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CASE OF THE MONTH

A painful forefoot mass

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A 60-year-old female presented with localised left forefoot pain and a palpable mass. She underwent further evaluation with MRI of the forefoot and subsequent surgical excision of a lesion in the second interspace.

IMAGING FINDINGS

MRI (Figures 1–3) showed a 2.4×1.1 cm mass in the second interspace, and a 2.1×0.9 cm mass in the third interspace. These masses were homogeneously hypointense on T_1 weighted imaging (Figures 1 and 3) and demonstrated avid heterogeneous enhancement following the administration of gadolinium on T_2 fat-saturated imaging (Figure 2).

DISCUSSION

Several disorders may produce localised forefoot pain in the metatarsal region. These include traumatic conditions of the soft tissues and bones (stress fractures, stress reaction, sesamoiditis and plantar plate disruption), arthritides, infection, tendon disorders and non-neoplastic masses [intermetatarsal bursitis, ganglia, granuloma and Morton's neuroma (MN)], and, rarely, soft-tissue or bone neoplasms [1].

Based on imaging findings and correlated with clinical opinion, these nodules were expected to be MNs.

A diagnosis of rheumatoid nodules was made following surgical excision (Figure 4) and histological analysis. This showed fragments of tissue focally

covered by synovium and consisting of hypocellular fibrous connective tissue, which appeared focally degenerate. It also revealed focal collections of necrobiotic collagen surrounded by palisaded histiocytes.

Rheumatoid nodules are infrequently encountered when MN is suspected and, as in our case, may only be diagnosed with histological correlation. Rheumatoid nodules can appear solid, cystic or a combination of both on MRI [2], and display signal intensity similar to MN on MRI.

The rheumatoid nodule is the most common cutaneous manifestation of rheumatoid arthritis (RA). Nodules are most commonly found on pressure points or extensor surfaces, but can occur in many locations throughout the body. Most frequently

Figure 1. T_1 weighted axial spin echo of left forefoot.

Figure 2. T_1 weighted fat-saturated axial spin echo of left forefoot post-administration of intravenous contrast.

involved are the extensor surfaces of the forearm, fingers, occiput, back and heel. Other areas may include finger joints, sacral prominences, the Achilles tendons, pinnae of the ears, scalp, ischial tuberosities and the sacrum [3].

Palpable nodules in subcutaneous tissues are the presenting feature of RA in up to 11% of patients [3].

Figure 3. T_1 weighted coronal spin echo of left forefoot.

Figure 4. Intraoperative picture of left forefoot at the time of surgical resection.

Almost all patients who form nodules as part of their RA are seropositive for rheumatoid factor. In our case, our patient was subsequently found to have had a previous diagnosis of seropositive RA.

MN (interdigital neuroma) was first described in 1876, and is a perineural fibrosis and degeneration of the common digital nerve [4]. MN is not true neuroma. MN most commonly occurs between the third and fourth metatarsals, and less often between the second and third metatarsals. MN is thought to arise as a result of compression of the interdigital nerve against the intermetatarsal ligament, although other causes such as ischaemia and compression of the nerve by an enlarged intermetatarsal bursa have also been suggested [5].

The diagnostic accuracy of MN with MRI has been shown to be high, reaching nearly 100% sensitivity and specificity [6]. Certain MRI criteria have been described to diagnose an MN [4]. These include a well-demarcated

spindle-shaped mass in the region of the neurovascular bundle on the plantar side of the deep transverse metatarsal ligament, a calibre change of the nerve and that the signal intensity of the MN is isointense to muscle on T_1 weighted images, and homogeneously or inhomogeneously hypointense to fat tissue on non-fat-suppressed T_2 weighted images.

The signal intensity of MN may vary considerably in gadolinium contrast-enhanced images. Intense enhancement may increase the conspicuity of MN on fat-saturated T_1 weighted images; however, only half of MNs enhance avidly following contrast administration,

and the other half demonstrate only low signal or only moderate enhancement [1,4,6]. MNs also typically measure 3–9 mm in transverse diameter, and lesions measuring >5 mm are likely to be symptomatic [4]. In our case, the two lesions measured 9 mm and 1.1 cm in transverse diameter, and may perhaps be considered a little large for a typical MN.

The differential diagnosis for MN does include a rheumatoid nodule. Differentiation between a rheumatoid nodule and MN based on clinical, imaging and surgical findings may be difficult, and histology may be required for a definitive diagnosis.

REFERENCES

1. Ashman CJ, Klecker RJ, Yu SJ. Forefoot pain involving the metatarsal region: differential diagnosis with MR imaging. *Radiographics* 2001;21:1425–40.
2. el-Noueam KI, Giuliano V, Schweitzer ME, O'Hara BJ. Rheumatoid nodules: MR/pathological correlation. *J Comput Assist Tomogr* 1997;21:796–9.
3. Sayah A, English JC. Rheumatoid arthritis: a review of the cutaneous manifestations. *J Am Acad Dermatol* 2005;53:191.
4. Zanetti M, Weishaupt D. MR imaging of the forefoot: Morton neuroma and differential diagnoses. *Semin Musculoskelet Radiol* 2005;9:175–86.
5. Zanetti M, Strehle JK, Kundert HP, Zollinger H, Hodler J. Morton neuroma; effect of MR imaging findings on diagnostic thinking and therapeutic decisions. *Radiology* 1999;213:583–8.
6. Zanetti M, Lederman T, Zollinger H, Hodler J. Efficacy of MR imaging in patients suspected of having Morton's neuroma. *AJR Am J Roentgenol* 1997;168:529–32.