Bone marrow oedema is a non-specific finding that can be confusing to interpret. The aetiology is occasionally unknown and there can be overlap between the appearances and presentations of specific syndromes. The differential includes common conditions such as bone contusions and infection; and more unusual entities including transient bone marrow oedema syndrome, complex regional pain syndrome, spontaneous osteonecrosis, and avascular necrosis.

We present a pictorial review and educational discussion of these entities including a strategy for distinguishing between them.

**Avascular Necrosis (AVN)**

Also termed osteonecrosis, AVN is pathologically characterised by segmental necrosis of subchondral bone followed by marginal demarcation of the infarcted areas by narrow fibrosis and reactive bone formation. Common causes include trauma, steroid use, alcohol consumption and sickle cell disease.

Magnetic resonance imaging (MRI) is the most sensitive modality to detect AVN. Findings depend on the chronicity of the process and include:

- Geographically decreased marrow signal on T1-weighted (T1W) imaging surrounded by a band of low signal, representative of ischemic bone
- The double line sign on T2-weighted (T2W) imaging – inner bright granulation tissue surrounded by sclerotic bone (dark)

**Spontaneous Osteonecrosis of the Knee (SONK)**

The exact aetiology of SONK is not fully understood. Proposed factors for the development of this condition include meniscal tears, chondromalacia, prior surgery and insufficiency fractures secondary to osteoporosis. It is typically unilateral and has a predilection for the medial femoral condyle. The clinical presentation is usually with sudden, severe, atraumatic pain that persists at rest.

Imaging findings on MRI include:

- Focal or diffuse low signal on T1WI in the subarticular region of the medial femoral condyle.
- Features of insufficiency fractures – seen as a dark line on T1WI and T2WI
- Associated bone marrow oedema may be present

**Chronic Regional Pain Syndrome (CRPS)**

CRPS is characterised by regional pain, either evoked or spontaneous that is disproportionate in magnitude or duration to the typical course of pain after similar tissue trauma.

There appear to be no MRI findings that are specific for CRPS. Bone marrow oedema is a variable finding, best appreciated on T1W fat-saturated sequences or T2W-STIR sequences. In suspected cases of CRPS bone marrow oedema on MRI may help to reinforce the clinical diagnosis or identify an alternative pathology to account for symptoms. A normal MRI does not rule out CRPS.

**Transient Bone Marrow Oedema Syndrome (TBES)**

This is a clinicoradiological entity in which transient non-specific subacute joint pain, primarily of the hip or knee is associated with characteristic MRI appearances in the absence of specific signs of AVN, antecedent trauma or infection. Surgical intervention is not indicated.

MRI findings are those of typical bone marrow oedema. Reversibility of these findings on serial imaging is characteristic.

Two specific imaging findings that have a strong positive predictive value for irreversible bone marrow oedema are:

- The presence of subchondral low signal on T2WI or contrast-enhanced T1WI
- Contour deformity in conjunction with subchondral low signal

**CONCLUSION**

In conjunction with the clinical history an understanding of the specific patterns and distribution of bone marrow oedema can help the radiologist differentiate the underlying causative pathology. This is useful in guiding further management, as certain patterns of bone marrow oedema such as TBES are best managed conservatively, whilst others, such as AVN warrant surgical intervention.