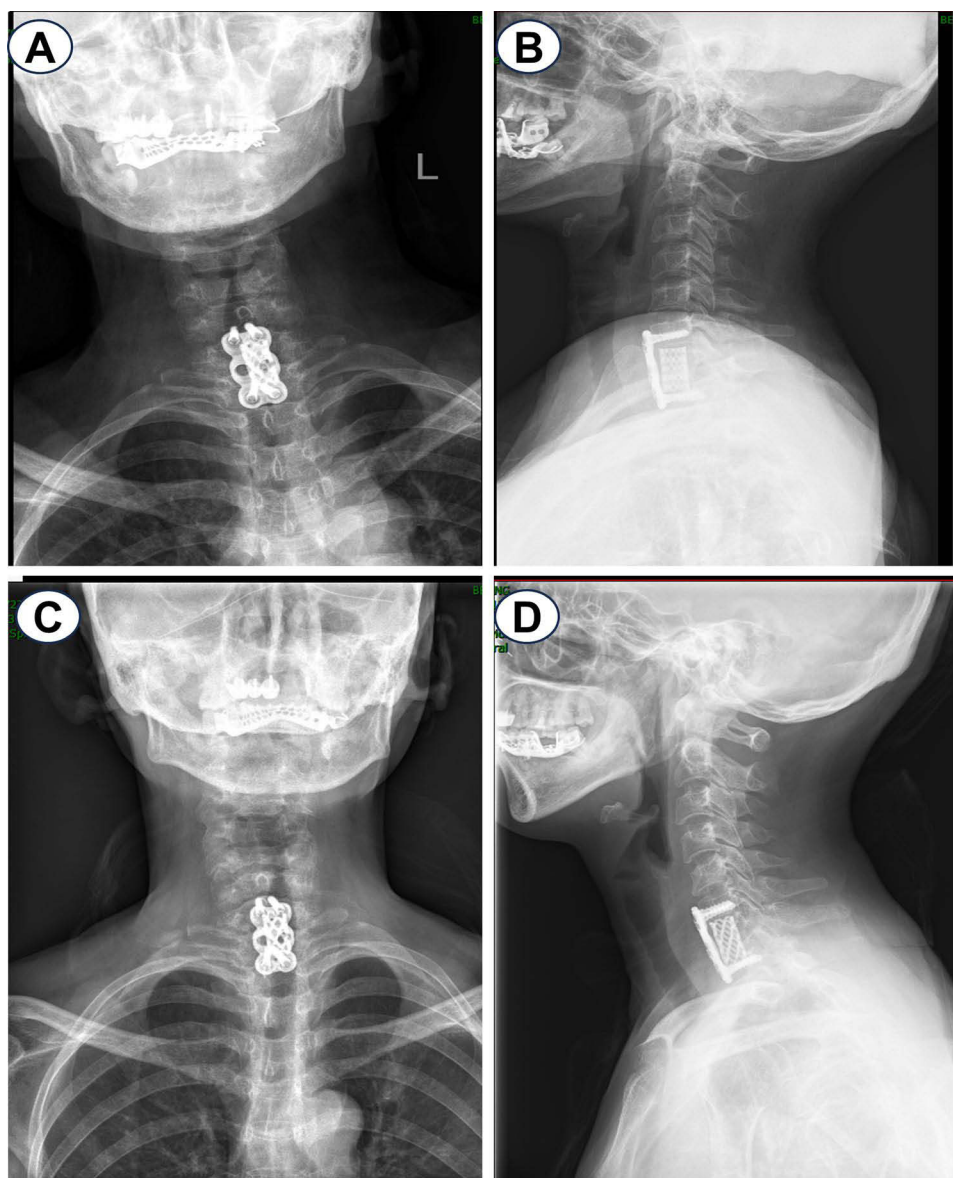
Brucellosis infection is mainly transmitted from cattle, sheep, pigs and other sick animals. And it can be transmitted to humans through damaged skin mucosa, digestive tract, respiratory tract and other ways.<sup>8</sup> Pathological changes can involve many organs and tissues, among which bone joint system is most often affected. 20%~80% of patient's bone joints are invaded, mainly manifested as spondylitis, arthritis, tenosynovitis, osteomyelitis, etc.<sup>12</sup> Among them, brucellosis spondylitis accounts for 2–53% of brucellosis, most of which are lumbar vertebrae, especially L4 and L5, followed by thoracolumbar vertebrae, and cervical vertebrae are rarely involved.<sup>13,14</sup> Therefore, clinical attention to cervical brucellosis spondylitis is not enough, and more confused with cervical tuberculosis, easy to misdiagnosis or missed diagnosis. Importantly, *Brucella* tends to destroy intervertebral discs and vertebral bodies, causing cervical instability, while its granulomas and abscesses are prone to spinal cord compression.<sup>11</sup> Therefore, surgical intervention should be performed as soon as possible with combined antibrucellosis drugs. Surgical treatment can completely remove the focus, relieve the compression of spinal cord and nerve root, reconstruct and maintain the normal sequence and stability of cervical spine.<sup>11,15</sup>

Brucellosis remains a significant public health concern in many countries, including China and neighboring regions, particularly in the developing world.<sup>16</sup> Brucellosis is predominantly associated with pastoral and agricultural areas, where livestock such as cattle, sheep, and goats are common sources of infection. Despite efforts to control the disease through



**Figure 3** (A) A large number of *Brucella* (1000x) can be seen in postoperative pathological Gram staining; (B) RT-PCR detects *Brucella melitensis* DNA at cycle 34 (red solid line *Brucella melitensis*; blue solid line *Brucella canis*; red dashed line *Brucella bovis*; blue dashed line *Brucella suis*); (C) TB DNA was not detected by RT-PCR (red solid line for tuberculosis; blue solid line for normal).

vaccination and public health measures, sporadic outbreaks continue to occur, often due to inadequate veterinary services and lack of awareness among farmers. Neighboring countries also face similar challenges, with varying prevalence rates influenced by local agricultural practices and the effectiveness of disease control programs.<sup>17</sup> In some regions, cross-



**Figure 4** (A and B) Bedside X-ray at 3 days after surgery; (C and D) X-ray at 2 weeks after surgery.

border movement of livestock and trade can exacerbate the spread of brucellosis, highlighting the need for coordinated international efforts to manage and prevent the disease. Similarly, in a recent review (2023) by Hikal et al,<sup>18</sup> the authors compared the epidemiology, prevention, and control strategies of *Brucella abortus* and *Brucella melitensis* in the United States and the Nile Basin countries (Egypt, Sudan, Ethiopia, and Tanzania). While the United States has successfully eradicated brucellosis from domestic animals, the disease remains highly prevalent and endemic in the Nile River Basin countries. The review highlights the importance of understanding the regional epidemiology of brucellosis to develop effective control and prevention strategies.

The persistence of brucellosis in developing countries is mainly driven by inadequate veterinary care, poor public health infrastructure, socioeconomic challenges, and the misuse of antibiotics, necessitating a comprehensive approach to control and eliminate the disease.<sup>19,20</sup> For example, the recent review by Hikal et al<sup>18</sup> also identifies several risk factors contributing to the persistence of brucellosis in developing countries, especially in the Nile Basin region. These factors include the lack of cooperation between policymakers, health officials, veterinary sectors, and farmers, which impedes the implementation of effective control and prevention strategies. Additionally, the review emphasizes the importance of

adopting a one-health approach, involving close coordination between human and animal health sectors, to combat brucellosis effectively. Addressing these risk factors and promoting collaboration among stakeholders could contribute to the successful control and eventual eradication of brucellosis in endemic countries. Addressing these risk factors requires a multi-faceted approach, including improving veterinary and public health services, raising awareness, and enhancing regional cooperation to effectively control and eliminate brucellosis.

RT-PCR plays a crucial role in detecting *Brucella* DNA, offering higher specificity for identifying the infectious agent compared to serological tests.<sup>21</sup> Tissue biopsy provides valuable insights not only through pathological examination but also by enabling bacterial culture and molecular biological testing, which are essential for definitive diagnosis. Furthermore, imaging modalities such as MRI aid in visualizing spinal lesions, abscesses, and other abnormalities, guiding appropriate treatment strategies. Antimicrobial therapy is a cornerstone, with the selection of suitable antibiotics based on susceptibility testing and a combined regimen for at least two weeks. Surgical intervention is often necessary and serves multiple purposes: thoroughly debridement of the infectious focus to facilitate bony healing, decompression of the spinal cord by resecting the affected vertebral body, and restoration of cervical spine stability through internal fixation.<sup>22</sup> The anterior cervical corpectomy performed in this case offered a relatively minimally invasive approach while effectively addressing the underlying pathology and restoring functional capacity.

The prognosis for patients with brucellosis cervical spondylitis is generally favorable when treated promptly and aggressively. However, the long-term outcome depends largely on the extent of spinal cord damage and the timely initiation of treatment. In our case, the patient responded well to the surgical intervention and antibiotic therapy, showing signs of recovery and improvement. Regular follow-up visits are crucial to monitor for any relapse or complications. Imaging studies, such as MRI, and serological tests should be performed periodically to assess the effectiveness of treatment and detect any recurrences early.<sup>5</sup> Close collaboration between the patient, clinicians, and rehabilitation specialists is essential for optimal long-term management and recovery.

As a single case report, our findings have inherent limitations. Firstly, the results cannot be generalized to a broader population due to the specific nature of the case. Secondly, the long-term outcomes and potential complications may not be fully represented in this report. Future directions for research include conducting larger studies to validate the diagnostic accuracy of RT-PCR in a wider cohort of patients with brucellosis cervical spondylitis. Additionally, clinical trials comparing different surgical interventions and antibiotic regimens would provide valuable insights into the most effective treatment strategies. Such studies could lead to improved guidelines for managing this rare but potentially debilitating condition.

## Summarize

Although cervical brucellosis spondylitis is rare, it can invade the intervertebral discs and vertebral bodies, easily leading to vertebral subluxation and further causing cervical instability. Furthermore, inflammatory granulomatous tissue and abscesses can compress the cervical spinal cord. In severe cases, paralysis may occur, possibly even causing lifelong disability for the patient. This condition requires high attention from clinicians. Our case report highlights the diagnostic value of RT-PCR and the effectiveness of surgical treatment in managing brucellosis cervical spondylitis. The rapid and accurate diagnosis facilitated by RT-PCR allowed for timely intervention, which was crucial in preventing further neurological complications. The surgical approach adopted successfully restored cervical stability, cleared abscesses, and relieved spinal cord compression, leading to a favorable outcome for the patient. However, the findings of this single case report should be interpreted with caution, and further research is warranted to validate these observations in a larger cohort. Nonetheless, this case adds to the growing literature on the management of brucellosis cervical spondylitis and underscores the importance of a multidisciplinary approach in treating complex infectious diseases.

## Abbreviations

B. Melitensis, *Brucella melitensis*; BS, Brucellosis spondylitis; CBS, Cervical brucellosis spondylitis; RBPT, Rose-Bengal Plate Agglutination Test; PPD test, Purified protein derivative test; RT-PCR, Real-time polymerase chain reaction; WBC, white blood cell; ESR, Erythrocyte sedimentation rate; CRP, C-reactive protein; PCT, Procalcitonin; CT, Computerized Tomography; MRI, Magnetic resonance imaging; C6, Cervical 6; T1, Thoracic 1.



## Patient Consent and Ethics Statement

This patient provided informed consent for publication of our study and accompanying images; The Ethics Committee of the Beijing Ditan Hospital of Capital Medical University approved the study.

## Consent for Publication

The Beijing Ditan hospital have approved publication of the patient's details. The patient provided written informed consent for publication of this case report and accompanying images.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

Bo Liu and Yao Zhang are co-first authors for this study. The authors report no conflicts of interest in this work.

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