www.jmscr.igmpublication.org
Impact Factor 5.84
Index Copernicus Value: 83.27
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v5i7.87

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Original Research Article

MR Imaging Features of Tuberculosis of the Spine

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ABSTRACT

Background: *Spinal tuberculosis is most common form of skeletal tuberculosis. Radiological findings mimic many other infections and spinal diseases. Understanding the pattern of infection, early detection of the disease is important to prevent the complications and disability, and MRI is the imaging modality of choice for diagnosing spinal infections and is promising diagnostic modality in patients with suspected spinal tuberculosis. The purpose of the study is to describe features of spinal tuberculosis (TB) on magnetic resonance imaging (MRI), extent of disease and complications.*

Methods: *MR images of 40 patients with proven Spinal Tuberculosis were retrospectively analyzed and results were tabulated.*

Results: *The majority of the patients were males (n=28) and are above 40 years age group (60%). The most common clinical presentation was pain (83%). The lumbar spine was the commonest site of the disease (27.5%) followed by thoracic region (22.5%). Typical presentation was most frequently observed (87.5%) and skip lesions were more among the atypical presentation (80%). 40% cases are associated with complications and most frequent complication observed was compressive myelopathy (43.75%).*

Conclusions: *MRI is highly sensitive in the detecting spinal tuberculosis at various stages of disease process , their pattern of occurrence and soft tissue involvement.*

Keywords: *Spinal tuberculosis, Magnetic resonance imaging, skip lesions, contiguous, Epidural, Psoas.*

INTRODUCTION

Tuberculosis (TB) was known lethal disease prior to the development of the antibiotics before 1950s, which thereafter showed a steady fall in incidence. However, Tuberculosis is still remained endemic in developing countries wherein poverty, malnutrition and the presence of drug resistant strains aid in spread of the disease. Resurgence of the disease is noticed since mid-1980s in developed countries, mainly in immigrants from countries where the disease is prevalent and in patients with immunodeficiency diseases or chronic diseases like DM, chronic renal failure, COPD, cirrhosis of the liver, leukemia, and lymphoma. Growing elderly population, poor living conditions, poor nutritional status, alcohol and drug abuse further contributed to this resurgence [1],[2],[3].

Tuberculosis is both pulmonary and extrapulmonary. In developing countries the skeletal tuberculosis is most common in children and is more aggressive in extension and abscess formation. Consequently the neurological complications and deformities are frequent. Whereas in industrialized countries adults are commonly affected. There is no predilection for either sex [4] . According to the previous studies it is revealed that the vertebral column is the common site of osseous involvement comprising of 50% of the skeletal tuberculosis and L1 vertebral body is the commonest location [5].

The varied presentation, serious complications and association of the spinal tuberculosis with immunodeficiency and chronic health diseases warrants its inclusion in the differential diagnosis in spinal disorders.

MRI has high sensitivity with satisfactory specificity in identifying spinal infections. Signal changes are seen early in the development of the disease, when no other image modality shows lesions especially Short time inversion recovery (STIR) sequence detects initial infective focus as inflammatory oedema. However, MRI is not specific for infection. Many non-infectious inflammatory diseases, degenerative diseases and pyogenic infections simulate TB spine. MRI is recommended when a spondylitis is suspected because early diagnosis avoids severe spinal or neurological complications. It enables anatomic localization of the disease in different planes, allows early detection of disk and bone destruction, and depicts extension in bone and soft tissues [6],[7],[8],[9] .

The purpose of the study is to evaluate MR imaging features of spinal tuberculosis, its different patterns of presentations and extent of the disease in patients with proven spinal tuberculosis.

MATERIALS AND METHODS

This is an observational, hospital based, single centre, retrospective study and included patients who had proven spinal tuberculosis and underwent a complete contrast enhanced MR examination of the spine between January 2011 to December 2014. Infection was proven in all patients with positive culture or histologic examination, either percutneous biopsy samples or surgically collected samples.MRI images of 40 patients were reviewed.

The study was conducted after obtaining the approval from the institutional review board to review the patients images and medical charts.

MR imaging

MRI spine was taken using 1.5Tesla Philips Achieva machine.

The sequences that were performed in our hospital for all cases of spine imaging are, T1W, T2W, STIR and contrast enhanced fat suppressed T1W images.

Gadodiamide is used at a dose of 0.1mmol per kilogram of body weight was used as an intravenous contrast agent.

Sagittal T1W [repetition time(TR)/echo time (TE) 427/18msec].

Sagittal STIR (short tau inversion recovery)-(3500/80 ms).

Sagittal T2W (3276/116) fast spin echo (FSE) sequences.

Axial T2W (2845/120) FSE sequences..

Sagittal T1-weighted images (TR 300 to 500 milliseconds, TE 20 to 30 milliseconds) and axial T1-weighed sequences provided the anatomic details for a survey of the spine. Scan time was1-2 minutes.

The parameters of T2-weighted imaging includes a TR of 2000 to 3000 milliseconds and a TE of 60 to 120 milliseconds; the acquisition time is 2 to 3 times longer than that of T1-weighted imaging.

Slice thickness 4 mm, and intersection gap 1 mm. FOV-301 mm

Imaging evaluation: Two radiologists independently reviewed the MR images in consensus. The following parameters were studied.

1. Extent of vertebral involvement: body / posterior spinal elements.
2. Wedging or compression.
3. Involvement of disc.
4. Sub-ligamentous extension.
5. Extent of abscess: Epidural / paravertebral / Psoas.

6. Spinal cord changes. Intradural/ Intramedullary: Nature and enhancement of the lesions.

Data analysis: The data was analyzed using SPSS programme. The results were presented using tables and graphs.

RESULTS

Most common presenting symptom was pain [83%] [neck pain, low back ache and radiating pain], Other symptoms observed were fever [5%], functional disability[2.5%], malaise, weight loss.

The age range of the patients presented with TB spine were between 20 to 70 years. 35% were in 21 to 30 age group and 60% [n-24] were below 40 years. Majority [n-28] of the patients were males [70%] and 30% were females.

Table 1: Distribution of the patients according to the vertebral body and posterior spinal elements involvement.

Sn	Location of the lesion within the vertebra	Number [N-40]	Percentage ([100%]
1	Typical lesions	35	87.5
2	Atypical lesions	5	12.5
Typical lesions			
1	Paradiskal lesions	21	60
2	Central lesions	4	11.4
3	Anterior Lesions	10	28.57
Atypical lesions			
1	Isolated posterior spinal lesion	1	20
2	Skip lesions	4	80

Table 2: Distribution of patients according to associated complication of tuberculosis of spine**.**

Sn	Complications	Number [N-40]	Percent (100%)
1.	Associated with complications	16	40
2.	Not associated with complications	24	60
Types of complications			
1	Compressive myelopathy	7	43.75
2	Gibbus deformity	5	31.25
3	Cord Oedema	2	12.5
4	Fractures	2	12.5

Different types of presentation of TB spine were observed according to the region of the spine involved [Figure1]. Most common presentation observed was lumbar spine, followed by thoracic and lumbo-sacral. Sacro-iliac [figure7] and Multifocal presentations were less. The presentation of the TB spine is further classified as typical and atypical according to the site of involvement of the vertebral body (primary focus) and intervertebral disk. [Table 1].

Most frequent [87.5%] typical presentation observed was involvement of the contiguous vertebrae [vertebral body-osteitis] with intervening disk [diskitis].

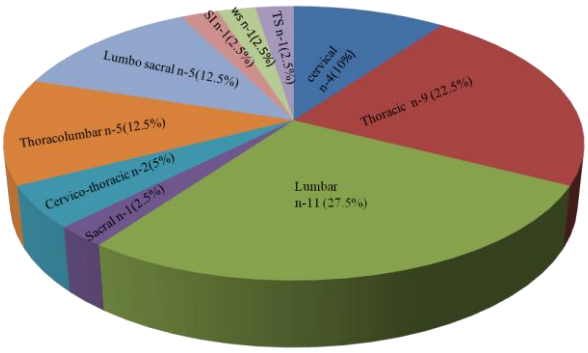

Figure 1. Pie chart showing regional distribution of spinal tuberculosis.

In the vertebral body three patterns of involvement were recognized.

Paradiskal lesions [figure 2].: The lesion is adjacent to the intervertebral disk leading to narrowing of the disk space. The narrowing of the disk space is either due to destruction of the subchondral bone with herniation of the disk into the vertebral body or direct involvement of the disk.

Table 3: Distribution of patients according to associated soft tissue collections of spinal tuberculosis

Sn.	Collections	Number [N-40]	Percent [100%]
1	With collections	38	95
2	Without collection	2	5
Site of collection			
1	Pre/+Paraspinal	8	21.05
2	Pre/+Paraspinal + Psoas	11	28.94
3	Pre/+Paraspinal + Epidural	13	34.21
4	Pre/+Paraspinal + Psoas + Epidural	6	15.79

Anterior lesion [figure 3]: This is a sub-periosteal lesion under anterior longitudinal ligament. The infection/pus spreads over multiple vertebral segments resulting in stripping of the periosteum and anterior longitudinal ligament from the anterior surface of the vertebrae. The stripping of the periosteum renders the vertebrae avascular and

susceptible to infection. The ischemia and pressure causes anterior scalloping of the vertebrae.

Figure 2. STIR and post GAD T1W Sagittal images showing typical lesion involving the contiguous vertebral end plates of C4 and C5, and intervening disk with disk space narrowing. There is associated mild anterior prevertebral collection, epidural collection cord compression. No evidence of cord oedema or infection.

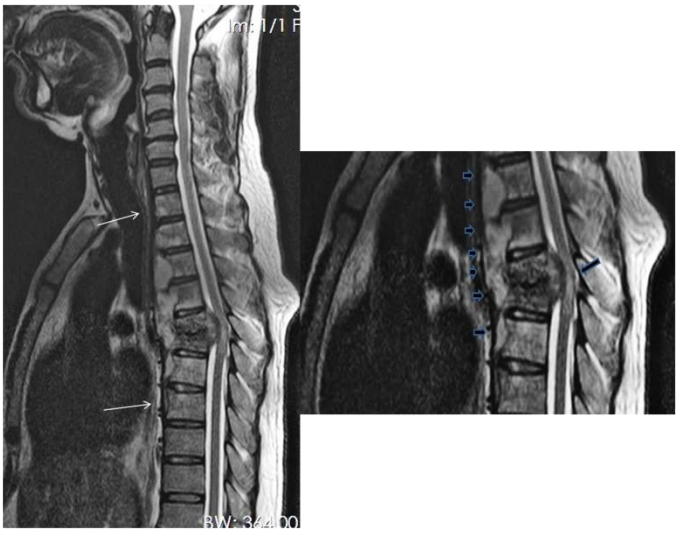

Figure 3. T2W Sagittal image showing signal intensity changes in T5 and T6 vertebrae with end plate destruction, loss of disk space. There is anterior sub-ligamentous extension of the collection with scalloping of the vertebral bodies. Epidural space collection together with posterior angulation of the vertebra compressing the cord with cord oedema and compression. Extension of the infection to the multiple contiguous thoracic vertebrae is seen.

Central lesion [figure 4]: This lesion is centered in the vertebral body. There is vertebral collapse leading to formation of vertebra-plana appearance. There is no involvement of the disk.

Atypical presentations observed were 1. skip lesions[Figure5]: Involvement of noncontiguous vertebrae with no evidence of involvement of intervertebral disk

2.Isolated involvement of the posterior spinal elements [Figure 6].

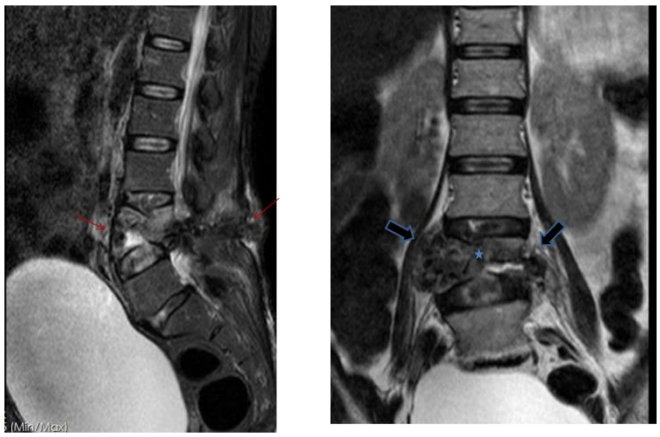

Figure 4. T2W Sagittal and coronal images reveal central lesion of L5 vertebral body with collapse. This patient had presented with neurogenic bladder. There is chronic sinus tract formation posteriorly into the subcutaneous plane.

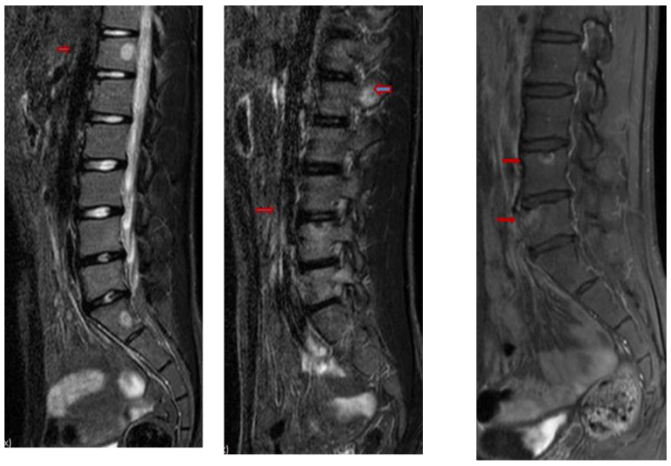

Figure 5. Sagittal images of T2W,STIR and post GAD show multiple enhancing lesions in the thoracic and lumbar vertebra and in the L1 posterior spinal elements. The CT guided biopsy from the spinous process confirmed tuberculosis.

Additionally the soft tissue involvement was demonstrated according to the involvement or collection in the pre and para vertebral, epidural and Psoas regions [figure 8], sub-ligamentous [figure 3] and mixed. The isolated collections [single compartment] are seen less compared to the collection in more than one compartment [89%].

Further the associated complications like fractures, compressive myelopathy, cord oedema [figure 3], gibbus deformity were identified[figure 9].

Cord compression is due to either epidural abscess or granulation tissue or in combination with vertebral collapse, subluxation, or dislocation.

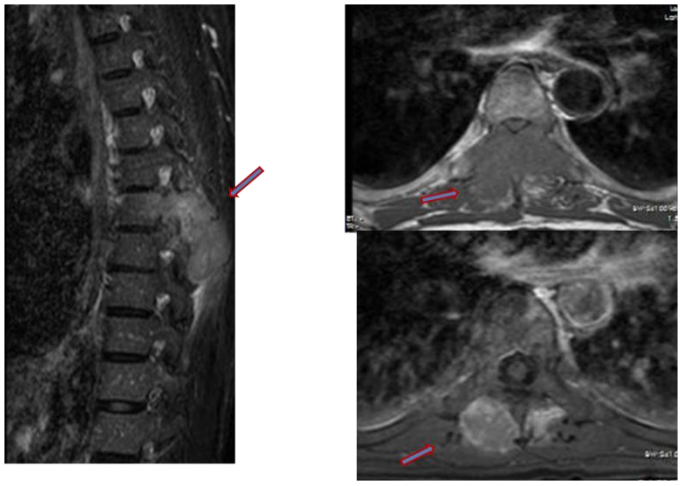

Figure 6.T1W and post GAD images reveal lesions in the laminae and spinous process of thoracic vertebrae involving two contiguous vertebrae. There is no involvement of the vertebral bodies. There is narrowing of the bony spinal canal.

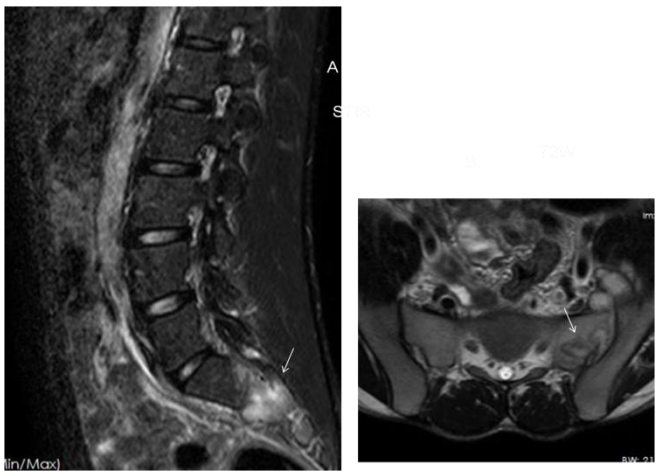

Figure 7. STIR Sagittal and T2W axial images showing hyperintense lesions in the sacral vertebrae with minimal prevertebral collection.

DISCUSSION

Percival Pott presented the classic description of spinal tuberculosis [TB] in 1779. Hence, spinal tuberculosis was called 'Pott's Disease'. It constitutes about 50% of the musculoskeletal tuberculosis. Tuberculosis is caused by a bacillus, Mycobacterium tuberculosis.

Spinal tuberculosis is usually secondary to the primary or reactivated infective focus either from the lung or genitourinary system. Spread of the infection to the spine is through hematogenous in most of the instances. Other types of spread are from paraspinal infection and lymphatic spread from adjacent structures like pleura or kidney.

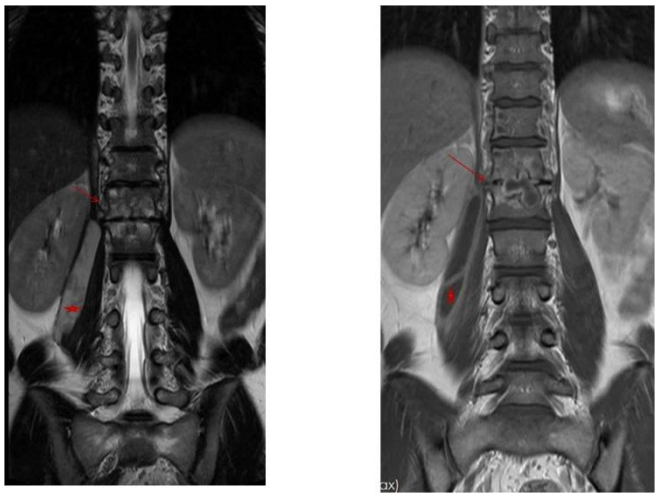

Figure 8. coronal T2W and post GAD T1W images show peripherally enhancing lesions in the T11, T12 and L1 with similar lesion in the right Psoas.

Figure 9.Sagittal T2W image reveals destruction and anterior erosion of the T12 and L1 vertebral bodies with posterior angulation and deformity.

Tuberculous infection is characterized by a delayed hypersensitivity immune reaction. In the vertebrae the granulomatous lesion develops containing central caseating necrosis, multinucleated giant cells, epitheloid cells and peripheral lymphocytes. The inflammatory reaction with formation of granulation tissue causes bone expansion and trabecular destruction, progressive demineralization, bone destruction and in later stages cartilage destruction with involvement of adjacent disc space. The osseous lytic lesions with distinct margins show no bone regeneration or periosteal reaction, which eventually undergoes fibrosis, sclerosis and ankylosis in chronic stages.

The proliferative granulation tissue causes thrombosis of the vessels, tissue necrosis and breakdown of the inflammatory cells results in paraspinal abscess. The pus may localize or track along the tissue planes. Progressive necrosis of the bone leads to kyphosis.

Typically the infection begins in the anterior aspect of the vertebral body adjacent to the disk. The infection then spreads to the adjacent vertebral bodies under anterior longitudinal ligament.

MRI findings:

The signal intensity changes on MR images follow the stage of the disease process. On T1W sequence most of the lesions were hypointense with irregular vertebral endplates. On T2W sequence the lesions were predominantly hyperintense, few heterointense with adjacent soft tissue hyperintensity. This is the result of the replacement of bone marrow by inflammatory exudates, and hyperaemia. On STIR sequence the collections edema within and adjacent to the spine were more striking. Post GAD fat suppressed T1W showed peripherally enhancing thick walled collections in the vertebrae and in soft tissue compartment.

Most of the results of our study like common presenting symptom, sex and age distribution, anatomical presentation of disease process, introsseous and extrosseous involvement, and complications of the disease were similar to the studies conducted by DJ Kotzke [11] and Sajid Ansari. [12], whereas the regional distribution in a study conducted by Dharmalingam et al[13] was more in thoracic spine [30%] followed by lumbar spine[27.3%] and the percentage of the skip lesions were more in our study compared to this study [12.5%]. Compared to study conducted by Khalequzzaman et al [14] our study showed more no of cases of soft tissue involvement and less number of complications. These differences in results can be attributed to different social conditions, accessibility of health care facilities and delayed hospital visit due to insidious onset.

CONCLUSIONS

Spinal tuberculosis is common cause of spondylodiskitis. It requires early diagnosis for successful therapy, to prevent complications and disability. MRI is an important diagnostic modality for early detection of the disease process, characterizing the lesion, detecting the complications and is an useful tool for planning treatment.

LIMITATIONS

Main limitation of our study are retrospective data collection, small sample size, and single center study. However our study results are on par with previous prospective studies. Large sample size which in prospective study followed will definitely more useful to extrapolate the results.

ACKNOWLEDGEMENT

The authors thank MRD and radiology staff of VIMS&RC hospital for helping in retrieving the MRI images of the patients and their records.

REFERENCES

1. Fain O,Lortholary O,Lascaux V,et al.Extra pulmonary tuberculosis in the northeastern suburbs of Paris: 141 cases. Eur J Intern Med 2000;11:145-150.
2. Srikanth Moorthy, Nirmal K.Prabhu.Spectrum of MR imaging findings in Spinal Tuberculosis. AJR Am J Roentgenol 2002;179:979-983.

3. Lauzardo M,Ashkin D,:Phthisiology at the dawn of the new century. Chest 2000;117:1455-1473.
4. Paradisi F, Corti G, Skeletal tuberculosis and other granulomatous infections. Baillieres Best Pract Res Clin Rheumatol 199; 13:163-177.
5. Moore S.L, Rafil M. Imaging of musculoskeletal and spinal Tuberculosis. Radiol Clin North America 2001;39:329-342.
6. Rivas-Garcia A, Sarria-Estrada S, Torrents-Odin C, Casas-Gomila L, Franquet E. Imaging findings of Pott's disease. European Spine Journal 2013;22(Suppl 4):567-578.
7. Blanco R, Ojala R, Kariniemi J, Niinimaki J, Tervonen O. Interventional and intraoperative MRI at low field scanner, a review. Eur J Radiol 2005;56:130–142
8. Cormican L, Hammal R, Messenger J, Milburn HJ. Current difficulties in the diagnosis and management of spinal tuberculosis. Postgrad Med J. 2006;82:46–51.
9. Lederman HP, Schweitzer ME, Morrison WB, Carrino JA. MR imaging findings in spinal infections:Rules or myths? Radiology 2003;228:506-514.
10. ShanleyDJ.Tuberculosis of the spine:imaging features.AJR AmJ Roentgenol.1995;164:659-664.
11. Kotzé DJ, Erasmus LJ. MRI findings in proven Mycobacterium tuberculosis (TB) spondylitis. South African Journal of Radiology. 2006;10(2):6–12.
12. Ansari S, Rauniyar RK, Dhungel K, et al. MR evaluation of spinal tuberculosis. Al Ameen J Med Sci. 2013;6(3):219-25.
13. Dharmalingam M. Tuberculosis of the spine-Sabah experience. Epidemiology, treatment and results, Tuberculosis 2004; 84:24-28.
14. Khalequzzaman S1, Hoque HW2 et al: Tuberculosis of Spine Magnetic Resonance Imaging (MRI) Evaluation of 42 Cases. Medicine today.2012;24(2): 59-62.
15. Loke TK, Ma HTG, Chan CS. Magnetic Resonance Imaging of the Tuberculous spinal infection. Austral as Radiol 1997;4:7-12.
16. Lolge S, Maheshwari M, Shah J, Patkar D, Chawla A. Isolated solitary vertebral body tuberculosis-study of seven cases. Clin Radiol 2003; 58:545-50.
17. Smith AS, Weinstein MA, Mizushima A, Coughlin B, Hayden SP et al. MR imaging characteristics of Tuberculous spondylitis vs vertebral osteomyelitis, AJR 1989;153:399-405.
18. J. Breckling, Ed., The Analysis of Directional Time Series: Applications to Wind Speed and Direction, ser. Name of the journal , year, Vol..No.
19. S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," journal name., vol. 20, pp. 569–571, Nov. 1999