

Radiological Evaluation of Septic Arthritis

Ankita Kashyap¹, Pranjit Thapa², Dibyajyoti Nath²

¹PGT, Dept of Radiology, Silchar Medical College & Hospital, Silchar, Assam, India

²Associate Professor, Dept of Radiology, Silchar Medical College & Hospital, Silchar, Assam, India

Received: 18-05-2022 / Revised: 13-06-2022 / Accepted: 07-07-2022

Corresponding author: Dr Pranjit Thapa

Conflict of interest: Nil

Abstract

Introduction: Inflammation of joints by pyogenic bacteria results in septic arthritis. It is an emergency condition, which needs early diagnosis & treatment. Delay results in cartilage & joint destruction resulting in significant morbidity & mortality. The prevalence of septic arthritis patients in the emergency department varies significantly between studies. Higher rates of septic arthritis are present in immune-compromised patients and those with prosthetic joints. X-ray is commonly used for joint imaging as it is widely available. CT & MRI gives more precise information on joints & adjoining soft tissue involvement.

Aim: The aims and objectives of this study were to evaluate age, sex distribution & the pattern of involvement of septic arthritis.

Method: It is an observational study conducted in the Department of Radiology, Silchar Medical College & Hospital (SMCH), Silchar, Assam, India from 1st June 2017 to 31st May 2018, for one year, after taking approval from the ethical committee of Silchar Medical College and Hospital, Silchar in clinic-pathologically confirmed cases of septic arthritis. A total of 23 patients of confirmed septic arthritis patients were evaluated with X-ray, CT & MRI. These findings were compared using suitable statistical methods.

Result: Of 23 cases of septic arthritis, the high incidence was found in the range 20-40 years (16 cases) followed by 40-60 years (4 cases). 17 cases (74%) were males and 6 cases (26%) were females. The most common radiographic finding in septic arthritis was the presence of marginal erosions followed by joint effusion, joint space narrowing and periarticular osteoporosis. On USG joint effusion and synovial thickening were seen in all cases. Synovial hyperemia in the Doppler study was noted in 20 cases. Joint effusion contained echogenic contents in a maximum number of cases. On CT, erosions and joint effusion were seen in all cases. Synovial thickening was seen in 20 cases and joint space narrowing in 12 cases. On MRI, erosions, bone marrow oedema, joint effusion, and synovial thickening with enhancement were seen in all cases. Soft tissue involvement was seen in 10 cases.

Conclusion: Imaging plays a vital role in diagnosing a case of septic arthritis and thereby decreasing both mortality and morbidity. Plain radiography is the basic first-line investigation. Ultrasound had an excellent sensitivity in diagnosing joint effusions, soft tissue changes and synovial thickening. CT also has a definitive role; however, radiation risks narrow down its use. MRI is the imaging modality of choice as it is both specific and sensitive. The only limitation is high cost and more time consumed. The sensitivity of diagnosing septic arthritis by MRI was 100%, by CT was 91.3%, by Radiography was 70% and by USG was 43.5%.

Keywords: Septic arthritis, Juxta articular osteoporosis, bone erosion, joint space narrowing, joint effusion.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Inflammation of joints by pyogenic bacteria results in septic arthritis. Usually, monoarticular involvement occurs in septic arthritis involving large joints like hip or knee, but polyarticular involvement of multiple small joints may also occur. It is an emergency condition, which needs early diagnosis & treatment [1]. Delay diagnosis and treatment results in cartilage & joint destruction resulting in significant morbidity & mortality.

The prevalence of septic arthritis patients with monoarticular involvement among emergency department varies significantly between studies; however, an incidence of 4–60 cases per 100,000 population per year is suggested in the literature [2]. Higher rates of septic arthritis are present in immune compromised patients and those with prosthetic joints, where disease incidence increases to 70 cases per 100,000 patients annually [3].

Aim:

The aims and objectives of this study was to evaluate age, sex distribution & the pattern of involvement of septic arthritis.

Methods and Materials

It is an observational study conducted in the Department of Radiology, Silchar Medical College & Hospital (SMCH), Silchar, Assam, India from 1st June 2017 to 31st May 2018, for a period of one year, after taking approval from the ethical committee of Silchar Medical College and Hospital, Silchar in clinic-pathologically confirmed cases of septic arthritis. A total of 23 patients of confirmed septic arthritis patients were evaluated with various imaging modalities.

The main sources of data for this study were the patients referred from the Departments of Orthopedics, Medicine, Surgery and Pediatrics of SMCH. In all

cases, history taking, and physical examinations were done. Informed consent was obtained from the subjects before commencing the investigations.

Inclusion criteria was all clinicopathological confirmed cases of septic arthritis. Exclusion Criteria were with acute traumatic bone fractures / dislocations /subluxations and other simultaneous joint disease.

Standard radiographs of the cases were obtained using Siemens 500 mA (Model-Klinoskop H / Fluoro-vision) machine in two planes perpendicular to each other, PA/AP view and lateral view of the joint involved.

X-Ray protocol: kVp used: 60-85kV, mAS used: 2-6 mAS, FFD: 100-115 cms, Cassette size: 18cm x 24cm & 24 cm x 30 cm.

Postero-anterior view (PA) of the joint involved: The patient is either supine or seated on the X-ray table. The affected limb is positioned such as to centralize the region of interest and sandbags are placed to help maintain this position. The cassette is kept in close contact with the posterior aspect of the joint. The radiograph is taken with the central ray at 90 degrees to the long axis of the joint passing through the joint.

Lateral view of the joint involved: The patient lies on the side to be examined, with the joint positioned such that it is in the vertical plane and fixed with the help of sandbag.

Computed Tomographic (CT) evaluation: All the cases were evaluated using PHILIPS INGENUITY ELITE / 128 slice MDCT. CT scan were done in required cases only to prevent undue radiation risk to the patients. Contiguous thin sections, 2-3 mm thick were obtained in axial planes

routinely. Reconstruction into other planes and 3D reconstructions were used wherever required. Radiation safety precautions were taken.

USG evaluation: Ultrasonography of the joint involved was carried out on HD 11 XE PHILIPS ultrasonography machine, with a high frequency (5 -12MHz) linear probe. Doppler techniques were used whenever the vascularity of a lesion was to be determined. Bilateral examination and comparison with the healthy side in various scanning planes were done to avoid misdiagnosis.

MRI evaluation: MRI was done almost for all cases in our study as it is considered the most sensitive and specific imaging modality for any musculoskeletal pathology. MRI evaluation was carried out on SIEMENS TIM AVANTO 1.5T SCANNER.

MRI protocol: The involved joint was positioned in the circular polarized extremity coil [By Siemens for routine orthopedic imaging {dimensions - 405 mm × 270 mm × 290 mm (L × W × H)}] with proper cushioning to prevent movement.

Whenever required contrast study was performed, Gd DTPA-dimeglumine solution was injected IV in a dosage of 0.1 mmol per kilogram body weight as a bolus and was followed by a saline flush.

MRI images were acquired in sagittal, coronal and axial planes in T1, T2 and PDFS images. We used 256x256 matrix for all sequences. Additional sequences – gradient sagittal/axial/coronal, three-dimensional GRE pulse, FS sequence, were done, wherever required. Pre and Post contrast T1FS axial, sagittal and coronal images were taken.

Results and observations

Of 23 cases of septic arthritis, on the basis of inclusion criteria, were examined by Plain radiography, CT, USG and MRI, final definitive diagnosis was done after correlation of these imaging findings with the follow-up study, based on operative findings on surgery/arthroscopy, clinical diagnosis in some cases, biochemical analysis, histopathological examination.

Of 23 cases of septic arthritis, high incidence in the range 20-40 years (16 cases) followed by 40-60 years (4 cases).

Table 1: Age distribution of septic arthritis

Age	0-20 years	20-40 years	40-60 years	>60 years	Total
No. of cases	3	16	4	0	23
Percentage	13	69.6	17.4	0	100

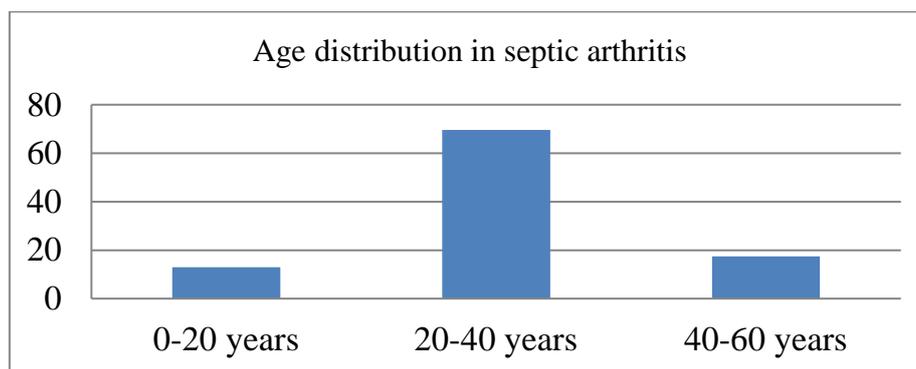


Figure 1: Bar diagram showing age distribution of septic arthritis

Sex distribution of septic arthritis of 23 cases of septic arthritis 17 cases (74%) were males and 6 cases (26%) were females.

Table 2: Sex distribution of septic arthritis

Sex	Male	Female
No. of cases	17	6
Percentage (%)	74	26

Radiographic features: In our study, the most common radiographic finding in septic arthritis was the presence of marginal erosions followed by joint effusion, joint space narrowing and periarticular osteoporosis.

Table 3: Radiographic features of septic arthritis

Radiographic features	Juxta articular osteoporosis	Joint space narrowing	Bone erosions.	Joint effusion
No. of cases	3	10	17	12
Percentage	13	43.5	74	52.2

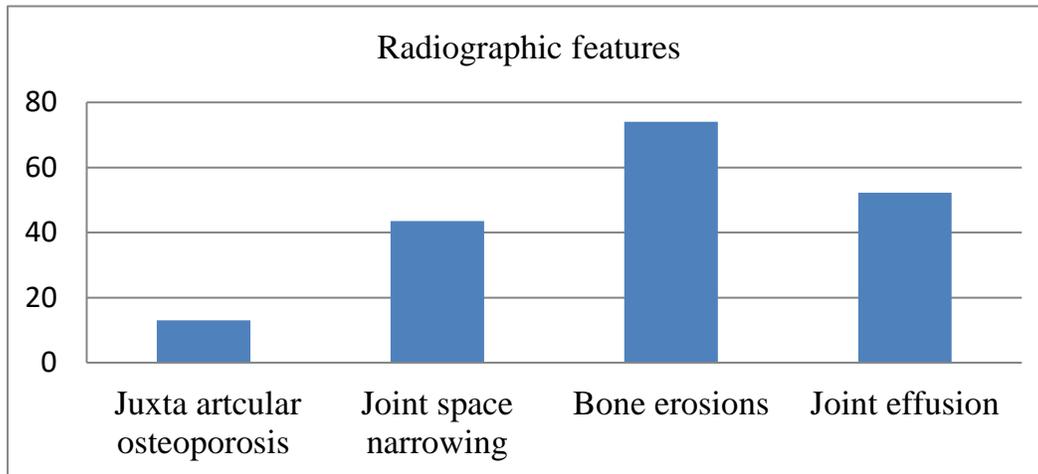


Figure 2: Bar diagram showing radiographic features of septic arthritis



A) Lateral view

B) AP view

Figure 3: Radiograph shows juxta articular osteoporosis, joint space reduction, erosions & soft tissue swelling.

USG features:

Joint effusion and synovial thickening were seen in all cases. Synovial hyperemia on Doppler study was noted in 20 cases. Joint effusion contained echogenic contents in maximum number of cases.

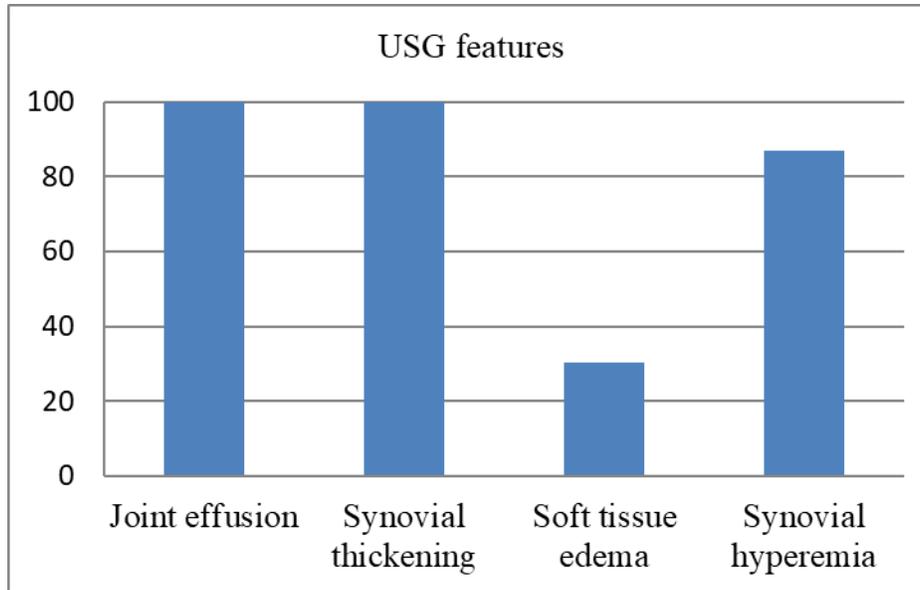


Figure 4: Bar diagram showing USG features of septic arthritis

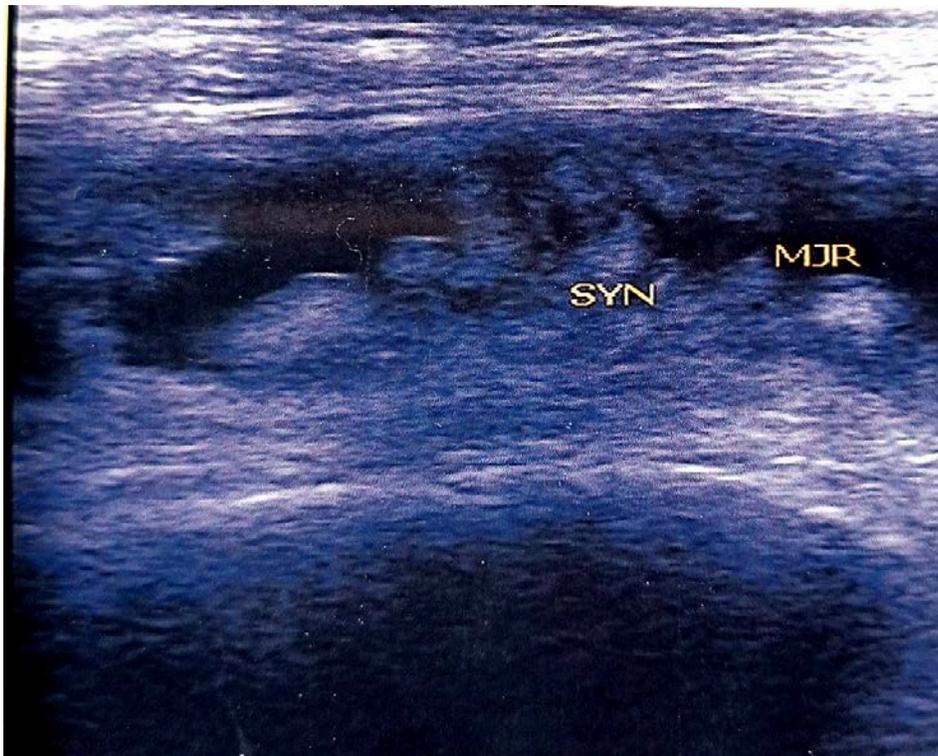


Figure 5: USG shows synovial thickening and joint effusion in the medial joint recess

CT features

Erosions and joint effusion were seen in all cases. Synovial thickening was seen in 20 cases and joint space narrowing in 12 cases.

Table 4: CT features of septic arthritis

CT features	Erosions	Joint space narrowing	Joint effusion	Synovial thickening
No. Of cases	23	12	23	20
Percentage	100	53	100	87

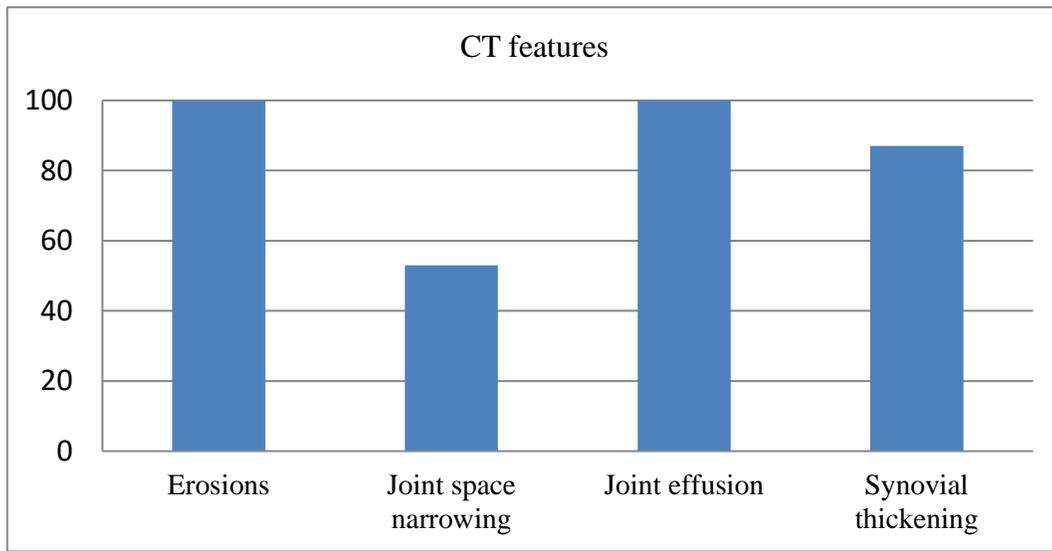
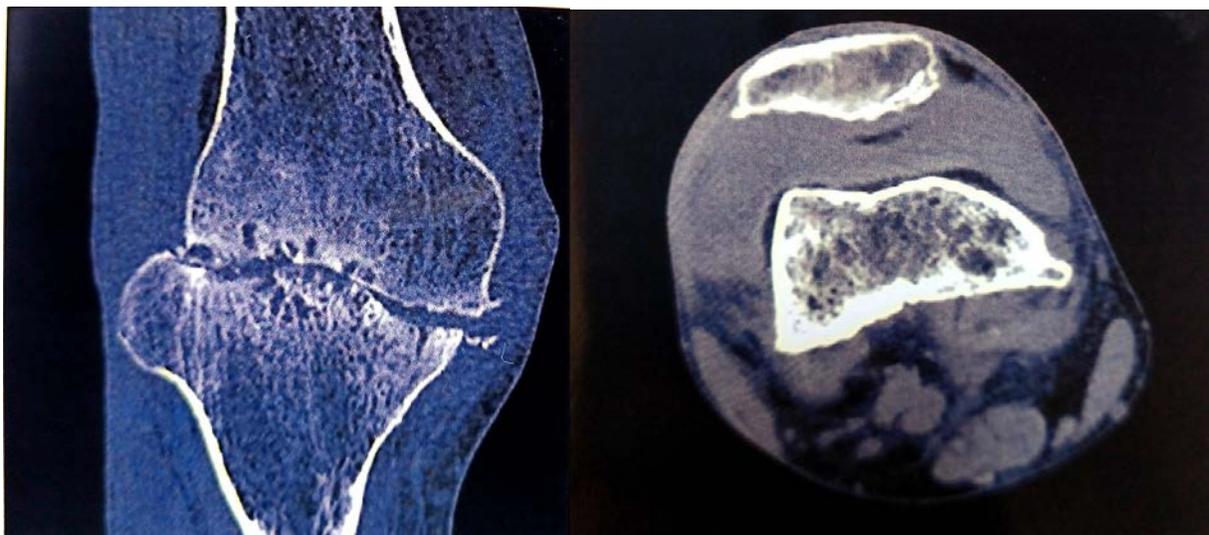


Figure 6: Bar diagram showing CT features of septic arthritis



A) Coronal

B) Axial

Figure 7: CT shows joint space narrowing, joint effusion and erosion.

MRI features

Erosions, bone marrow oedema, joint effusion, synovial thickening with enhancement were seen in all cases. Soft tissue involvement was seen in 10 cases.

Table 5: MR features of septic arthritis

MR features	Erosions	Bone marrow edema	Joint effusion	Synovial thickening with enhancement	Soft tissue involvement
No. Of cases	23	23	23	23	10
Percentage	100	100	100	100	43.7

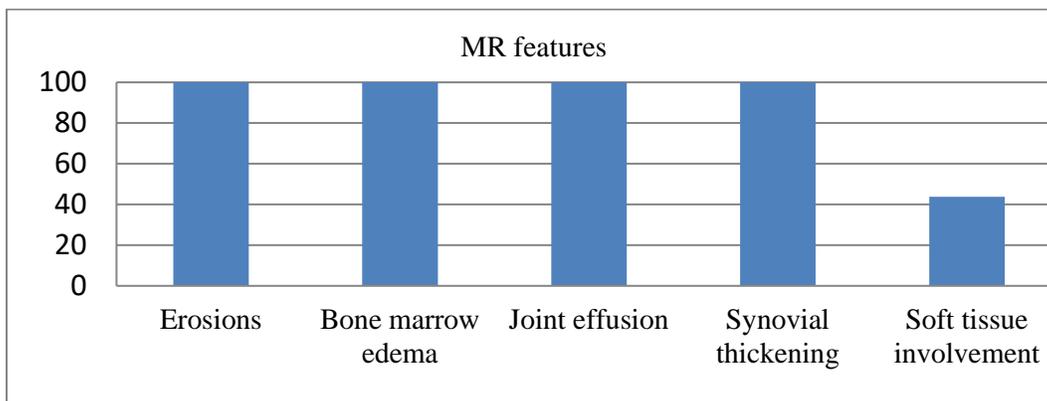


Figure 8: Bar diagram showing MR features of septic arthritis

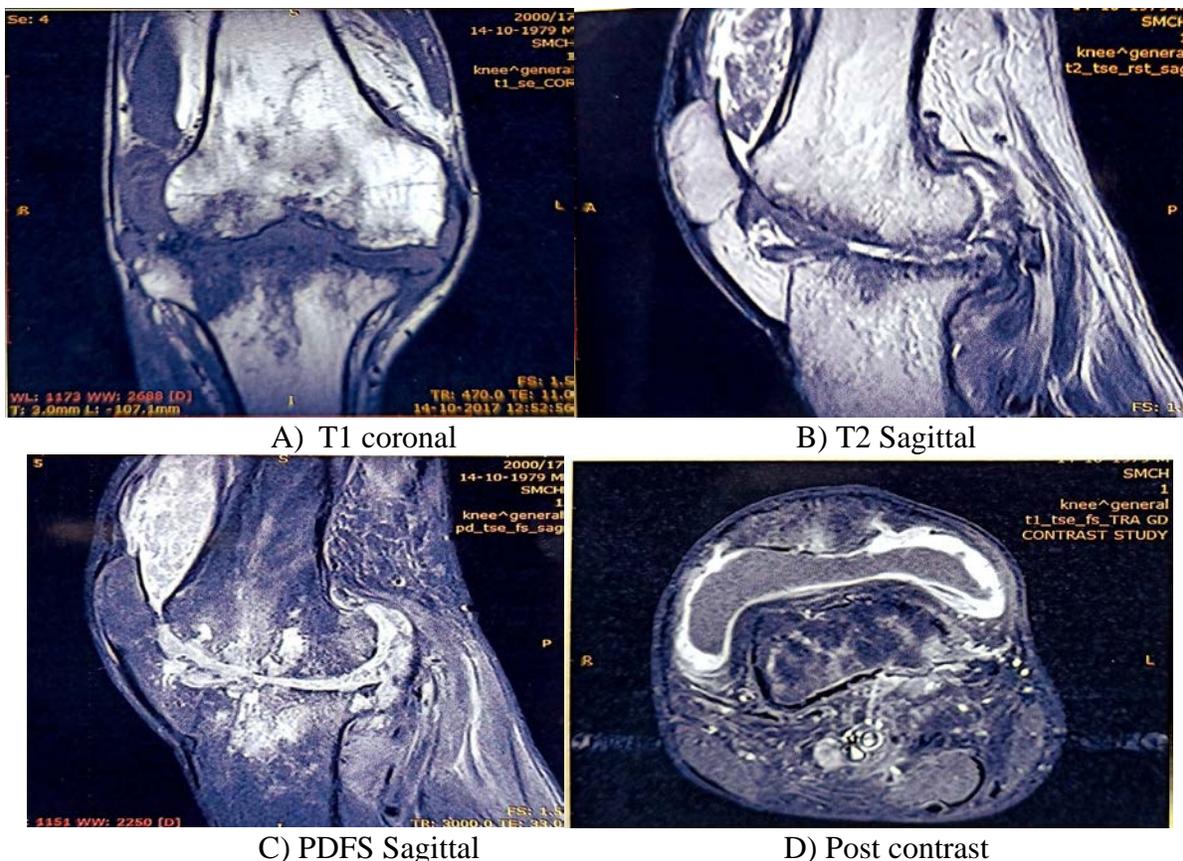


Figure 9: MRI shows erosions, joint effusion, synovial thickening demonstrating post contrast enhancement. PDFS hyperintensity suggesting bone marrow edema.

Sensitivity of imaging modalities in diagnosis of septic arthritis: The sensitivity of diagnosing septic arthritis by MRI was 100%, by CT was 91.3%, by Radiography was 70% and by USG was 43.5%.

Table 6: Sensitivity of imaging modalities

Modality	Radiograph	USG	CT	MRI
No. of cases diagnosed	16	10	21	23
Sensitivity	70	43.5	91.3	100

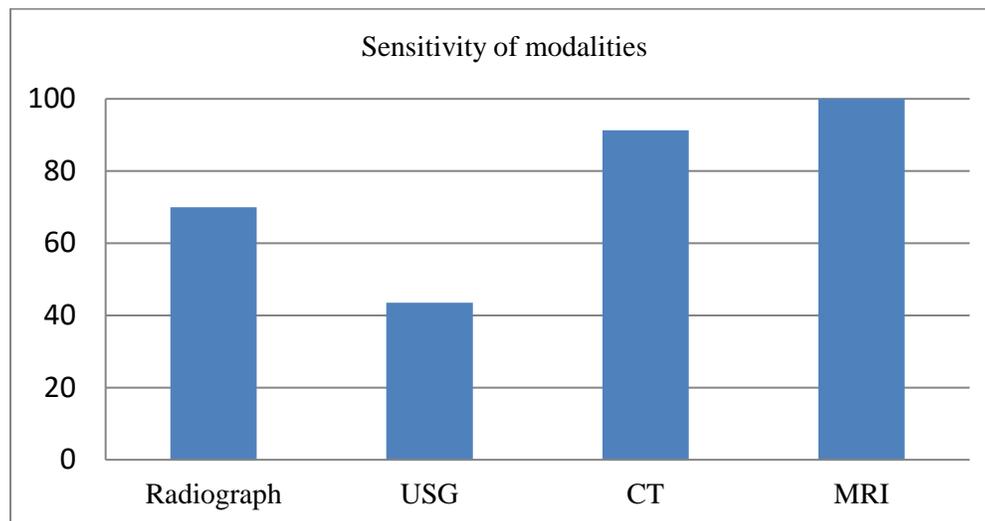


Figure 10: Bar diagram showing sensitivity of imaging modalities in diagnosis of septic arthritis.

Discussion

Of the 23 cases of septic arthritis in our study, males were more commonly affected than females. The most common age group seen was in the range of 20-40 years. Tubercular arthritis is not uncommon in a developing country like ours and hence should always be considered in any case of chronic monoarthritis. Maximum cases belonged to the age range 20-40 years (69.6%). Males were more commonly affected. Knee joint was the most common joint involved in our study.

In a study conducted by Ogunlusi JD et al [4] out of 39 patients 34 had monoarticular septic arthritis, male to female ratio of 2.9:1 and the most common joint involved was the knee joint. Al-Saleh S et al [5] and Morgan et al [6] in their studies found that the mean age of patients with infective arthritis was 39.7 years and 30 years respectively. All

patients in the study by Al-Saleh S et al [5] were monoarticular. The knee joint was the most common joint. In both the studies a male preponderance was seen. Our study correlated to the above-mentioned studies.

On Plain radiography and CT, the most common features of septic arthritis in our study were the presence of erosions and joint effusion. Joint space narrowing and juxta-articular osteoporosis were also seen. Similar findings were also noted by Hadadi A et al [7] in their study, where 20.7% of cases showed similar radiographic findings. Huang T et al [8] reported that significant joint abnormalities in infective arthritis were joint space narrowing (5 cases), bone destruction (9 cases) and osteoporotic change (6 cases). Out of 51 cases, 45 were monoarticular and the knee joint was most commonly affected.

In our study, USG features of synovial thickening and joint effusion were seen in all patients with septic arthritis. In color Doppler study, increased vascularity was noted in the thickened synovium. Mnif J et al [9] reported that joint effusion with internal echogenic floating debris was noted in 50% of cases with septic arthritis. USG allows early diagnosis of joint effusion with high accuracy (93.5%) in cases of septic arthritis. In our study, joint effusion was noted in all cases (100%) of septic arthritis. Draghi F et al [10] reported that the sensitivity of USG in detecting joint effusion is 81.3% and specificity of 100%. Bhargava S et al [11] also concluded that USG is very accurate in early diagnosis of infective arthritis. They found that the sensitivity and specificity of USG was 68%.

In our study, MRI features noted were synovitis, bone marrow oedema, erosions, and soft tissue involvement. Prasad S et al [12] in their study found that out of 24 patients, 18 showed synovitis, 10 showed bone marrow oedema, 4 showed erosions and 5 showed soft tissue involvement which were comparable to findings in our study. Graif M et al [13] reported the MRI findings of septic arthritis in their study which included joint effusion (79%), synovial thickening (68%), synovial enhancement (94%), bone erosions (79%), bone marrow edema (74%) and bone marrow enhancement (67%) and soft tissue edema (63%). Choi JA et al [14] and Michael Karchevsky et al [15] also had similar findings of infective arthritis on MRI. The sensitivity of MRI in diagnosing septic arthritis in our study was 100%. Michael Karchevsky et al [15] in their study concluded that the sensitivity and specificity were 100% and 77% respectively. Hopkins KL et al [16] also found the same percentage of sensitivity and specificity in their study.

Conclusion

Septic arthritis is not an uncommon entity in general medical and rheumatology practices. A correct diagnosis and follow-up are crucial for appropriate treatment. A delay in cases of septic arthritis can result in serious complications to the patient and finally might lead to death. Hence imaging plays a vital role in decreasing both mortality and morbidity of a patient with monoarticular symptoms.

Plain radiography is the basic first-line investigation. Ultrasound had an excellent sensitivity in diagnosing joint effusions, soft tissue changes and synovial thickening. CT also has a definitive role; however, radiation risks narrow down its use. MRI is the imaging modality of choice as it is both specific and sensitive. The only limitation is the high cost and more time consumed.

The present study aimed to evaluate the radiological findings of septic arthritis and to correlate it with established literature. With no doubt our study found that MRI was the ultimate imaging modality to evaluate a case of septic arthritis, Radiography, USG and CT provided an important supportive role.

Acknowledgements: The authors would like to thank the Department of Orthopedics, Surgery, Medicine & Paediatrics, Silchar Medical College & Hospital, Assam, India for referring cases from indoor and outdoor services.

Reference

1. Learch, T. J. & Farooki, S. Magnetic resonance imaging of septic arthritis. *Clin. Imaging* 2000;24, 236–242.
2. Cisternas, M. G. et al. Trends in Medical Care Expenditures of US Adults with Arthritis and Other Rheumatic Conditions 1997 to 2005. *J. Rheumatol.* 2009;36, 2531–2538.
3. Cooper, C. & Cawley, M. I. Bacterial arthritis in an English health district: a

- 10-year review. *Ann. Rheum. Dis.* 1986;45, 458–463.
4. Ogunlusi, J. D., Ogunlusi, O. O., Oginni, L. M. & Olowookere, J. A. Septic Arthritis in a Nigerian Tertiary Hospital. *Iowa Orthop. J.* 2006;26, 45–47.
 5. Al, -Saleh Salman, Al, -Arfaj Abdurahman, Naddaf, H., Haddad, Q. & Memish, Z. Tuberculous Arthritis: A Review of 27 Cases. *Ann. Saudi Med.* 1998;18, 368–369.
 6. Morgan, D. S., Fisher, D., Merianos, A. & Currie, B. J. An 18-year clinical review of septic arthritis from tropical Australia. *Epidemiol. Infect.* 1996;117, 423–428.
 7. Hadadi, A., Rasoulinejad, M., Khashayar, P., Mosavi, M. & Morad, M. M. Osteoarticular tuberculosis in Tehran, Iran: a 2-year study. *Clin. Microbiol. Infect.* 2010;16, 1270–1273.
 8. Huang, T.-Y. et al. Tuberculous arthritis—a fourteen-year experience at a tertiary teaching hospital in Taiwan. *J. Microbiol. Immunol. Infect. Wei Mian Yu Gan Ran Za Zhi* 2007;40, 493–499.
 9. Mnif, J. et al. [Ultrasonography in the diagnostic approach of septic arthritis]. *Rev. Chir. Orthop. Reparatrice Appar. Mot.* 1997;83, 148–155.
 10. Draghi, F. et al. Joint effusion of the knee: potentialities and limitations of Ultrasonography. *J. Ultrasound* 2015;18, 361–371.
 11. Shiv, V. K., Jain, A. K., Taneja, K. & Bhargava, S. K. Sonography of hip joint in infective arthritis. *Can. Assoc. Radiol. J. J. Assoc. Can. Radiol.* 1990;41, 76–78.
 12. Prasad, S. et al. Features of extra-spinal musculoskeletal tuberculosis: A retrospective study from a North Indian Tertiary Care Institute. *Indian J. Rheumatol.* 2017;12, 146.
 13. Graif, M., Schweitzer, M. E., Deely, D. & Matteucci, T. The septic versus nonseptic inflamed joint: MRI characteristics. *Skeletal Radiol.* 1999;28, 616–620.
 14. Choi, J.-A. et al. Rheumatoid Arthritis and Tuberculous Arthritis: Differentiating MRI Features. *Am. J. Roentgenol.* 2009;193, 1347–1353.
 15. Karchevsky, M., Schweitzer, M. E., Morrison, W. B. & Parellada, J. A. MRI Findings of Septic Arthritis and Associated Osteomyelitis in Adults. *Am. J. Roentgenol.* 2004;182, 119–122.
 16. Hopkins, K. L., Li, K. C. & Bergman, G. Gadolinium-DTPA-enhanced magnetic resonance imaging of musculoskeletal infectious processes. *Skeletal Radiol.* 1995;24, 325–330.