

## Hearing loss and accompanying disturbance of Neurobrucellosis cases

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### ABSTRACT

Up to 5-10% of Brucellosis cases manifest with neurobrucellosis and course with various forms such as meningocephalitis, cerebellitis, acute meningitis, myelopathy, radiculopathy neuropsychiatric syndromes and cranial neuropathy. Brucella toxin damages the inner ear and leads to sensorineural hearing loss. We aim to report seven patients who were diagnosed as neurobrucellosis accompanying with hearing loss problem and were hospitalized to Infectious Diseases Department between 2005 and 2010. Long term fever, headache, hearing loss, walking disability were the predominant symptoms, Bilateral sensorineural hearing loss was the most frequent finding. And the other findings were also dysarthria, ataxia walking and increased deep tendon reflexes. Common symptoms were long term fever (100%), headache (71.4%), chills (57%), vomiting and exhaustion (29%). Neurologic findings such as walking instability (four patients), paraplegia (two patients) and hearing disturbances (seven patients) were recognized. Rifampicin, doxycycline and trimethoprim/ sulfamethaxazole agents were administered to our patients and the duration of treatment should be decided depending upon individual cases (4-12 months). Hearing thresholds were restored after treatment in five patients. Only two patients' hearing loss were partially improved after therapy. Neurobrucellosis should be considered in long term fever accompanying the unexplained neurological symptoms such as hearing loss. In neurobrucellosis patient should be tested in hearing thresholds.

**KEY WORDS:** Neurobrucellosis, Hearing loss, Neurological symptoms.

Pak J Med Sci April - June 2012 Vol. 28 No. 3 556-559

### How to cite this article:

Ucmak H, Kokoglu OF, Kirecci E, Yildirim Y, Oguzhan O. Hearing loss and accompanying disturbance of Neurobrucellosis cases. Pak J Med Sci 2012;28(3):556-559

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- \* Received for Publication: August 8, 2011
- \* Revision Received: November 16, 2011
- \* Accepted for Publication: February 10, 2012

### INTRODUCTION

Brucellosis is an endemic zoonosis in Southern Turkey. The disease is mainly transmitted to humans through the ingestion of raw milk or non-pasteurized cheese contaminated with *Brucella* spp.<sup>1</sup> Up to 5-10% of brucellosis cases manifest with neurobrucellosis and course with various forms such as meningoencephalitis, cerebellitis, acute meningitis, myelopathy, radiculopathy, and neuropsychiatric syndromes,<sup>1,2</sup> and also, sometimes cranial neuropathy is observed. Vestibulocochlear which is a cranial nerve can be affected from brucellosis. The acoustic nerve was described as the most frequently involved cranial nerve. Brucella toxin damages the inner ear and leads to sensorineural hearing loss.<sup>1,3</sup>

We aim to report seven neurobrucellosis cases who had hearing loss and then discuss our findings with the literature.

### METHODOLOGY

The patients who were diagnosed as neurobrucellosis accompanying with hearing loss problem were hospitalized to Infectious Diseases Department from February 2005 to December 2010. Neurobrucellosis Diagnosis was done with the existence of a neurological picture not explained by any other neurological disease, evidenced by positive culture or serological tests either in cerebrospinal fluid (CSF), and the presence of inflammatory alteration in the CSF. If one of either the Rose Bengal test or the Wright agglutination test was positive, then the patient was accepted to be seropositive.<sup>1</sup> All individuals were examined by an otolaryngologist. Standard audiometry test was performed to evaluate hearing levels. Pure-tone average hearing thresholds were calculated at different frequencies (250–6000 Hz) of the auditory airway. The patients were questioned to obtain their own opinion regarding hearing loss. Speech discrimination score assessments were carried out by audiometry.<sup>4</sup> The study was approved by Ethics Committee of the Faculty of Medicine.

### RESULTS

During the past 6 years, seven patients with neurobrucellosis were encountered. All patients lived in Brucella endemic region of Turkey. Three patients (42.9%) were males and the others (57.1%) were females. Four women were housewives. One man was a worker, the other man was jobless and third one was an prisoner. The average age of the patients was calculated as 33.8 (range: 23-49) years. Seven patients were hospitalized with the diagnosis of meningoencephalitis. Common symptoms were long term fever (100%), headache (71.4%), chills

(57%), vomiting and exhaustion (29%). Ataxia, seizure and decreased level of consciousness each was seen in only one patient (14%). Neurologic findings such as walking instability (four patients), paraplegia (two patients) and hearing disturbances (seven patients) were recognized (Table-I). Lumbar puncture was done in all patients. Pleocytosis including predominantly lymphocytes was observed as well as protein was measured as >100 mg/dL in CSF of all patients.

CSF sugar was <40 mg/dL (glucorrhachia/glycemia) in all patients. The Brucellacapt test, serum Tube agglutination (STA) or Wright test were performed on seven CSF samples. But two blood STA samples were negative (Table-II). Blood culture and bone marrow culture were positive for *Brucella melitensis* in one (14.3%) patient. CSF cultures were negative in all patients. Laboratory parameters are shown in Table-II. Cranial computed tomography (CT) or magnetic resonance imaging (MRI) examinations were done in all patients. Cranial MRI revealed dural or basal meningeal enhancement with periventricular edema, and mild hydrocephaly in five patients. In the others we found only mild hydrocephaly in MRI. All patients' cochlear ducts were normal bilaterally, and there was no other inner ear abnormalities in temporal CT. In addition, there was no granuloma formation in the middle ear. The spinal MRI of two having spastic paraplegia demonstrated posterior disc bulging at L2/L3-L5/S1 levels. The other patients' spinal cord MRI images with contrast media were not detected any pathology for brucellosis. The 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup> and 5<sup>th</sup> patients who had walking instability were evaluated with electromyography (EMG) in whom nerve conduction studies were found to be consistent with lumbosacral polyradiculoneuropathy.

The cause of hearing loss was investigated with various tests by some other clinics before

Table-I: Summarizes the presenting pictures of neurobrucellosis in our patients.

Cases	Neurologic Examination		Hearing Loss	Dtr (deep tendon reflexes )	Cognitive impairment
	Walking instability	Motor Weakness			
Case 1	+	bilateral lower legs	+	+	+
Case 2	+	bilateral lower legs	+	+	+
Case 3	-	left arm lethargy	+	-	-
Case 4	+	bilateral lower legs	+	+	-
Case 5	+	bilateral lower legs	+	+	-
Case 6	-	-	+	+	-
Case 7	-	left arm lethargy	+	-	-

Table-II: Parameters in the diagnosis of brucellosis cases.

Cases	Gender	Years Old	Diagnosis	CRP	ESR	SAT (blood)	SAT (CSF)	Brucella Capture Test (CSF)
Case 1	Woman	49	Meningoencephalitis	5.9	30	Negative	1/160	1/2560
Case 2	Man	44	Meningoencephalitis	3.8	18	1/2560	1/320	1/1280
Case 3	Man	23	Meningoencephalitis	2.9	10	Negative	1/160	1/5120
Case 4	Woman	27	Meningoencephalitis	5.9	86	1/80	1/640	1/5120
Case 5	Woman	25	Meningoencephalitis	2.9	7	1/80	1/640	1/1280
Case 6	Man	45	Meningoencephalitis	3.2	6	1/160	1/80	1/320
Case 7	Woman	37	Meningoencephalitis	3.2	6	1/160	1/80	1/320

\*CRP normal range (0-5ng/ml)

neurobrucellosis was diagnosed (mean 4-6 months). Hearing loss had two patients with both ears and five patients with left or right ear. Sensorineural hearing loss (SNHL) were diagnosed in five patients with moderate level (40-60 dB) and two patients with high level (61-80 dB) The average hearing thresholds were measured > 45 dB in those with moderate level hearing loss and > 68 dB in those with high-level hearing loss in standard audiometry. Speech discrimination scores were found between 68 and 72% in high-level hearing loss and 92 and 96 % in moderate level hearing loss.

## DISCUSSION

Neurobrucellosis is a rare complication of brucellosis and sometimes neurological symptoms may be the only finding.<sup>1,2</sup> First, second, fourth and fifth patients had leg weakness, difficulty in performing activities of daily living and gait disturbance. Third and seventh patients had lethargy on the left arm (Table-I). The spinal cord or nerve roots may secondarily be involved by brucella due to spondylitis, vasculitis and arachnoiditis.<sup>5</sup> The patients with leg weakness (first, fourth, fifth) and arm lethargy (third, seventh) gave a good response to the treatment and started to improve clinically.

Imaging findings on MRI was meningeal enhancement. We did not see white matter changes, and vascular changes. Cranial nerve (CN) involvement in brucellosis is frequent especially at the sixth, seventh and eighth CNs from the point of complications.<sup>1,6</sup> Our cases' physical examinations revealed left ocular ptosis and hypoesthesia on the left mental region of face (3<sup>rd</sup> and 6<sup>th</sup> patients) and facial paralysis (7<sup>th</sup> patient). CN paralysis due to brucellosis usually improves without leaving any severe complications following the administration of antibiotics.<sup>6</sup> However, chronic CNS infections often result in permanent neurologic deficits. In our

cases, CN paralysis resolved completely after the treatment.

The individualization of the therapy is important. Rifampicin, doxycycline and trimethoprim/sulfamethaxazole have been found to be effective to use for long periods in neurobrucellosis. These chemotherapeutics have good central nervous system penetration and synergistic actions. Sometimes, ceftriaxon may be added to this regimen as the fourth agent.<sup>7,8</sup> These antibiotics were administered to our patients and the duration of treatment should be decided depending upon individual cases (4-12 months). All patients received antibiotic therapy, until the serum agglutinins decreased to normal levels.

*B. melitensis* was isolated from blood culture and bone marrow culture in only one patient It was the most commonly isolated species from neurobrucellosis cases.<sup>8</sup> In some studies, hearing loss has been reported in low rates in neurobrucellosis.<sup>1,7-9</sup> When *Brucella* toxin penetrates into the labyrinth, it affects the cochlear system and causes some kind of damage and results in hearing loss.<sup>3,9,10</sup> It was reported in some studies that the hearing loss improved following the treatment.<sup>10</sup> Although therapy is completed, hearing loss can be permanent in some cases.<sup>5,6,8,10</sup>

After treatment for six months, our patients' audiological evaluation revealed that five patients' hearing loss resolved and auditory threshold decreased to < 20 dB. In neurobrucellosis, SNHL is usually bilateral, and particularly affects the high frequencies. Nine Patients (4<sup>th</sup> and 5<sup>th</sup>) with high-frequency hearing loss in both ears did not improve completely in our patients either. Al-Sous et al reported no pathologic features on the brain MRI examinations in five patients with hearing loss.<sup>5</sup> There was no significant pathology on the brain MRI or temporal CT examinations to explain hearing loss in our patients.

Conclusively, neurobrucellosis should be considered in cases with unexplained long term fever accompanying with neurological symptoms such as hearing loss and walking instability. In cases of neurobrucellosis, the patients have to be tested by means of hearing thresholds.

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