Original Article

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Role of WBC Scan in Osteomyelitis

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Abstract

Osteomyelitis is either an acute or chronic infection of the bone. It is most commonly seen in the lower limbs, post trauma. Osteomyelitis is very difficult to treat compared to other soft tissue infections. Patient needs prolonged hospitalization and medications for treatment of osteomyelitis. The diagnosis of osteomyelitis and the reconstruction of post traumatic osteomyelitic defect is a challenging one from surgical point of view. It needs multidisciplinary approach involving orthopedic and plastic surgeons for effective management. In this case report, we are assessing the role of WBC scan in the case of a 24-year-old gentleman with a proximal tibial fracture and popliteal artery injury and with exposed tibial bone in the knee joint following a road traffic accident, to identify osteomyelitic changes in the bone.

Keywords: Osteomyelitis; WBC scan.

INTRODUCTION

Bone infections are more common following road traffic accidents due to heavy contamination during the injury. Both acute and chronic osteomyelitis will present with swelling, pain and erythema at the site of infection. However, chronic osteomyelitis is associated with less systemic signs and symptoms.[1,2] Thus, in the setting of chronic non healing wounds and ulcers, which does not respond to appropriate therapy, chronic osteomyelitis should be suspected. Identifying the bone infection is the critical step in treatment of osteomyelitis. There are various investigations available for identifying osteomyelitis such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and nuclear imaging scans like triple phase bone scan and White Blood Cell (WBC)/ Leukocyte scan. The initial diagnostic modality of choice is a plain film X-ray.[1,3] In our case study, we are assessing the role ofnuclear scan such as WBC scan which was done after x-ray and triple phase bone scan came equivocal in the setting of an non healing traumatic ulcer over the left knee region. This study highlights the role of WBC scan in the management of osteomyelitis.

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METHODS AND MATERIALS

This study was conducted in tertiary care centre in department of plastic surgery after getting the department ethical committee approval. Informed consent was obtained. The subject was a 24 year old male who had a road traffic accident, which left him with a left open type 3C proximal tibial fracture with popliteal artery injury. He had first undergone knee spanning external fixator application with popliteal artery exploration and repair. Then he underwent wound debridement with illizarov fixation andCannulated Cancellous (CC) screw fixation for lateral tibia before finally undergoing wound debridement with skin grafting. However, despite skin grafting, the patient continued to have a raw area over the left knee, which on examination had sloppy margins with surrounding skin scarred and proximal tibia exposed (Fig. 1). There was also restriction of movement at the left knee joint. He was then taken over by the department of plastic surgery for further management. As there was popliteal artery injury along with soft tissue injury of the lower limb which causes severe vascular compromise and tissue scarring around the left knee joint and lower limb, so microvascular flap surgery was deferred and conventional flap was planned. After admission, investigations were done to identify the cause of the non-healing of the wound. Osteomyelitis was suspected to be the primary cause and the patient underwent a Technetium 99m-methyl diphosphonate (Tc 99m MDP) triple phase bone scan which revealed the possibility of active osteomyelitis. To confirm further, he underwent a WBC scan (Fig. 2 and 3), which found no evidence of active osteomyelitis of the proximal tibia or the knee joint. Following this he underwent hydro jet debridement with regenerative therapies like Low Level Laser Therapy (LLLT)(Fig. 4), Autologous Platelet Rich Plasma (APRP) infusion (Fig. 5), cultured epidermal grafting and dermal grafting, collagen scaffold application (Fig. 6) and Regulated Oxygen Negative Pressure Wound Therapy (RONPWT)(Fig. 7) for wound bed preparation. He then underwent local perforatorkeystone flap (Type 2B)(Fig. 8) with a split thickness skin graft over the raw area (Fig. 9). The debrided bone during surgery which was sent for histopathology reported as chronic osteomyelitic changes and hence, intravenous (IV) antibiotics were givenaccording to tissue culture and sensitivity.

Fig. 1: Raw area over the left knee

Fig. 4: Application of Low Level Laser Therapy

Fig. 5: Application of Autologous platelet rich plasma infusion

Fig. 6: Scaffold application

Fig. 7: Application of RONPWT

Fig. 8: Keystone flap (Type 2B)

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LABELED LEUKOCYTE SCAN FOR INFECTION IMAGING NUCLEAR MEDICINE REPORT

Hosp No.		**N M No.**	
Patient Name		**Father/Husband Name**	
Age/Sex	24 Years[/ // /]/M	**Report date/Time**	20/07/2022--16:39
IP/OP Location	I-PLS SUR 5427	**Organ**	
Service	PLASTIC SURGERY		
		Mobile No	

Study date: 18.07.2022 & 19.07.2022

Indication for the study:

Case of suspected osteomyelitis of the left leg. The patient sustained a fracture of left tibia following a road traffic accident in July 2021. He was diagnosed to have left open type 3C proximal tibial fracture with popliteal artery injury. Underwent knee spanning external fixator application with popliteal artery exploration on 14.07.2021. Underwent wound dressing and Ilizarov fixation with CC screw for left tibial plateau on 10.08.2021. Underwent wound dressing and skin grafting on 25.08.2021. Ilizarov ring was removed on 18.11.2021. He presented with complaints of non healing wound and discharge from the left knee region over the lateral aspect. He was planned for skin grafting. One CC screw was removed on 06.01.2022. He started to walk with support from April 2022. Skin grafting was done, grafts were taken from the medial and lateral aspect of the right thigh. He came with complaints of persistent pus discharge from the lateral aspect of the left knee region. Another CC screw was removed from the proximal part of the left tibia one week back. On examination, vacuum dressing was done over the left knee region. Tc99m MDP triple phase bone scan (04.07.2022) revealed possibility of active osteomyelitis. Leucocyte-labelled scan to rule out osteomyelitis of the proximal end of left tibia.

Study procedure:

50 ml of venous blood was withdrawn in a syringe containing 7 ml of ACD. It was allowed for settling of RBC for 5 hours at 37 degree celsius in the incubator. Plasma was separated with the assistance of gravity and centrifuged at 150g for 5 minutes. Platelet rich plasma and leukocyte pellets were separated. 18 mCi of freshly prepared Tc-99m HMPAO was added to the leucocyte pellet and kept in the incubator for 20 minutes at 37 degree celsius. It was then centrifuged at 150g for 5 minutes. Supernatant was removed. Labeling efficiency was calculated to be 50%. It was reconstituted with platelet rich plasma and injected intravenously.

A spot image of thorax was acquired 20 minutes post injection to check quality of the radiopharmaceutical preparation.

Spot images of bilateral knee regions and proximal tibia were acquired 2.5 hours and 19 hours post injection.

Image quality: Good.

Patient motion: None.

Findings:

The 2.5 hours delayed images show mild to moderately increased tracer uptake in the anterior aspect of the proximal end of the left leg, just adjacent to the left knee region.

19 hours delayed images show mildly increased tracer uptake in the same site.

SPECT/CT images obtained after 2.5 hours of injection reveal mildly increased tracer uptake in the subcutaneous plane anterior to the tibial condyles

No other abnormally increased focal tracer uptake is noted.

Physiological tracer uptake in the liver, spleen and bone marrow is noted.

Impression:

No scan evidence of active infection or osteomyelitis in the left knee joint and proximal left tibia.

Printed On : 20/07/2022 04:41
Printed By :

Technologist Name : NIL

Note: No need of signature. This Report has been digitally authorised by

Fig. 2 and 3: WBC scan report

Fig. 9: Split thickness skin graft of raw area

RESULTS

Intra-operative and post-operative periods were uneventful for the patient. The raw area took up the split thickness skin graft well (Fig. 9). Flap remained healthy (Fig. 10). Patient was discharged with no complications.

Fig. 10: Healthy flap

DISCUSSION

In case of high suspicion of osteomyelitis and about a week's history of signs and symptoms, MRI is a useful tool for detecting osteomyelitis, with highsensitivity and specificity.[3,4,5] However, metal hardware may make the test unreliable, displacing bone marrow. In this scenario Tc99 MDP triple phase bone scan and Indium 111 labelled WBC scan are more useful tools. The nuclear imaging tests are highly sensitive but with poor specificity, showing false positives with other inflammatory conditions. Biopsy is essential for establishing the diagnosis and directing the treatment plan as it gives an idea about microbe and antibiotic susceptibility. Nuclear imaging like WBC scan as mentioned earlier are used when other imaging and investigations prove equivocal. It has a sensitivity 60 to 100% and specificity 69 to 92%6. WBCs are harvested from the patient and labelled with Indium-111. It is then injected back into the patient7.Uptake increases to that of liver or greater in case of any inflammatory pathology. However, in the setting of osteomyelitis, if the patient had been on IV antibiotics prior, there will be a false negative result. In the case of presence of prosthesis, there is difficulty interpreting the scan due to displacement of marrow. In case of other non-infective inflammatory conditions also, the WBC scan can produce false positive result. Due to the various false positive and false negative results that can arise in a WBC scan, it is imperative that the clinical and histopathological correlation be made.An open fracture, especially in the proximal segment of bone as seen in this case is an apt setting for the development of osteomyelitis. Without, addressing the underlying infection, it is unlikely that the wound heals. Hence it was imperative to come to a definitive diagnosis. In this case, the triple phase bone scan was suggestive of osteomyelitis. WBC scan if it had come positive would have further strengthened the clinical suspicion. However, it came negative for active osteomyelitis. The most conclusive investigation was the biopsy which was done in view of strong clinical suspicion. The discrepancy with WBC scan may be due to the prior prolonged use of IV antibiotics,which may cause the suppression of infective load in the bones, and the presence of metallic screws. Hence, in this case it is difficult to make a conclusion as to whether the WBC scan was useful in the diagnosis of osteomyelitis.

CONCLUSION

WBC scan is a useful nuclear imaging to aid in the diagnosis of osteomyelitis, despite the possibilities of false positives and false negatives. In this case, it was inconclusive probably due to prior prolonged IV antibiotic use and presence of metallic screws. The patient was later proven to have chronic osteomyelitis on biopsy taken of the diseased bone segment. The result which was obtained from our study will not be sufficient to exclude the usefulness of the WBC scan in identifying osteomyelitis as it is a single case report. We need a larger population to identify the limitations of the WBC scan.

REFERENCES

1. Schmitt SK. Osteomyelitis. Infect Dis Clin North Am. 2017 Jun;31(2):325-338.
2. Lew DP, Waldvogel FA. Osteomyelitis. N Engl J Med. 1997 Apr 03;336(14):999-1007.
3. Hatzenbuehler J, Pulling TJ. Diagnosis and

management of osteomyelitis. Am Fam Physician. 2011 Nov 01;84(9):1027-33.

4. Lam K, van Asten SA, Nguyen T, La Fontaine J, Lavery LA. Diagnostic Accuracy of Probe to Bone to Detect Osteomyelitis in the Diabetic Foot: A Systematic Review. Clin Infect Dis. 2016 Oct 01;63(7):944-8
5. Zimmerli W. Clinical practice. Vertebral osteomyelitis. N Engl J Med. 2010 Mar 18;362 (11):1022-9.
6. Lewis SS, Cox GM, Stout JE. Clinical utility of indium 111-labeled white blood cell scintigraphy for evaluation of suspected infection. Open Forum Infect Dis. 2014 Sep;1(2):ofu089.
7. Roca M, de Vries EF, Jamar F, Israel O, Signore A. Guidelines for the labelling of leucocytes with (111)In-oxine. Inflammation/Infection Taskgroup of the European Association of Nuclear Medicine. Eur J Nucl Med Mol Imaging. 2010 Apr; 37(4):835-41.