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MUSCULOSKELETAL

Role of Diffusion Weighted Imaging in Musculoskeletal Infections: Current Perspectives

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Abstract
Accurate diagnosis and prompt therapy of musculoskeletal infections are important prognostic factors. In most cases, clinical history, examination and laboratory findings help one make the diagnosis, and routine magnetic resonance imaging (MRI) is useful to identify the extent of the disease process. However, in many situations, a routine MRI may not be specific enough especially if the patient cannot receive contrast intravenously, thereby delaying the appropriate treatment. Diffusion-weighted imaging (DWI) can help in many such situations by providing additional information, accurate characterization and defining the extent of the disease, so that prompt treatment can be initiated. In this article, we illustrate the imaging findings of the spectrum of musculoskeletal infections, emphasizing the role of DWI in this domain.

Key Points
- *Abscess in background cellulitis is detected on DWI.*
- *Infectious tenosynovitis shows diffusion restriction as compared to mechanical tenosynovitis.*
- *Pyomyositis with abscess can be differentiated from diabetic myonecrosis on DWI.*
- *Intraosseous abscess is bright on DWI versus devitalized tissue, sequestrum and air.*
- *DWI can be used to differentiate spine infection from simple Modic changes.*

Keywords MRI · DWI · Diffusion · Infection · Abscess

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Introduction

Musculoskeletal infections are commonly encountered in medical practice and involve bones, soft tissues, muscles, cartilage and joints [1]. Early diagnosis and treatment are critical for preventing disabling sequelae. Clinical history, physical examination and laboratory findings, such as increased erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are helpful in making a diagnosis of active inflammation or infection, and magnetic resonance imaging (MRI) plays an important role in defining the nature and extent of the infection [2]. However, many other noninfectious disease processes produce similar imaging findings on routine MR sequences. Many adult patients with infection are diabetic or have renal impairment, and contrast cannot be administered intravenously. Diffusion-weighted imaging (DWI) can be obtained as an additional pulse sequence in these patients and it can play an important role in detection, differentiation and characterization of the spectrum of infectious processes from other lesions. There is a paucity of literature discussing the role of DWI in musculoskeletal infections. In this article, we discuss the imaging findings of the spectrum of musculoskeletal infections, emphasizing the role of DWI in this domain. The pitfalls of DWI are also outlined with respective case examples.

MRI: technical considerations

Although many MR sequences can be applied for the imaging of musculoskeletal infections, T1-weighted (T1W) and fluid-sensitive sequences (either short-tau inversion recovery [STIR] or fat-suppressed T2-weighted [fsT2W]) in two or three planes are most commonly used. STIR images are more sensitive in detecting soft tissue and bone marrow oedema owing to superior fat suppression, especially along curvatures; however, STIR has a lower signal-to-noise ratio (SNR) than fsT2W [3]. Intravenous administration of gadolinium is used to define the extent of infection and helps to detect non-enhancing necrotic (devitalized) tissue, air and foreign bodies [4]. DWI is being increasingly used in musculoskeletal diseases [5].

DWI is a noninvasive method used to measure the Brownian motion of water molecules. Diffusion-sensitizing gradients are applied in DWI, where the *b* value defines the diffusion moment. With a *b* value of 0, the image is similar to the T2W image; with increasing *b* values, it becomes more sensitive to the detection of restricted diffusion. Dephasing resulting from the movement of the water molecules between the two opposing gradients results in signal loss on DWI. The signal loss is proportional to the degree of movement of water molecules and the *b* value. Apparent diffusion coefficient (ADC) maps, obtained by repeating the sequence with different *b* values, quantify the observed signal loss [6].

Various technical factors need to be considered for optimal image quality on DWI. Usually DWI is obtained before intravenous administration of contrast to avoid perfusion effects. Focusing on the axial plane is the best way to avoid ghosting artefacts. One can choose a range of *b* values (>2–3), from 0 to 1000, to generate a good curve for ADC calculation. Any *b* values greater than 50 to 100 usually avoid perfusion effects. Fat suppression can be obtained by frequency-selective or inversion recovery techniques. The latter reduces SNR, but reduces ghosting owing to better fat suppression [7]. Single-shot echo planar imaging (EPI) is commonly used over multi-shot EPI owing to shorter scanning time. However, the advantages of multi-shot EPI include decreased distortion, ghosting artefacts and susceptibility artefacts. The new 'Resolve' sequence employs multi-segmented read-out with reduced distortions. Finally, keeping the echo spacing tighter (<0.7 ms) further reduces image blurring and ghosting artefacts. Incorporation of compressed sensing may further reduce the diffusion acquisition times.

Normal and abnormal musculoskeletal tissue appearances on DWI

Similar to heavily fsT2W images, the muscles show intermediate to dark signal on DWI, the bones and subcutaneous tissue show dark signal, and nerves show mild increased signal. The corresponding ADC images show increased signal in vessels and adjacent fluid containing structures. Higher *b* value DWI (>50–1000 ms) encompasses vascular signal suppression. Most normal structures are dark on DWI except, nerves, stationary fluid and lymph nodes. Normal ADC values of different structures in the musculoskeletal system are summarized in Table 1.

A hyperintense signal on DWI corresponds to an area where water motion is restricted and appears as a bright signal on DWI and a dark signal on the ADC map [6]. As intracellular water has more restricted movement compared to extracellular water, increased cellularity leads to an increased signal on DWI. This is true in highly cellular tumours such as lymphoma and high-grade malignancies [8, 9]. On the other hand, restricted diffusion in the central necrotic portion of the abscesses is related to restricted water motion due to high-viscosity pus with inflammatory cells, bacteria, proteins and cellular debris [10]. Bones normally have a combination of red and yellow marrow with considerable fat. Therefore, increased signal within bone marrow is in essence not diffusion restriction but enhancement of diffusion related to inflammatory oedema and cellularity. The degree of enhancement varies depending upon the spectrum of pathology, i.e. reactive oedema, osteomyelitis, intraosseous abscess and necrotic bone, with most DWI signal in intraosseous abscess and least signal alteration in sequestrum.

Pathologic entities

Musculoskeletal infections can be broadly classified into two categories: superficial lesions, such as cellulitis, infectious tenosynovitis and bursitis, and deep lesions, including necrotizing fasciitis, pyomyositis, septic arthritis, osteitis and osteomyelitis [11, 12]. Further discussion will focus on this spectrum of musculoskeletal infections with emphasis on the role of DWI in this domain (Table 2).

Table 1 Range of ADC values in normal musculoskeletal structures

Structure	ADC ($\times 10^{-3}$ mm^2/s)
Water	2.5–3.0
Skeletal muscle	1.3–1.4
Yellow marrow	0.3–0.4
Red cellular marrow	0.8–1.0
Cartilage	1.0–1.1
Peripheral nerve	1.1–1.3

Table 2 Range of ADC values in the spectrum of musculoskeletal infections in authors' experience

Pathology	ADC ($\times 10^{-3}$ mm^2/s)
Soft tissue oedema	2.0–3.0
Cellulitis	1.2–2.0
Soft tissue abscess	0.6–1.1
Pyomyositis	1.5–1.8
Reactive bone marrow oedema	1.4–1.9
Osteomyelitis	1.1–1.4
Intraosseous abscess	0.6–1.1

Superficial infections

Cellulitis

Cellulitis is a non-necrotizing superficial bacterial infection of the skin and subcutaneous tissues without involvement of the underlying fascia and muscles. Staphylococcus and streptococcus are the most common types of bacteria responsible for cellulitis. Clinically, cellulitis presents with local erythema, warmth, swelling and tenderness, with systemic signs of fever and leukocytosis. Although cellulitis is a clinical diagnosis, an MRI is usually obtained to define the extent of infection and to detect any underlying abscess that may need to be drained [13]. On MRI, cellulitis is seen as skin thickening with areas of low signal on T1W and high signal on STIR/fsT2W images [14]. The presence of contrast enhancement in cellulitis helps differentiate it from other noninfectious causes of subcutaneous oedema, such as fluid overload, congestive heart failure and lymphatic obstruction, which can result in similar findings on T1W and STIR/fsT2W images [15]. In situations where contrast cannot be administered intravenously, the differentiation of cellulitis from subcutaneous oedema can be very difficult. In our experience, DWI can be helpful in demonstrating some restriction of diffusion in cellulitis (ADC 1.2–2.0) while simple subcutaneous oedema shows increased diffusion (ADC 2.0–3.0) (Figs. 1, 2). One can also detect small pockets of abscess in the mound of oedema like signal on fsT2W images, which are known to cause restricted diffusion (ADC 0.6–1.2) [16, 17].

Septic bursitis

Septic bursitis usually results from penetrating injury, spread from adjacent infection and haematogenous routes. Olecranon, prepatellar and retrocalcaneal bursae are the most commonly involved sites. Septic bursitis usually presents as localized pain over the inflamed bursa, swelling, fever and lymphadenopathy. On MRI, septic bursitis demonstrates T1 hypointense and T2 hyperintense heterogeneous fluid collection with thick enhancing walls [18]. However, noninfectious causes such as rheumatoid arthritis, gouty arthropathy and trauma can result in similar findings [19]. DWI helps one detect infectious bursitis by demonstrating restricted diffusion due to the viscous nature of the fluid/pus [10]. Presence of haemorrhage in trauma settings will produce T2 shine through and susceptibility artefacts from blood products.

Infectious tenosynovitis

Infectious tenosynovitis is the infection of the tendon and its synovial sheath; it usually results from a penetrating injury or extension from adjacent infection [20]. Patients present with localized pain and tenderness over the inflamed site, fever and painful range of motion of the involved tendon. MRI demonstrates a distended and thickened tendon sheath, with a varying signal of the complex fluid. The tendon itself appears ill defined and thickened with intermediate signal intensity associated with surrounding soft tissue oedema. Intense peripheral enhancement is usually seen on post-contrast images [20, 21]. However, these findings are not specific and can be seen in traumatic, mechanical and inflammatory causes of tenosynovitis. As infectious tenosynovitis usually evolves rapidly, it is considered a surgical emergency. DWI can be helpful in differentiating infectious tenosynovitis from noninfectious causes by demonstrating restricted diffusion due to the viscous nature of the fluid/pus in the tendon sheath and adjacent cellulitis (Fig. 3). The fluid in the tendon sheath in infectious tenosynovitis will be seen as a bright area on DWI and dark on the ADC map. Tendon tears and erosions are also nicely identified as bright signal alterations on DWI.

Pitfalls in DWI of superficial infections

Ghosting artefacts are common in extremity imaging as a result of suboptimal fat suppression and lower SNR. These effects may mar the imaging quality for superficial extremity lesions. The imaging distortion may cause lesion displacement by up to 6 mm [22]. The effects are more pronounced in the phase encoding direction and can be mitigated somewhat by better fat suppression (STIR), tighter echo spacing, use of parallel imaging and higher bandwidth. Air in the soft tissues can further cause susceptibility artefacts and distort imaging. While such artefacts might be useful to detect tiny amounts of air in soft tissue infections, it may also obscure relevant anatomy (Fig. 3).

Deep infections

Necrotizing fasciitis

Necrotizing fasciitis is a rapidly progressive infection of the deep fascia, with subcutaneous and facial necrosis. Although

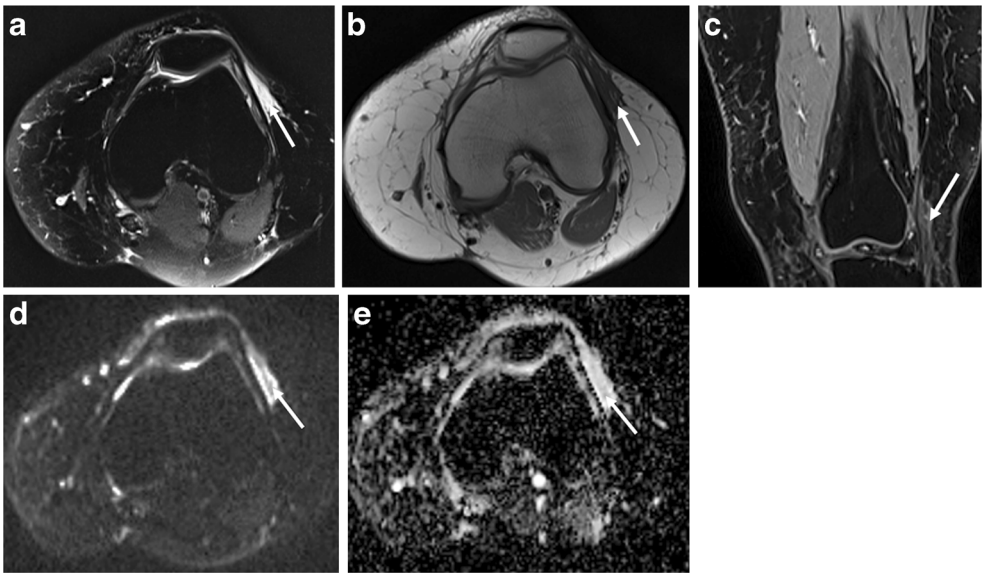

Fig. 1 Soft tissue oedema without cellulitis. Axial fsT2W (**a**), T1W (**b**), coronal contrast-enhanced fsT1W (**c**), axial DWI (**d**) and ADC (**e**) images of a 46-year-old woman with soft tissue oedema and no clinical signs of infection. There is non-enhancing T2 hyperintense and T1 hypointense soft tissue signal alteration in the lateral aspect of the knee without restricted diffusion (ADC value of 2.5×10^{-3} mm^2/s) (*arrows* in **a**–**e**) consistent with simple oedema and fascial fluid

most cases develop as polymicrobial infections, group A beta-haemolytic streptococcus is the single most common causative organism [23, 24]. Most common sites of involvement include the extremities, perineum and trunk [25]. This disease most commonly involves the elderly and immunocompromised patients, who present with severe pain, fever, hypotension and multi-organ failure. MRI is often not performed in this setting as it can delay treatment. When obtained, MRI will show deep fascial thickening and fluid collections with reactive muscle oedema as a hyperintense T2 signal [26]. Early stages of necrotizing fasciitis will demonstrate a contrast enhancement of the deep and intramuscular fascia, but in later stages of the disease, it may be decreased or absent as the tissue becomes devitalized [27]. The presence of subcutaneous gas foci, seen as signal loss on MRI, is considered specific for this process [13]. DWI images are not specific in making the diagnosis [28], but can be helpful in demonstrating the deep fascial and intramuscular abscesses, which will show restricted diffusion (Fig. 4). Presence of air will distort the imaging quality as described above; however, the related susceptibility artefact may help one identify its presence.

Abscess and infectious myositis (pyomyositis)

Many soft tissue infections may result in localized inflammatory mass, which undergoes liquefactive necrosis and results in a well-defined walled-off abscess [29]. MRI will demonstrate a low to intermediate signal on T1W images and a high signal on T2W images with a peripheral rim enhancement. In appropriate clinical settings, these features are fairly specific for the diagnosis of an abscess. However, some necrotic tumours may have a similar imaging appearance. By demonstrating the restricted diffusion in the centre of the abscess, DWI is helpful in differentiating these two entities. Conversely, a tumour will show restricted diffusion in the wall as a result of high cellularity [30]. Pyomyositis is a purulent infection of the skeletal muscles complicated by abscess formation [31].

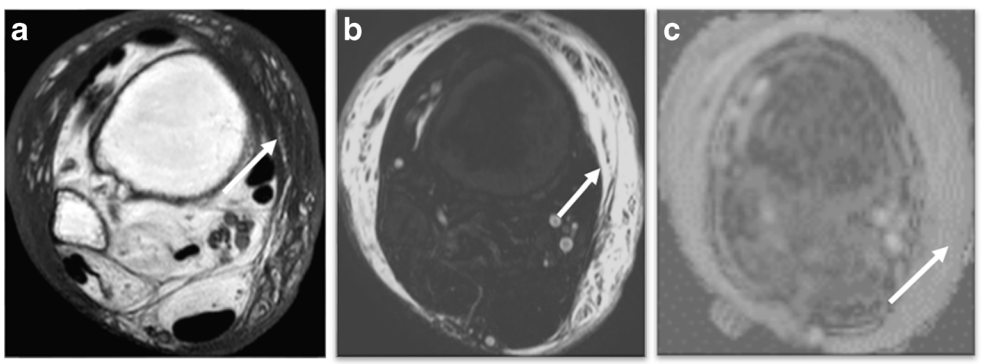

Fig. 2 Cellulitis. Axial T1W (**a**), fsT2W (**b**) and ADC (**c**) images of the lower leg of a 55-year-old with clinically suspected lower extremity infection. The images demonstrate oedema-like signal on T1W and T2W images with mild restricted diffusion (ADC value of 1.6×10^{-3} mm^2/s) in the superficial soft tissues of the lower extremity (*arrows* in **a**–**c**) consistent with cellulitis without osteomyelitis

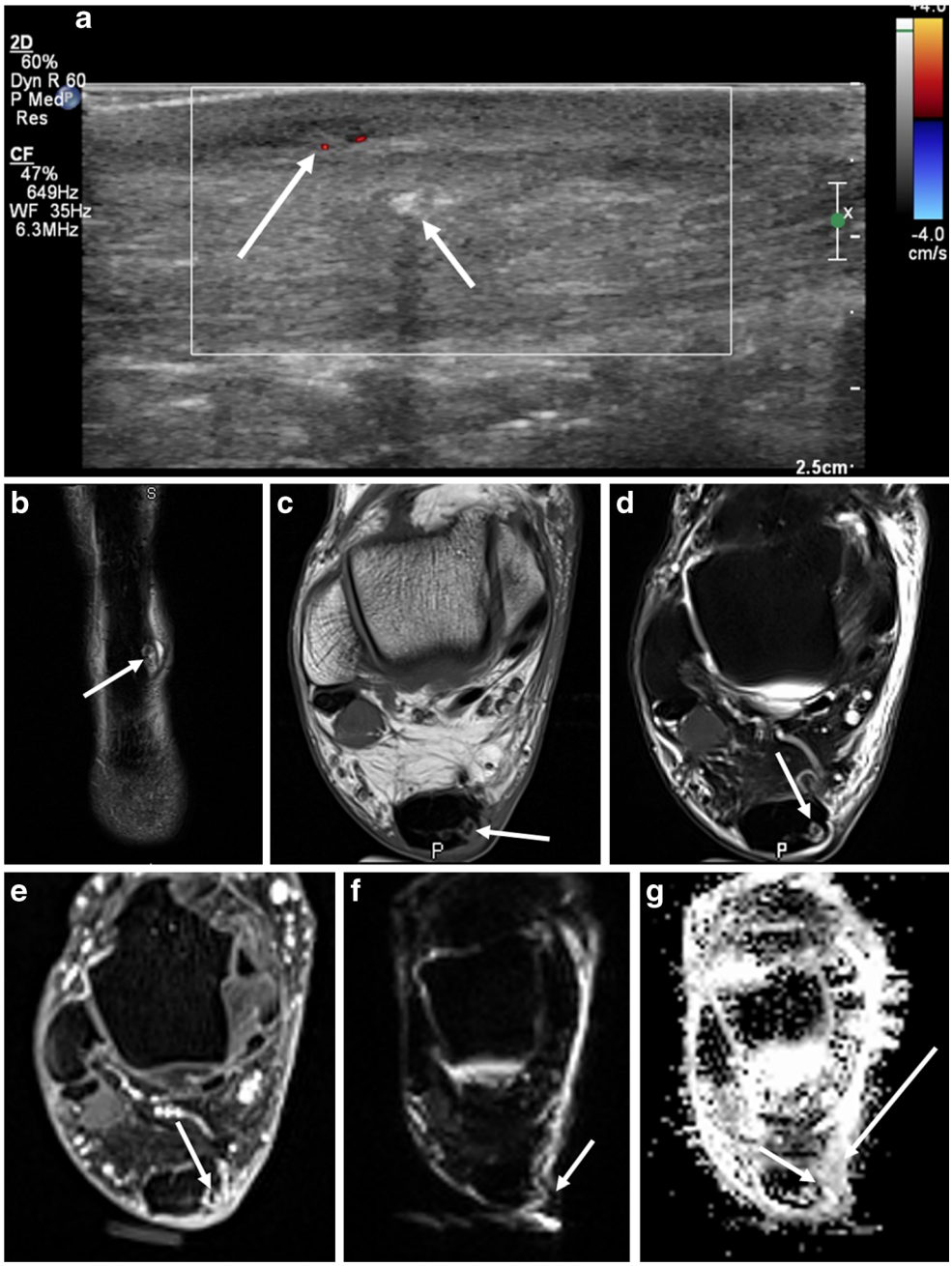

Fig. 3 Cellulitis, tendinitis and gas (*arrows*). US (**a**), sagittal fsT2W (**b**), axial T1W (**c**), fsT2W (**d**), post-contrast fsT1W (**e**), DWI (**f**) and ADC (**g**) images of an adult man with local injury over posterior lower calf and suspected infection. Notice increased Doppler flow on US (*large arrow* in **a**) and restricted diffusion (ADC value of 1.6×10^{-3} mm^2/s (*large arrow* in **g**). Achilles tendon infection site shows target sign due to intratendinous air (*small arrows* in **b**–**g**), which causes local distortion of DWI (*arrow* in **f**)

On MRI, in the initial phlegmonous stage, the affected muscle is enlarged and shows non-specific findings of an increased signal on T2W images with architectural loss [14, 32]. On DWI, one would see increased diffusion in the muscle (ADC 1.5–1.8). As the infection evolves, muscle abscesses form, and these on MRI appear as fluid signal cavities with peripheral rim enhancement. However, such an appearance can also be seen in diabetic myonecrosis and necrotic tumours [33]. DWI is helpful in differentiating these conditions, as an abscess cavity will show restricted diffusion in the center (ADC 0.6–1.1) due to thick and viscous pus (Fig. 4) [34, 35]. The surrounding muscle oedema will show increased diffusion due to inflammation and expanded extracellular space. DWI can also differentiate muscle oedema and haematoma (causes T2 shine through and susceptibility artefacts) from a drainable abscess.

Septic arthritis

Septic arthritis usually results from the direct inoculation of the joint space by the microorganisms. The increasing use of prosthetic joints has resulted in an increasing incidence of septic arthritis in the recent past. Patients usually present with pain, fever and decreased range of motion. MRI usually

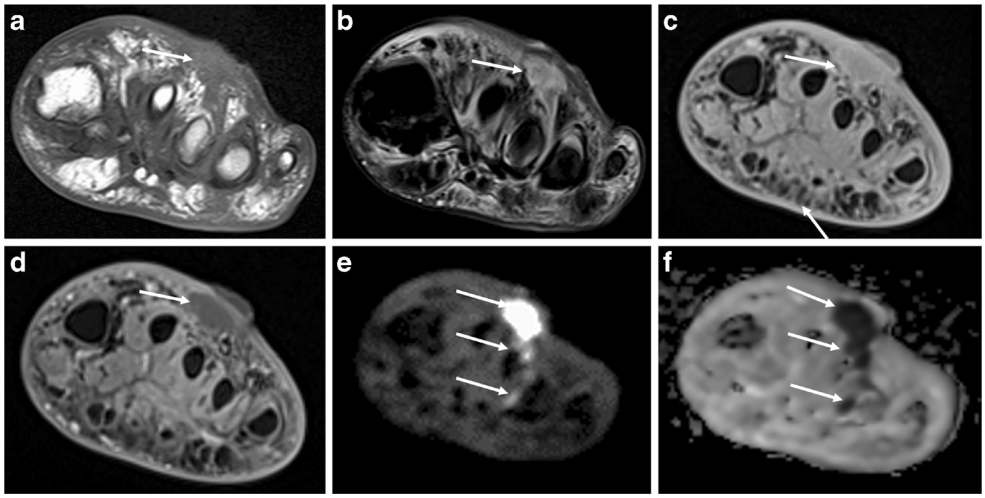

Fig. 4 Cellulitis and deep abscess (*arrows*). Axial T1W (**a**), fsT2W (**b**), pre-contrast fsT1W (**c**), post-contrast fsT1W (**d**), DWI (**e**) and ADC (**f**) images of an adult diabetic man with dorsal foot ulcer and fever. The images demonstrate T1 isohyperintense and T2 hyperintense signal alteration (*arrows* in **a**, **b**). There is central non-enhancing area (*arrows* in **c**, **d**) suggesting necrosis or abscess. Notice conspicuous abscess underneath the skin ulcer (*arrows* in **e**, **f**) on DWI with restricted diffusion (ADC value of 0.7×10^{-3} mm^2/s) and deeper extension into the intermetatarsal space

demonstrates complex joint fluid with an intermediate signal on T1W and T2W images with synovial thickening and intense contrast enhancement as well as perisynovial oedema.

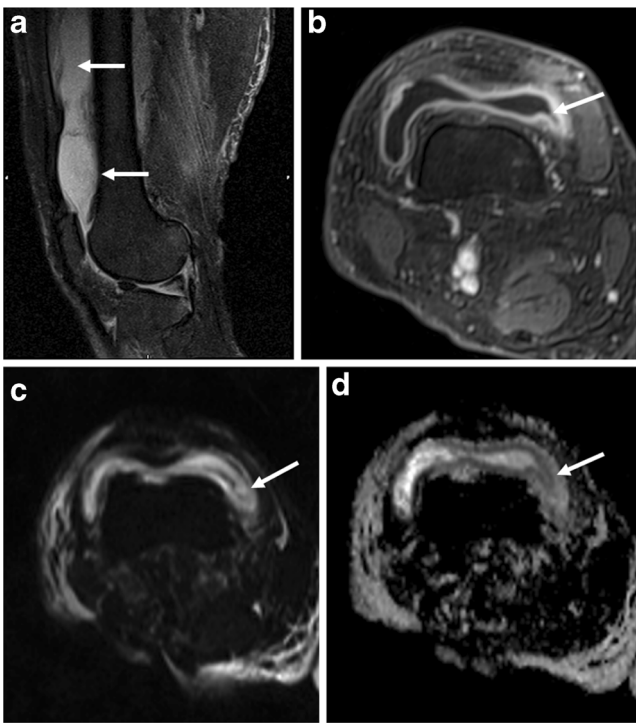

Fig. 5 Septic arthritis. Sagittal STIR (**a**), axial post-contrast fsT1W (**b**), axial DWI (**c**) and ADC (**d**) images of a 53-year-old man with fever and painful knee with restricted range of motion. The images show large knee effusion (*arrows* in **a**) with synovial thickening and enhancement (*arrow* in **b**). Notice restricted diffusion (ADC value of 1.7×10^{-3} mm^2/s) consistent with clinical suspicion of septic arthritis

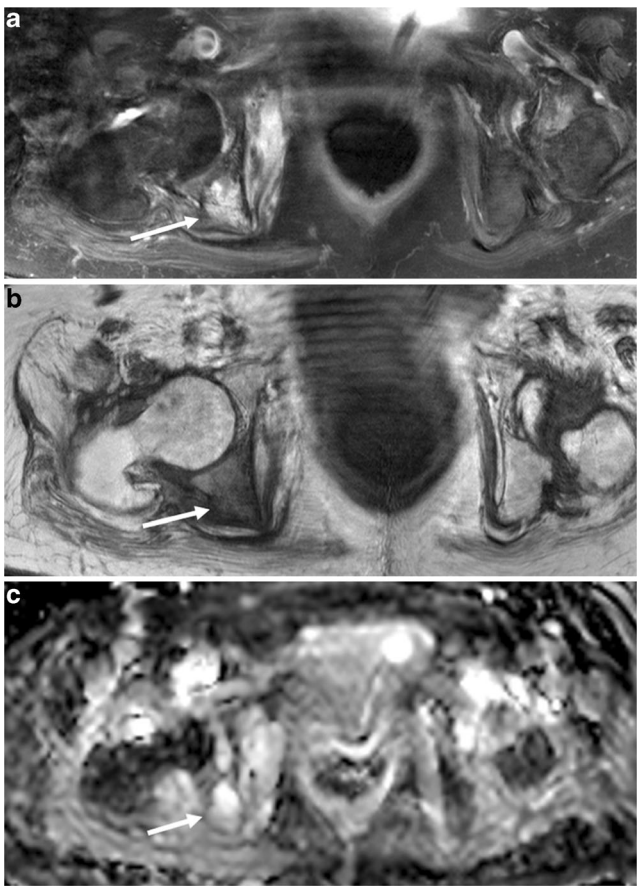

Fig. 6 Stress reaction (*arrows*). Axial fsT2W (**a**), T1W (**b**), DWI (**c**) and ADC (**c**) image of an adult man with right ischial pain. Images demonstrate T2 hyperintense (*arrow* in **a**) and T1 hypointense (*arrow* in **b**) bone marrow signal in the right ischial spine without evidence of restricted diffusion (*arrow* in **c**) and ADC value of 1.9×10^{-3} mm^2/s in this patient with reactive bone marrow oedema from stress reaction and no clinical evidence of osteomyelitis

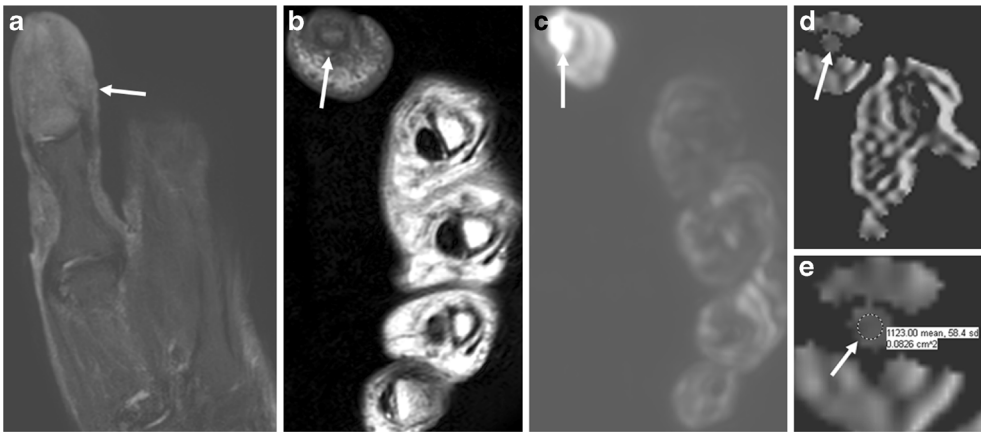

Fig. 7 Cellulitis with osteomyelitis. Coronal fsT2W (**a**), axial T1W (**b**), DWI @ B800 (**c**) and ADC (**d**, **e**) images of an adult man with suspected thumb osteomyelitis. Images demonstrate T2 hyperintense (*arrow* in **a**) and T1 hypointense (*arrow* in **b**) bone marrow signal in the distal phalanx of the thumb with associated restricted diffusion (*arrow* in **c**) and ADC value of 1.1×10^{-3} mm^2/s (**d**, **e**) in this patient with biopsy-proven osteomyelitis

However, other noninfectious inflammatory synovitis can lead to similar findings on routine MRI sequences [36, 37].

DWI can help differentiate septic arthritis from other entities as purulent and pus-like intra-articular fluid will show restricted diffusion and a lower ADC value in the former [38, 39]. However, early stages of pyogenic arthritis may not show very low ADC values in the joint fluid because of minimal changes in the inflammatory cellular component and viscosity (Fig. 5). Conversely, in some cases, underlying diseases such as rheumatoid arthritis or osteoarthritis may have increased protein content and inflammatory cellular density, causing restricted diffusion. DWI may play a role in reducing the number of unnecessary invasive joint aspirations. DWI may also play some role in differentiating septic arthritis from transient synovitis in paediatric patients [40].

Osteomyelitis

Osteomyelitis refers to the inflammation and infection of the bone marrow caused most commonly by *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Enterobacter* species. In children, the haematogenous route of inoculation is most common while in adults, osteomyelitis is most commonly caused by a direct spread. And a corollary to the same in adults usually holds true, i.e. if there is no sinus tract or ulcer, osteomyelitis is highly unlikely [41]. On MRI, infected bone marrow appears as a low signal of T1W images and a high signal on fluid-sensitive images with diffuse marrow enhancement on gadolinium administration. Intramedullary abscesses and necrotic areas show rim enhancement. Sometimes reactive bone marrow oedema can have similar bone marrow findings; however, in the former, T1 hypointensity is restricted to the subcortical surface [41, 42]. DWI shows normal bone as dark signal with excellent negative predictive value. It can help differentiate reactive oedema from osteomyelitis (Figs. 6, 7). Pus related to intraosseous abscess formation in osteomyelitis will have enhanced bone diffusion with relative restriction (ADC = 0.6–1.1). On the other hand, reactive bone marrow oedema will show minimal DWI signal enhancement with increased ADC (1.4–1.9). DWI is also helpful in localizing

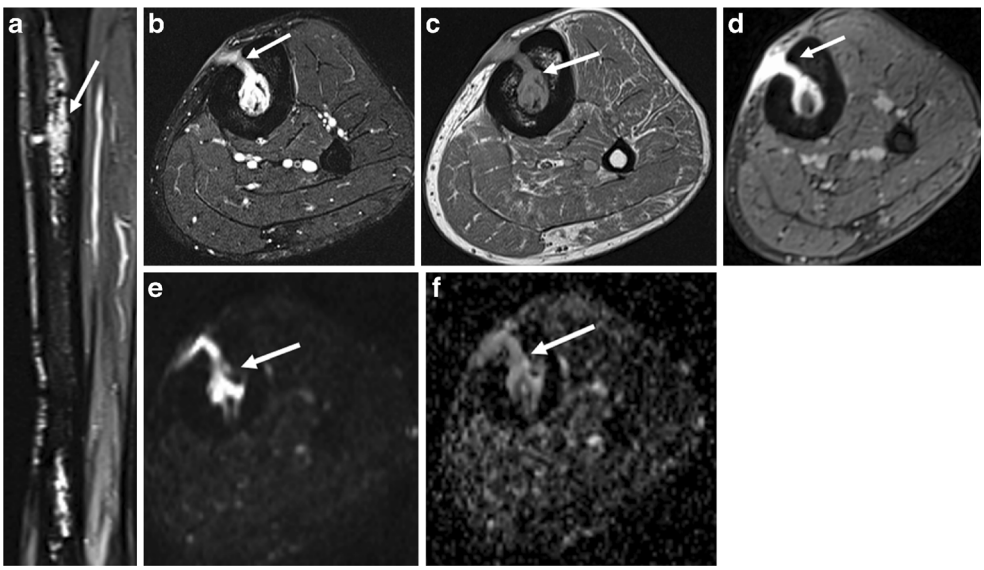

Fig. 8 Osteomyelitis on antibiotics. Sagittal and axial fsT2W (**a**, **b**), axial T1W (**c**), contrast-enhanced fsT1W (**d**), DWI (**e**) and ADC (**f**) images of a 55-year-old man who presented with prior history of pinning for tibial fracture and a draining wound. The images demonstrate enhancing T2 hyperintense and T1 hypointense bone marrow with a sinus tract leading to a soft tissue wound (*arrows* in **a**–**d**). Notice associated restricted diffusion (ADC value of 1.1×10^{-3} mm^2/s) consistent with persistent active osteomyelitis in the proximal tibia (*arrows* in **e**, **f**). There was reactive oedema in the pin tract site of the distal tibia

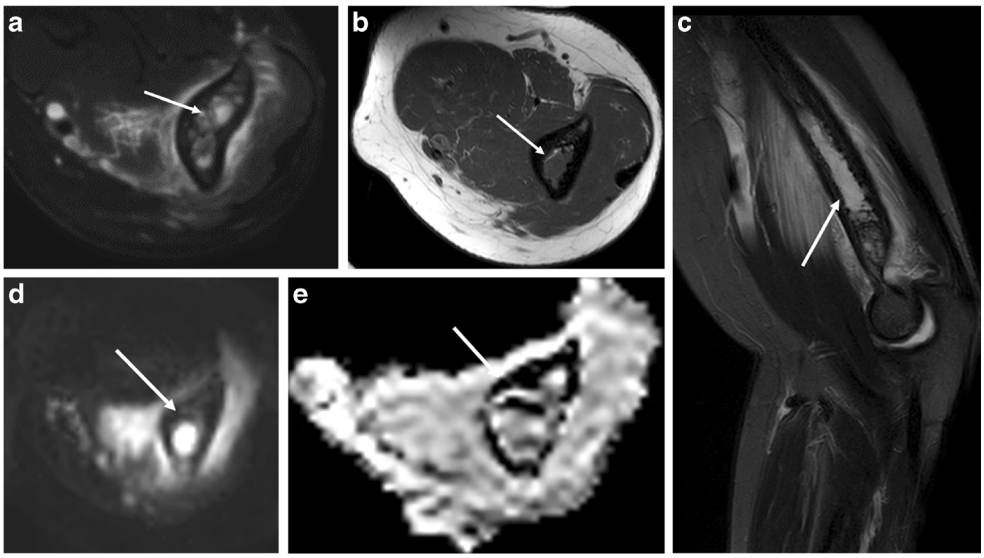

Fig. 9 Active bone infarct. Axial fsT2W (**a**), T1W (**b**), sagittal fsT2W (**c**), axial DWI (**d**) and ADC (**e**) images of an adult patient with known sickle cell disease. The images demonstrate T2 hyperintense (*arrows* in **a**, **c**) and T1 hypointense (*arrow* in **b**) bone marrow signal alteration in the distal humerus. Notice associated restricted diffusion and ADC value of 1.6×10^{-3} mm^2/s (*arrows* in **d**, **e**)

pin-tract infections in long bones as focal increased signal with ADC restriction as compared to fsT2W images that show diffuse increased signal in/along the track site (Fig. 8). Necrotic bone (sequestrum), air and devitalized tissue will show dark signal on DWI and ADC maps, while ischemic but not dead bone shows increased DWI and ADC signals.

Another entity that can be difficult to differentiate from the osteomyelitis of the foot is neuropathic joint. The presence of low T1 and T2 signal with involvement of the midfoot in the absence of the sinus tract, ulcer or abscess favours neuropathic joint. DWI can further help differentiate these entities by demonstrating restricted diffusion in the soft tissue and intraosseous abscess.

Bone marrow abnormality resulting from osteomyelitis can also be difficult to differentiate from bone infarct on routine MRI, both of which occur with increased frequency in haemolytic anaemia patients (Fig. 9) [43]. However, DWI can help one find subperiosteal and intraosseous abscesses in the affected bones, thereby confirming superimposed infection. As a result of the strong suppression of the background signal, areas of restricted diffusion in DWI stand out from the surrounding structures, thereby increasing the chances of detection [44].

In the spine, DWI can be used to differentiate infection from Modic type I changes; find intradiscal abscesses; differentiate paraspinal abscesses from other haematoma, discs and fluid; and postsurgical abscesses from postsurgical non-infected fluid collections [45]. Occasionally, it is difficult to differentiate an abscess from other pathologies, such as post-surgical fluid collection, necrotic tumours, haematoma and CSF leak on conventional MRI even with gadolinium enhancement. Once again, DWI can help by demonstrating the restricted diffusion in abscesses [46, 47].

Pitfalls in DWI of deep infections

While pitfalls described in the "Superficial infection" section also hold true for deeper infections, the effects are less

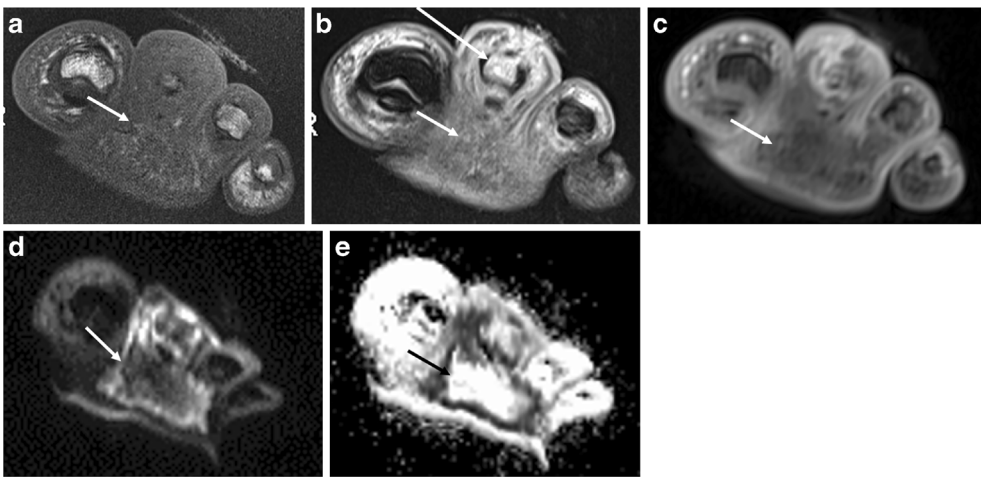

Fig. 10 Osteomyelitis with devitalized tissue. Axial T1W (**a**), fsT2W (**b**), contrast enhanced fsT1W (**c**), DWI (**d**) and ADC (**e**) images of a 63-year-old diabetic man with 2nd toe ulcer and suspected osteomyelitis. The images confirm 2nd toe distal phalanx osteomyelitis (*long arrow* in **b**). Notice ill-defined area of signal alteration and poor enhancement with no restricted diffusion and ADC value of 2.6×10^{-3} mm^2/s (*small arrows* in **a**–**e**) consistent with devitalized tissue and not abscess

pronounced for the latter. This is due to absence of air–skin interface and the fact that deeper lesions are usually bigger and are less likely to get obscured by ghosting artefacts. Artefacts related to local air, metal or blood products should be kept in mind. Finding lesions on DWI and correlation with ADC maps and conventional images are still the key in avoiding these pitfalls. Finally necrotic tumours can mimic abscesses, and infarcts can mimic osteomyelitis (Fig. 7). Therefore, correlation with clinical findings, finding haemorrhage in tumours, fat in infarcts and lack of adjacent fascial changes are important keys in differentiating these lesions.

Summary of key points

The following key points summarize the role of DWI in musculoskeletal infections:

1. Imaging is usually required for defining extent and associated findings in infections.
2. The central necrotic portion of abscesses shows restricted diffusion as opposed to devitalized tissue (Fig. 10).
3. Cellulitis will show contrast enhancement, and restricted diffusion can detect underlying abscess.
4. No contrast enhancement and restricted diffusion is seen in noninfectious subcutaneous oedema.
5. Septic bursitis and infectious tenosynovitis show restricted diffusion in the fluid.
6. Noninfectious causes of joint effusion and tenosynovitis will not show restricted diffusion.
7. Pyomyositis demonstrates restricted diffusion, which helps in differentiation from necrotic tumours and diabetic myonecrosis.
8. Restricted diffusion in the intraosseous abscess will help in diagnosis of osteomyelitis.
9. DWI can be used to differentiate spine infection from Modic changes.

Conclusion

Although there has been a paucity of prior research on this topic, the available literature and our experience suggest that DWI supplements conventional MR imaging in the domain of musculoskeletal infections as a problem-solving tool in increasing lesion conspicuity, differentiating among different but related entities and accurate characterization. Knowledge of the aforementioned imaging findings, key points and imaging pitfalls may help ensure proper diagnosis and prompt treatment planning.

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Institutional review board approval was not required because it is a review article and did not involve human research subjects.

Written informed consent was not required for this study because all the images used for this review article did not have any identifiable patient information. Methodology: retrospective, observational, multicentre study.

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