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Abstract

Brucella polyradiculopathy is a rare manifestation of neurobrucellosis. Polyradiculopathy usually gradually progress and cause numbness and muscle weakness in extremities. Patients may present with pain, sensory abnormality, weakness of the extremities, and gate abnormality. Neurobrucellosis is diagnosed according to signs and symptoms, using laboratory tests including serology and imaging. Magnetic resonance imaging with gadolinium injection usually shows enhancement of lumbar nerve roots in *Brucella* polyradiculopathy. For confirmation of polyradiculopathy, nerve conduction studies and electromyography examination are used. Treatment of *Brucella* polyradiculopathy is not different from that of neurobrucellosis. The most common medications used for the treatment are rifampicin, trimethoprim-sulfamethoxazole, doxycycline, ceftriaxone, ciprofloxacin, and streptomycin. Clinical features of the patients guide the physician for duration of treatment. Prompt diagnosis without delay in treatment is associated with fewer sequelae and excellent prognosis.

Keywords

Brucellosis • Neurobrucellosis • Polyradiculopathy
• Polyradiculoneuritis

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Abbreviations

CNS	Central nervous system
CSF	Cerebrospinal fluid
EMG	Electromyography
MRI	Magnetic resonance imaging
NCV	Nerve conduction velocity
PNS	Peripheral nervous system

17.1 Introduction

Brucella infection rarely involves the central nervous system (CNS) with different clinical manifestations [2, 16, 21, 30]. Presentation may be with depression, encephalitis, meningitis, brain abscess, convulsion, cranial nerve palsy, sub-arachnoid hemorrhage, and decreased level of consciousness [19]. Brucellosis may affect the peripheral nervous system (PNS) with a variety of signs and symptoms [27]. Neurologic involvement due to brucellosis was reported in 1.7–10 % of the patients with brucellosis [8, 11, 25].

Complications of neurobrucellosis may be due to the acute-febrile phase of the diseases or may be due to the toxic-febrile phase, i.e., those related to primary involvement of CNS or PNS by the *Brucella* bacteria. Involvement of the CNS is commonly acute and presents as meningitis or encephalitis. Involvement of the PNS mainly present as polyradiculoneuritis [6]. Neurobrucellosis may affect any part of the CNS and PNS and present as any neurological disease [18]. Neurobrucellosis presentations are myelitis, myelopathy, paraplegia, radiculoneuritis, intracerebral abscess, epidural abscess, intradural abscess, demyelination, Guillain-Barré syndrome, polyneuritis, and cranial nerve palsy [7, 8, 10, 11, 16, 30]. Shehata et al. [26] demonstrated that CNS involvement was detected in 33 % of patients and PNS involvement was seen in 22 % of patients. In some cases, however, combined involvement of both CNS and PNS may occur simultaneously [4].

17.2 Clinical Manifestations

Clinical manifestations of neurobrucellosis are categorized as central and peripheral involvement. Peripheral involvements include neuropathy or

radiculopathy. Central involvements include meningitis, cranial nerve palsy, and encephalitis [24].

Clinical manifestation of neurobrucellosis may be due to direct effect of microorganism on the nervous system or may be due to indirect effect with immune mechanisms that eventually lead to neuropathy. In animal model, anti-GM1 ganglioside antibodies are found to be produced in the response to ganglioside-like molecules of *Brucella*. These antibodies can cause flaccid weakness and ataxia-like symptoms.

Neurobrucellosis may present as meningoencephalitis, polyradiculoneuropathy, or both. The main presentation of the peripheral form is polyradiculoneuropathy and the main presentation of the central form is meningoencephalitis [17]. *Brucella* involvement of the spine has no specific manifestation. It may be due to an abscess or granuloma with compression effect on the spinal cord [24]. Polyradiculopathy is one of the rare clinical manifestations of brucellosis.

Brucellosis may affect the CNS and PNS via direct effects of microorganisms or indirect effect by toxin or cytokines. So the presentation may differ ranging from acute illness to chronic form [13]. Polyradiculopathy usually gradually progress and cause sensory and motor weakness in upper and lower limbs [20]. Patients may present with pain, sensory loss and weakness of the limbs, and difficulty of walking [13] but usually present with weakness of the lower extremities [5]. Spinal root involvement presents as lower motor neuron diseases [3]. Magnetic resonance imaging (MRI) is a useful imaging modality for the diagnosis of spinal root involvement. Spinal root involvement and subsequent polyradiculopathy are similar to other neurological diseases [17]. Radiculopathy is probably due to inflammation of the meninges and the intrathecal portion of the roots. The pathogenesis of myelopathy may involve demyelination as spasticity persists or worsens after radiculopathy improves [5]. Neurobrucellosis may present as Guillain-Barré-like syndrome with bilateral polyradiculopathy without sensory involvement [3]. Neurobrucellosis may be manifest as recurrent transverse myelitis. Immune system response and recurrent transverse myelitis due to neurobrucellosis has been reported. Krishnan et al. [22] reported a patient with four episodes of transverse myelitis that lead to quadriplegia.

Brucella antibody was detected from his cerebrospinal fluid (CSF). High level of interleukin-6, IL-8, and macrophage chemoattractant protein-1 in CSF was detected. The patient responded to intravenous cyclophosphamide and plasma exchange [22]. Neurobrucellosis symptoms may last 8 weeks before diagnosis, ranging from 1 week to 4 months [6]. The recovery from neurobrucellosis may be accompanied by some sequelae. Paraparesis, dementia, sphincter dysfunction, and peripheral facial paralysis may occur [10].

17.3 Diagnosis

Brucellosis polyradiculopathy is often diagnosed by its neurological manifestations, laboratory tests, and imaging [9]. Neurobrucellosis is a treatable disease. Most of the diagnostic methods may reveal negative results. That is why high index of suspicion is necessary for the diagnosis of neurobrucellosis especially in endemic areas [1]. Clinical suspicion and accurate evaluation of patients with polyradiculoneuritis is the most important clue in diagnosis and treatment [14]. Early diagnosis is essential to prevent severe and permanent complications and sequelae of nerve

roots [2, 8, 24]. *Brucella* tube agglutination with Coombs test is sensitive and specific. Enzyme-linked immunosorbent assay is considered superior to the agglutination tests [9]. Blood culture is not a useful laboratory test for diagnosis of *Brucella* polyradiculopathy. It takes a long time for results; moreover the results are usually negative [28]. In Erdem et al.'s study [12], blood culture was positive for brucellosis in 37 % by automated method and CSF culture was positive in 25 % and 9 % by automated and conventional CSF culture, respectively. Clinical and radiologic correlations are necessary. It may have a range from a normal imaging of a patient with severe clinical manifestation to imaging abnormality with or without significant clinical finding (Figs. 17.1 and 17.2) [4]. MRI of the spine may reveal swelling of the nerve root that may be enhanced by the use of gadolinium [20]. Diagnosis of *Brucella* polyradiculopathy or polyradiculoneuritis can be achieved by CSF analysis, laboratory tests including serology, electromyography (EMG) and nerve conduction velocity (NCV) examinations, and correlation with clinical manifestations [13]. MRI with gadolinium injection usually shows enhancement of the lumbar nerve root [5]. For confirmation of polyradiculopathy, NCV studies and EMG

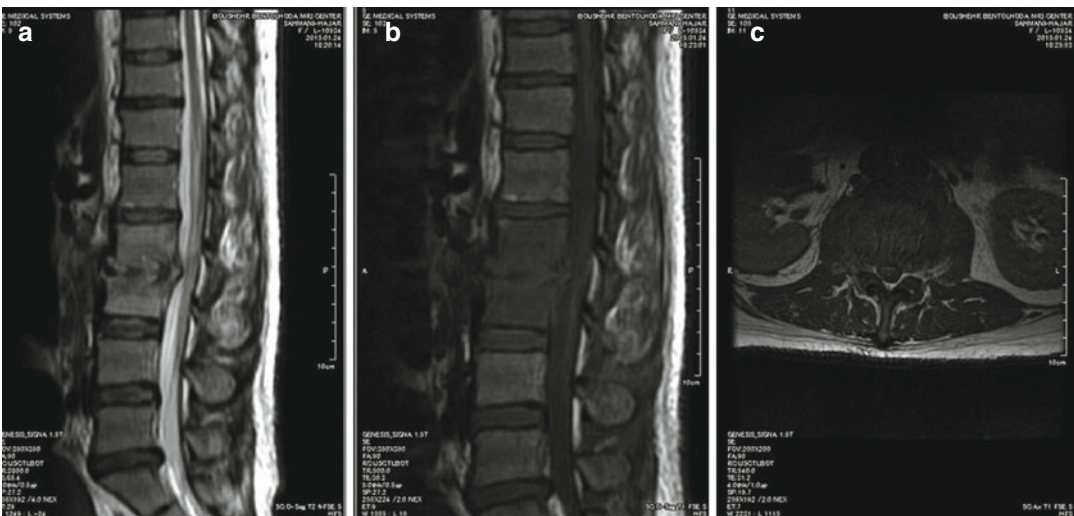


Fig. 17.1 A 35-year-old woman with numbness of lower extremity. (a) Sagittal T2-weighted MRI scan shows loss of low signal intensity of the cortical end plates and high signal in disk space and herniated disk. (b) T1-weighted MRI depicts loss of low signal intensity of the cortical end

plates, destruction of the intervertebral disk space and end plates and decreased signal intensity in L1–L2 vertebral bodies. (c) Axial T1-weighted MRI shows end plates with decreased signal intensity and high signal intensity in paravertebral soft tissues

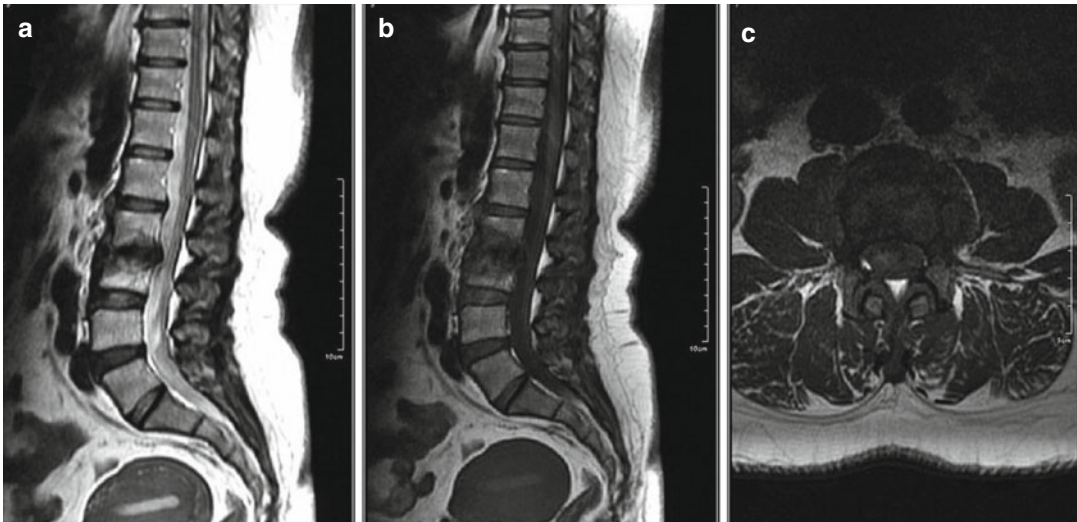


Fig. 17.2 A 41-year-old woman with pain and weakness of lower extremity. (a) Sagittal T2-weighted MRI shows intervertebral disk with decreased signal intensity. (b) T1-weighted MRI reveals destruction of the intervertebral

disk space and end plates and decreased signal intensity in L2–L3 vertebral bodies. (c) Axial T1-weighted MRI depicts end plates with decreased signal intensity

examination are used. Prolonged F waves, decreased NCVs and amplitude, and paraspinal muscle denervation potentials may be seen by NCV and EMG study [13].

17.4 Treatment

As polyradiculoneuritis is one manifestation of neurobrucellosis, the treatment is the same as neurobrucellosis. Polyradiculoneuritis should be diagnosed and managed promptly. It may cause permanent and irreversible sequelae with diagnosis or treatment delay [29]. Treatment of polyradiculoneuritis may be a combination of doxycycline, rifampicin, trimethoprim/sulfamethoxazole, ciprofloxacin, ceftriaxone, and streptomycin. Duration of therapy varies in different studies, most of them recommend at least 3 months treatment [5, 23]. Duration of treatment ranging from several weeks to several months depends on patient's condition; it may be shortened to 12 weeks if rapid improvement occurs. According to Gül et al.'s study [18], duration of therapy is 6 months with combination antibiotic therapy, in spite of the fact that the therapy should be individualized. In contrast in Asadipouya

et al.'s study from Iran [6], duration of treatment was as short as 8 weeks in about half of the patients. Corticosteroids are not proven to be useful on localized brucellosis [13]. Moreover, rehabilitation should also be a part of the treatment in brucellosis polyradiculopathy [15].

Conclusion

Diagnosis of *Brucella* polyradiculoneuritis needs a high index of suspicion [9]. In patients with polyradiculoneuritis, brucellosis should be considered in the differential diagnosis especially in endemic areas. That may lead to early diagnosis and treatment [13], and in this situation the prognosis will be excellent. Some items will correlate closely with prognosis that includes duration of illness, *Brucella* spp. virulence, timing between diagnosis and starting antibiotic, and duration of antibiotic therapy [6].

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