Nuclear medicine techniques: a better weapon in detecting a rare case of epiphyseal osteomyelitis caused by *Salmonella* in a patient without sickle cell disease

F Caobelli*, F Magli², C Pizzocaro¹, F Terragnoli², UP Guerra¹

Abstract

Introduction

An osteomyelitis may be difficult to diagnose by conventional imaging methods; nuclear medicine imaging can detect a lesion in the very early stages, highlighting the metabolic changes preceding structural ones. We present a case of *Salmonella* osteomyelitis in a 26-year-old woman, involving the distal epiphysis of the right femur.

Case report

After performing an MRI, which showed a non-specific osteolytic lesion, the patient underwent a bone scan and a scintigraphy with labelled granulocytes, both integrated by a SPECT/CT regional study. After diagnosing osteomyelitis, the patient underwent surgical curettage, and *Salmonella* spp. group B was isolated. The patient finally underwent antibiotic therapy with complete relief.

Conclusion

Our case report is a clear example of how nuclear medicine techniques can address the diagnosis of infectious lesions better than conventional imaging.

Introduction

An osteomyelitis caused by *Salmonella* sp. is an extremely rare manifestation, especially in non-sickle cell patients, but with potentially lethal consequences on the skeletal system.

The involvement usually affects a single joint, but also vertebrae or any other bones can be involved; frequently, an osteomyelitis caused by *Salmonella* is associated with particular pathological conditions like immunodepression, systemic lupus erythematosus, renal transplantation, sickle cell disease or pre-existing joint disease. The pathology in immunocompetent adults is usually due to the ingestion of contaminated food products.

The onset of such pathology in young patients, in the absence of significant anamnestic data, can hardly be recognised, although a prompt and correct diagnosis is absolutely necessary.

Conventional imaging suffers from lack of specificity, especially at the early stage of the disease. Conversely, nuclear medicine imaging can be useful for diagnosing and monitoring *Salmonella* bone lesions, giving more information than conventional imaging.

We here present a very unusual case of osteomyelitis caused by *Salmonella typhi* in a non-sickle cell patient, whose diagnosis could be obtained only with nuclear medicine imaging.

Case report

A 26-year-old non-sickle patient came to our observation for worsening pain of the right knee, intumescence, joint effusion and functional limitation with severe lameness. The patient underwent an MRI, performed 1 week before, showing a non-specific osteolytic area located on the distal epiphysis of the right femur (Figure 1). A culture on synovial effusion was unremarkable.

To exclude other bone localisations, the patient underwent a whole-body bone scan, integrated by a regional SPECT/CT study, revealing only a hot spot corresponding to the lesion described on MRI (Figure 2). We, therefore, suggested to perform a scintigraphy with labelled granulocytes, which revealed an intense radiopharmaceutical uptake of the same lesion (Figure 3), suggesting a diagnosis of osteomyelitis.

The patient underwent a surgical curettage and *Salmonella* spp. group B was isolated, sensitive to levofloxacin.

A targeted antibiotic therapy was therefore started, with complete relief and without any sequelae. Thirty days later, the patient underwent a follow-up 18F-FDG PET/CT, which was unremarkable (Figure 4). The use of PET instead of labelled granulocyte scan was decided to avoid possible allergic reactions; in fact, we usually label granulocytes *in vivo* by using radioactive antibodies, which are rarely responsible of allergic reactions.

Discussion

Reports of haematogenous osteomyelitis caused by *Salmonella* can be rarely found in literature, and in most cases an underlying condition can be identified.

The association between osteomyelitis caused by *Salmonella* and sickle cell disease is well known, but also other underlying conditions have been reported to be associated; therefore, reports of patients affected by osteomyelitis caused by *Salmonella* and without any other pathological studies are extremely rare.

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Gould et al.\(^3\) reported a case of a granulomatous *Salmonella* osteomyelitis in a non-sickle cell patient. In this case, there was a strong association with anti-tumour necrosis factor therapy causing immunodepression. Also in this article, only conventional radiological imaging data are provided.

Unlike other reports, the patient in our case had no underlying conditions, and the infection was probably due to food poisoning; moreover, in our case, the use of nuclear medicine techniques permitted to detect an infectious focus, which was later diagnosed as osteomyelitis on pathological examination.

The role of nuclear medicine in detecting foci of osteomyelitis has been reported by some authors. In particular, 18F-FDG PET/CT was demonstrated to be accurate and rapid in identifying the presence or absence of an infective source in selected cases\(^10\), with high negative predictive value\(^11\). The singular advantage of F-18 FDG PET over MRI is the ability to monitor quantitatively the response to antimicrobial treatment. The standard uptake value is expected to decrease over time as antimicrobial therapy takes effect in two case studies\(^5,12\).

In our case, we documented the possible role of scintigraphy with labelled granulocytes, which allows the same findings in most cases of infection and presents many advantages, like the more widespread availability and the lower cost.

The early diagnosis of osteomyelitis caused by *Salmonella* spp. allows to start an effective surgical treatment and adequate antibiotic therapy, thus avoiding severe consequences on skeletal system. In many cases, neither laboratory finding nor conventional imaging allows a definitive diagnosis.

Ispahani et al.\(^4\) described five cases (two children and three adults) in a retrospective analysis of their records of patients with extraintestinal *Salmonella* infections admitted in a 17-year period. However, no data about radiological or molecular imaging were described.

Sucato et al.\(^8\) and Santos et al.\(^9\) also described other similar cases; in particular, a fatal case of vertebral osteomyelitis due to *Salmonella* spp. associated with infected abdominal aortic aneurysm was reported. Also in these articles, no data about the use of nuclear medicine techniques can be found; due to the retrospective design of the study, the possible presence of underlying pathologies could not also be investigated.

The possible role of scintigraphy with labelled granulocytes, which allows the same findings in most cases of infection and presents many advantages, like the more widespread availability and the lower cost.

**Figure 1:** MRI coronal imaging showing an osteolytic area on the right knee (arrow). The image has non-specific features.

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All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript.

All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.

References

Conclusion
Our case report is a clear example of how nuclear medicine techniques can address the diagnosis of infectious lesions better than conventional imaging; therefore, such methods should be kept in mind by orthopaedic surgeons in order to have a precise diagnosis, which can allow to plan an effective treatment.

Consent
Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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Figure 2: Segmentary SPECT imaging of whole-body bone scan. There is an evidence of a ‘hot spot’ corresponding to an area of increased bone matrix deposition.

Figure 3: Scintigraphy with labelled granulocytes. SPECT/CT fused images. Transaxial, sagittal and coronal images are shown. There is the evidence of an intense radiopharmaceutical uptake corresponding to an infectious focus, later diagnosed as osteomyelitis caused by Salmonella spp.

Figure 4: 18F-FDG PET/CT fused images on follow-up. Transaxial, sagittal and coronal images are shown. There is the evidence of a ‘cold’ area corresponding to the previously noticed infectious focus.
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