The Diagnostic Value of MRI in Brucella Spondylitis With Comparison to Clinical and Laboratory Findings

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ABSTRACT

Background: Brucellosis is an endemic zoonotic disease, especially in the Middle East and Mediterranean regions and can involve many organs and tissue. Osteoarticular involvement is the most common complication. Spondylitis is its most prevalent clinical form in adults, and there may be difficult in diagnosis and treatment. In present study, we aimed to assess these diagnostic value of MRI, in patients with spondylitis due to brucella, comparing with clinical and laboratory findings. **Method:** Patients with low back pain who were admitted to Sheikhol-raees MRI center were included in this study. None of these patients had any documented infectious disease. Diagnosis of brucellosis was made, based on MRI findings, which would be approved by serology. After confirmation with serology, the group with positive serology were compared with the negative group, in sex, age, MRI findings level of vertebral involvements, signal intensity in T1 weighted and T2 weighted. **Results:** Among 53 patients with diagnosis of brucella spondylitis, 33 underwent serology study, 20 were positive and 13 were negative and the others consider out of study. From these 20, 3 had tuberculosis spondylitis, whose mean age was 56 and the 67% of them were male. Mean age in the positive brucella spondylitis were 46 and 67% of them were male. In negative group mean age was 55, and of whom 57% were male. There was no statistically significant difference in MRI findings such as changes in signal intensity, disk space narrowing, Intracanalicular mass, Abscess formation. Level of involvement in vertebrae. **Conclusion:** The results of this study shows that although MRI is Modality of choice in diagnosis of spondylitis, it is not enough specific to diagnosis the reasons of spondylitis.

Key words: Brucellosis, Spondylitis, MRI, Vertebrae.

1. INTRODUCTION

Brucellosis is a world wide disease which caused by a gram-negative bacilli called *Brucella* (1). Brucellosis is a systemic zoonotic disease which was introduced by Bruce (1887) from died patients on the Malta Island for the first time. This disorder also known as Malta fever, Mediterranean fever, Cyprus fever, Undulant fever, Gibbiter fever and Typhomalarial fever (2). Person with brucellosis at home and consumption of unpasteurized dairy products is considered the most important methods of transmission (3).

Clinical protests of this disorder include osteoarticular (20-30%), genitourinary symptoms for orchiepididimitis (up to 40%), liver abscess (1%), meningitis CNS involvement (1-2%), cardiovascular disease and endocarditis (1%) (4).

Therefore, the most common symptom of patients with brucellosis

would be musculoskeletal protests and among this peripheral arthritis, sacroiliitis, spondylodiscitis, and etc. are the most common complaints of these patients (5). Vertebral brucellosis usually starts from upper endplate due to strong blood flow and sometimes, it can be involved the lower endplate (6). Diagnosis and treatment of vertebral involvement is the most difficult among musculoskeletal brucellosis conflicts.

A definitive diagnosis of brucellosis can be done by using blood culture and isolating bacteria from blood. It also can be isolated from BM, joint fluid, pus, abscess or CSF. Polymerase chain reaction (PCR) is a sensitive and specific method for detecting the brucella in blood and the other samples. Wright's and Rose Bengal tests also used to detect agglutinated antibodies and Coombs test for quantification non-agglutinated antibodies

		Brucellosis				Total	χ ²	P-value
		Positive		Negative				
		Not observed	Observed	Not observed	Observed			
Reduction of intervertebral disc space	Frequency	0	17	0	13	30	-	-
	Percentage	0	100	0	100	100		
Endplate involvement	Frequency	0	17	0	13	30	-	-
	Percentage	0	100	0	100	100		
Vertebral body involvement	Frequency	12	5	13	0	30	4.58	0.052
	Percentage	70.6	29.4	100	0	100		
Abscess, para/pre vertebral granum	Frequency	11	6	9	4	30	0.068	1.000
	Percentage	64.7	35.3	69.2	30.8	100		
Epidural abscess	Frequency	10	7	12	1	30	4.22	0.09
	Percentage	58.8	41.2	92.3	7.7	100		
Intra canalicular mass	Frequency	10	7	9	4	30	0.34	0.708
	Percentage	58.5	41.2	69.2	30.8	100		
Involvement level (L1-L2)	Frequency	14	3	13	0	30	2.54	0.23
	Percentage	82.4	17.6	100	0	100		
Involvement level (L2-L3)	Frequency	14	3	13	0	30	2.54	0.23
	Percentage	82.4	17.6	100	0	100		
Involvement level (L3-L4)	Frequency	15	2	13	0	30	1.63	0.49
	Percentage	88.2	11.8	100	0	100		
Involvement level (L4-L5)	Frequency	11	6	7	6	30	0.36	0.71
	Percentage	64.7	35.3	53.8	46.2	100		
Involvement level (L5-S1)	Frequency	14	3	6	7	30	4.34	0.056
	Percentage	32.4	17.6	46.2	53.8	100		

Table 1. Comparison of MRI results in Brucellosis+ and Brucellosis- groups

when there is no possibility to use cultivation methods. Although, another method, Enzyme-linked immunosorbent assay (ELISA), with high sensitivity and specificity is more common nowadays (7, 8).

Spinal pain is one of brucellosis symptoms which is one of the most common complaints in society. The brucellosis patient may do not have any other symptoms of the disease or spinal pain may cause by the complication of brucellosis which the patients afflicted some years ago. Having lack of specific clinical symptoms for brucellosis and disc herniation symptoms imitation of this disease make it hard to diagnose based on clinical symptoms. MRI uses to overcome these complications (9, 10).

Although spine, bone scan, and CT scan radiographs provide useful information for detection of brucellosis spondylodiscitis but none of these modalities can provide information as useful as MRI. The ability to imaging in different plans and high tissue contrast caused MRI as a modality choice to evaluate patients with infected spondylitis and their follow up. MRI has several advantages rather than other modalities such as segregation of spondylodiscitis from other spinal pathologies and brucellosis spondylodiscitis from other factors that cause spondylodiscitis (11, 12). MRI was considered as one of the most sensitive diagnosis method for spondylitis and spondylodiscitis in other studies (13, 14).

In previous studies, the sensitivity and specify of MRI was evaluated in patients who confirmed their brucellosis by serology. In this study, it has been intended to diagnose brucellosis by using MRI data and then confirm it by serology. Finally, the sensitivity and specificity of each markers would be evaluated.

2. METHODS

This prospective cohort study contained 53 patients with brucella spondylitis but 33 cases had sufficient data to in-

volve. Patients with previous diagnosis of brucellosis, follow up MRI for heart disease, spinal surgery history, and insufficient data were excluded. Patients referred to sheikhol - raees MRI center regardless to their sex and age were recruited within 2 years.

All normal cases were omitted due to high sensitivity of MRI in inflammatory lesions. Serology tests such as 2ME, coombs wright, and wright were used to confirm brucellosis spondylitis in patient who were suspected to spondylitis due to their MRI report.

Evaluated variables, diagnostic factors of brucella spondylitis, of this study were signal changes of vertebral bodies for T2 increasing signal, T1 decreasing signal, endplate conflicts, pre/para-vertebral abscesses, epidural abscess, and etc. Value and specificity of each factors were evaluated for detection of brucella spondylitis. It should be noted that the changes were reported by a radiologist who was blind to the test results of patients.

The statistical analysis has been done by SPSS ver. 16. Descriptive data were reported as distribution and percentage. Contingency table and Fisher's exact test were used to inferential statistical analysis of the hypothesis.

3. RESULTS

The participants were divided into three groups, Tuberculosis (TB) (n=3), Brucellosis⁺ (n=18), and Brucellosis⁻/TB⁻ (n=13) groups. TB group contained 2 male and the mean age were 56±13.11 years old (Min and Max were 44 and 70 years old, respectively). 12 patients in Brucellosis⁺ group were male and the mean age of this group was 43.88±16.49 years old (Min and Max were 16 and 68 years old, respectively). The last group, Brucellosis⁻/TB⁻, contained 9 male participants and the mean age for this group was calculated 52.307±12.37 years old (Min and Max were 35 and 75 years old, respectively).

		Spondylitis				Total	χ ²	P-value
		Positive		Negative				
		Not observed	Observed	Not observed	Observed			
reduction of intervertebral disc space	Frequency	0	20	0	13	33	-	-
	Percentage	0	100	0	100	100		
Endplate involvement	Frequency	0	20	0	13	33	-	-
	Percentage	0	100	0	100	100		
Vertebral body involvement	Frequency	15	5	13	0	33	3.83	0.13
	Percentage	76	25	100	0	100		
Abscess, para/pre vertebral granum	Frequency	13	7	9	4	33	0.063	1.000
	Percentage	65	35	69.2	30.8	100		
Epidural abscess	Frequency	12	8	12	1	33	4.14	0.056
	Percentage	60	40	92.3	7.7	100		
Intra canalicular mass	Frequency	13	7	9	4	33	0.063	1.000
	Percentage	65	35	69.2	30.8	100		
Involvement level (L1-L2)	Frequency	16	4	13	0	33	2.95	0.13
	Percentage	80	20	100	0	100		
Involvement level (L2-L3)	Frequency	16	4	13	0	33	2.95	0.13
	Percentage	80	20	100	0	100		
Involvement level (L3-L4)	Frequency	18	2	13	0	33	1.38	0.508
	Percentage	90	10	100	0	100		
Involvement level (L4-L5)	Frequency	13	7	7	6	33	0.41	0.71
	Percentage	65	35	53.8	46.2	100		
Involvement level (L5-S1)	Frequency	17	3	6	7	33	5.62	0.02
	Percentage	85	15	46.2	53.8	100		

Table 2: Comparison of MRI results in Spondylitis+ and Spondylitis- groups As it shown in table 2, none of the variables had significant differences in both groups based on Fisher test except involvement level of L5-S1 (P-value=0.02).

Comparison of MRI results between Brucellosis⁺ and Brucellosis⁻ groups

Various variables were evaluated for both Brucellosis⁺ and Brucellosis⁻ groups in this study which are shown in Table 1. These variables include reduction of intervertebral disc space, involvement of endplate, the vertebral body involvement, abscess or para/pre vertebral granum, epidural abscess, intra canalicular mass, involvement level of various vertebrae (L1-L2), (L2-L3), (L3-L4), (L4-L5), and (L5-S1).

All patients Brucellosis⁺ and Brucellosis⁻ groups had reduction in intervertebral disc space. The signal changes as hypo-intense and hyper-intense in T1 and T2 were observed in MRI results. All patients in both groups also showed endplate involvement in their MRI. Statistical analysis of this variables for these groups of patients did not show any significant differences.

Comparison of MRI results between Spondylitis⁺ and Spondylitis⁻ groups

Patients also divided into 2 groups according to their spondylitis. The Spondylitis⁺ group contained 20 patients (14 patients were male) with mean age 45±70 years old (Min and Max were 16 and 70 years old, respectively). Spondylitis⁻ group contained 13 patients (9 patients were male) with mean age 52.30±12.37 years old (Min and Max were 35 and 75 years old, respectively). All mentioned variables were evaluated for these groups as well (Table 2).

4. DISCUSSION

Brucellosis is an endemic disease which can infect human through milk and unpasteurized dairy products from infected cattle and it is a public health concern and need more consideration. Due to its ability to effect multiple organs it has broad clinical protests (15).

Spinal involvement is one of its common troubles which

can has various protests. Its rate increased dramatically in recent years worldwide, but using MRI help more to diagnose it (13).

Despite to all studies which has done retrospective (for example: a study by Beheshti et al (16)), brucellosis confirmed first then spinal involvement had been evaluated, this study adopted new approach. In this study we tried to use MRI as a diagnostic approach instead of serology. It is notable that lumbar spondylitis has been investigated in this study to extract contents of involvement for each vertebrae of spine.

In a study in Ankara, Turkey, (2000) 452 patients positive for brucellosis were examined. Their results had been shown disk space involvement, disk space reduction, endplate involvement, and para/pre vertebral abscess in 85.7%, 25.7%, 23.9%, and 16.7% of patients respectively (17) which is partially same to our results. Same to our results, they reported spinal brucellosis is more common in male. The study noted that few reports suggested an association between HLA-B27 with Osteo-Articular involvement is brucellosis. The T1 vertebrae involvement is hypo-intense and T2 is hyper-intense in spinal brucellosis while intervertebral disk shows signal intensity reduction (17).

In another study in Spain, it had been shown that brucella spondylitis patients are older and have longer duration of disease in comparison to healthy participants. The MRI signal changes was reported same to previous (18). Only three of 32 patients with positive serology had positive blood culture results in this study. Lower lumbar spine involvement, intact of vertebrae structure next to osteomyelitis, and paraspinal soft tissue involvement had been proposed as diagnostic factors (18).

In a study on patients with brucella spondylitis, the mean age of patients were 57±13 years old with same gender frequency. 23 of 26 spondylitis patients suffered from lumbar

involvement which contained 2 vertebrae but 3 patients had simultaneous involvement of 3 adjoining vertebrae (19).

Our results indicated that 33% of patients suffered from Tuberculosis spondylitis and others suffered from Brucella spondylitis. Signal changes in T1 and T2 images were hypo intense and hyper intense and observed in all participants, however, endplate involvement was observed in all as well. The statistical analysis by Fisher method did not show any significant relation between groups for these variables. As it shows in Table 1, there was not any significant differences between Brucellosis⁺ and Brucellosis⁻ groups.

All variables were evaluated in Spondylitis⁺ and Spondylitis⁻ groups. The results illustrated a significant difference between these two groups only in involvement level of L5-S1 vertebrae.

The calculation of sensitivity and specificity of MRI in this study due to the lack of false negative and true negative were not feasible.

5. CONCLUSION

According to the statistical analysis of this study and insignificant results between variables, it can be concluded that although MRI has high sensitivity in spondylitis diagnosis but its specificity for various types of spondylitis such as TB or Brucellosis need more investigation. Although vertebrae involvement level did not have significant differences between groups, but having attention to the involvement of upper spin vertebrae may be useful for differential diagnosis.

• Conflict of interest: none declared.

REFERENCES

1. Seleem MN, Boyle SM, Sriranganathan N. Brucellosis: a re-emerging zoonosis. *Veterinary microbiology*. 2010; 140(3): 392-8.
2. Young EJ, Brucella spp. *Principles and Practice of Clinical Bacteriology*, 2nd ed. John Wiley & Sons Ltd, West Sussex, England, 2006: 265-72.
3. Sofian M. et al., Risk factors for human brucellosis in Iran: a case-control study. *International Journal of Infectious Diseases*. 2008; 12(2): 157-61.
4. Assadi M. et al. Brucellosis in Iran: A Literature Review. *Journal of American Science*. 2013; 9(3).
5. Memish Z. et al. Brucella bacteraemia: clinical and laboratory observations in 160 patients. *Journal of Infection*. 2000; 40(1): 59-63.
6. Tekkök IH. et al. Brucellosis of the spine. *Neurosurgery*. 1993; 33(5): 838-44.
7. Al Dahouk S. et al. The detection of Brucella spp. using PCR-ELISA and real-time PCR assays. *Clinical laboratory*. 2003; 50(7-8): 387-94.
8. Chothe S, Saxena H, Chachra D. Comparative evaluation of PCR and ELISA for diagnosing bovine brucellosis. *Intas Polivet*. 2013; 14(1): 80-4.
9. Harman M. et al. Brucellar spondylodiscitis: MRI diagnosis. *Clinical imaging*. 2001; 25(6): 421-7.
10. Özaksoy D. et al. Brucellar spondylitis: MRI findings. *European Spine Journal*. 2001; 10(6): 529-33.
11. Gouliouris T, Aliyu SH, Brown NM. Spondylodiscitis: update on diagnosis and management. *Journal of Antimicrobial Chemotherapy*. 2010; 65(suppl 3): iii11-iii24.
12. Gouliouris T, Aliyu SH, Brown NM. Spondylodiscitis: update on diagnosis and management - authors' responses. *Journal of Antimicrobial Chemotherapy*. 2011: dkr079.
13. Bozgeyik Z. et al. Clinical and MRI findings of brucellar spondylodiscitis. *European journal of radiology*. 2008; 67(1): 153-8.
14. Kouijzer I. et al. A comparison of the diagnostic value of MRI and FDG-PET/CT in suspected spondylodiscitis. in *Society of Nuclear Medicine Annual Meeting Abstracts*. 2014.
15. Namiduru M. et al. Brucellosis of the spine: evaluation of the clinical, laboratory, and radiological findings of 14 patients. *Rheumatology international*. 2004; 24(3): 125-9.
16. Beheshti S. et al. Seroprevalence of brucellosis and risk factors related to high risk occupational groups in Kazeroon, South of Iran. *The international journal of occupational and environmental medicine*, 2010; 1(2 April).
17. Turgut M, Turgut A, Koşar U. Spinal brucellosis: Turkish experience based on 452 cases published during the last century. *Acta neurochirurgica*. 2006; 148(10): 1033-44.
18. Solera J. et al. Brucellar spondylitis: review of 35 cases and literature survey. *Clinical infectious diseases*. 1999; 29(6): 1440-9.
19. Bodur H. et al. Brucellar spondylitis. *Rheumatology international*. 2004; 24(4): 221-6.