Intra-articular and Peri-articular Tumours and Tumour Mimics- What a Clinician and Onco-imaging Radiologist Should Know

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Abstract

Definitive determination of the cause of articular swelling may be difficult based on just the clinical symptoms, physical examinations and laboratory tests. Joint disorders fall under the realms of rheumatology and general orthopaedics; however, patients with joint conditions manifesting primarily as intra-articular and peri-articular soft tissue swelling may at times be referred to an orthopaedic oncology department with suspicion of a tumour. In such a situation, an onco-radiologist needs to think beyond the usual neoplastic lesions and consider the diagnoses of various non-neoplastic arthritic conditions that may be clinically masquerading as masses. Differential diagnoses of articular lesions include infectious and non-infectious synovial proliferative processes, degenerative lesions, deposition diseases, vascular malformations, benign and malignant neoplasms and additional miscellaneous conditions. Many of these diseases have specific imaging findings. Knowledge of these radiological characteristics in an appropriate clinical context will allow for a more confident diagnosis.

Keywords: intra-articular, peri-articular, synovial, tumours

Introduction

In addition to benign and malignant tumours of the epimetaphyseal regions of bone, synovium, and juxta-articular soft tissues, a wide spectrum of infectious and non-infectious processes of the joints may present as intra-articular and peri-articular masses (Table 1) (1,2). This article reviews the typical imaging features of various intra- and peri-articular masses and mass-like lesions with special emphasis on the magnetic resonance imaging (MRI) findings that suggest a specific diagnosis. It aims to equip the reader with a pragmatic approach to imaging of patients presenting with suspected tumour-like swelling in and around joints.

Benign and malignant tumours of bone and juxta-articular soft tissues

Almost any tumour arising from epi-metaphyses of long bones or juxta-articular soft tissues may mimic a joint swelling. Examples of bone tumours that commonly arise in this location include chondroblastoma and aneurysmal bone cyst in the younger population and giant cell tumour, clear cell chondrosarcoma and malignant fibrous histiocytoma in adults (Figure 1). Extra-osseous soft tissue involvement by malignant tumours and synovial effusion resulting from

intra-articular tumour extension or sympathetic response may also result in peri-articular and/or joint swelling (3).

A wide spectrum of benign and malignant soft tissue neoplasms may occur in the peri-articular location. Among these, synovial sarcoma

Figure 1: Antero-posterior and lateral radiograph (a,b) of the right knee in a patient with parosteal osteosarcoma who presented with painful knee swelling and restriction of movement.

deserves a special mention as it has a predilection for juxta-articular soft tissues (2). It is discussed in detail under the synovial malignancies.

Benign Synovial Tumours

Lipoma

True intra-articular lipomas are extremely rare lesions. (4) Unlike lipoma arborescens, a true lipoma is a solitary round or oval lesion and is composed of mature adipose tissue enclosed by a thin fibrous capsule (Figure 2). It may be covered by synovial tissue and may have a vascular pedicle. Villous proliferation of the synovial membrane is absent. True lipomas of the knee joint are generally located in relation to the subsynovial fat on either side of the patellar ligament or over the anterior surface of the femur (5–8). Intra-articular lipomas are usually non-calcified masses that are predominantly hyperintense on both T1 and T2-weighted images (4,9,10).

Synovial malignancies

Synovial Sarcoma

Synovial sarcoma is a mesenchymal neoplasm named because of its resemblance to synovial tissue under light microscopy (2). Despite its name, fewer than 5% of lesions are intra-articular in origin; instead, they usually occur near joints (2). Most synovial sarcomas are located in the extremities, with two-thirds in the

Table 1: Classification of conditions that may present clinically as intra-articular and peri-articular masses

Etiology	Condition	Differential diagnoses

Neoplastic	Benign & malignant neoplasms	Osseous origin:
		   Any primary neoplasm such as osteogenic sarcoma etc.
		   Metastases
		
		Extra-osseous soft tissue origin:
		   Synovial sarcoma
		   Synovial chondrosarcoma
		   Synovial metastases
		   Synovial chondrolipoma
		   Synovial liposarcoma etc.

Non-neoplastic	Noninfectious synovial proliferative processes	Pigmented villonodular synovitis Synovial osteochondromatosis Lipoma arborescens
	Infectious granulomatous diseases	Tubercular arthritis Fungal arthritis
	Deposition diseases	Gout Amyloid arthropathy
	Inflammatory conditions	Rheumatoid arthritis Chronic aseptic synovitis Bursitis Tenosynovitis of periarticular tendons
	Degenerative lesions	Synovitis Ganglions Cysts Loose bodies
	Vascular malformations	Synovial hemangioma Arterio-venous malformations
	Miscellaneous conditions	Neuropathic arthropathy Hemophilic arthropathy Lipohemarthrosis Cyclops lesion

lower extremities. They particularly occur around the knee in the popliteal fossa of adolescents and young adults (15–40 years of age). Radiographic features of these tumours are not pathognomonic. However, a soft-tissue mass near a joint of a young patient, particularly a calcified lesion (30%), is suggestive of the diagnosis (2,11). On MRI, the lesion is hypointense on T1-weighted (T1W) and hyperintense on T2-weighted (T2W) images and demonstrates multilobulation and marked heterogeneity (creating the "triple sign") with haemorrhage, fluid levels and septa (creating the "bowl of grapes" sign) (Figure 3) (2,11,12). Slow growth (average time to diagnosis, 2–4 years) and small size (< 5 cm at initial presentation) of the lesion may result in a mistaken initial diagnosis of a benign indolent process (11).

Synovial Metastases

Metastatic spread of tumours to the joints and synovium is rare, despite the highly vascular

Figure 2: Chondrolipoma of the knee. A 29-year-old male patient presented with a painless, non-tender swelling on the lateral aspect of the left knee. Axial T2- weighted (a), coronal T1-weighted (b) and fat suppressed proton density (PD) weighted (c) images show a well-defined pear shaped fat signal intensity lesion with multiple internal curvilinear hypointensities deep to the lateral patellar retinaculum and extending beneath vastus lateralis muscle consistent with an atypical lipomatous lesion. Biopsy and histopathologic examination of the surgical specimen demonstrated a chondrolipoma.
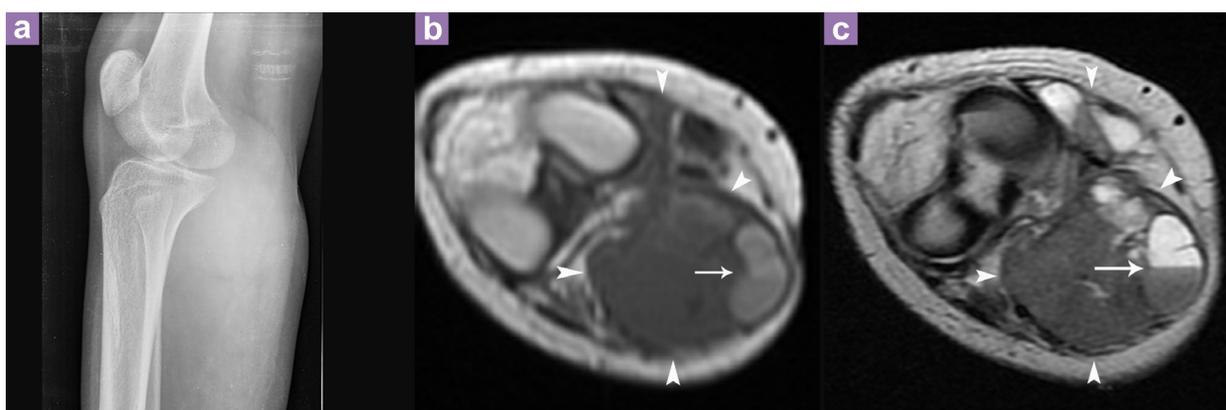
Figure 3: A 16-year-old boy presented with an indolent swelling on the posterior aspect of the right knee. Lateral knee radiograph (a) reveals an ill-defined soft tissue density mass in the popliteal fossa with no obvious calcifications. Axial T1 and T2-weighted magnetic resonance images (b and c respectively) show a heterogeneous, multilobulated juxta-articular mass in the popliteal fossa (arrowheads) with septations and cystic areas. One of the lobules demonstrates hyper intense signal on T1 and fluid levels on T2-weighted image (arrows) compatible with hemorrhage. Histopathology examination demonstrated a biphasic synovial sarcoma.

nature of the synovium (13–17). Metastatic arthritis can involve the synovium, the joint cartilage or both (Figure 4). It can reflect either direct metastatic invasion of the synovium or reactive synovitis caused by juxta-articular bone metastases (13–17). The most frequent primary tumour that metastasises to the joint is lung carcinoma, with adenocarcinoma being the most common histological type and the knee being the most commonly involved joint (13). Diagnosis

can be made with either joint fluid cytology or synovial biopsy. The prognosis is generally poor with abysmal survival rates (13,16).

Rare malignancies

Although exceedingly rare, primary intra-articular liposarcoma and synovial chondrosarcoma (Figure 5) have been reported in literature, usually involving the knee joint (18–20).

Figure 4: A 54-year-old man with disseminated colon cancer presented with a focal, hard swelling on the medial aspect of left knee. Axial T1, T2 and fat suppressed PD-weighted image (a, b and c respectively) show a lobulated soft tissue mass in medial patello-femoral compartment of the left knee, involving medial patellar retinaculum and causing erosion of medial border of patella. The mass shows iso intense signal to muscle on T1 and hyper intense signal intensity on T2 and fat suppressed PD-weighted images. Biopsy examination of the lesion demonstrated adenocarcinoma with histology identical to the primary lesion in colon.

Figure 5: Synovial chondrosarcoma in a 71-year-old man presenting with a gradually progressive, mildly painful knee swelling and limitation of movement. Lateral radiographs of the right knee; (a) demonstrates an intra- and peri-articular mass with chondroid pattern of matrix mineralization. Sagittal and axial T2-weighted images, (b and c respectively) confirm the synovial origin of the mass with a predominant extra-articular component, extending into surrounding soft tissues and causing large bony erosions (arrows), features favoring an aggressive behavior. The mass shows a lobulated appearance with heterogeneously hyper intense signal intensity on T2-weighted images. Biopsy of the mass demonstrated a low grade chondrosarcoma.

Non-Infectious Synovial Proliferative Processes

### *Pigmented villonodular synovitis (PVNS)*

PVNS is a benign proliferative disorder of the synovium that may affect the joints, bursae or tendon sheaths (1,2,21,22). It usually occurs in the third and fourth decades of life, with no gender predilection (1). The condition can be localised or diffuse (2). When the entire synovium of the joint is affected and there is a major villous component, the condition is referred to as diffuse pigmented villonodular synovitis. Presence of a discrete intra-articular mass is called localised pigmented villonodular synovitis. PVNS of the tendon sheath is known as giant cell tumour of the tendon sheath (21–24). The knee is the most frequently affected joint followed by the hip, ankle and shoulder (1,2). Diffuse PVNS presents clinically as chronic monoarthritis, commonly with haemarthrosis (1,21,22), and is treated by total synovectomy with a tendency for local recurrence. The focal form is effectively treated with resection. Radiosynovectomy has been used as an alternative treatment option, usually for the diffuse form in which complete surgical resection may be problematic and the risk of local recurrence post-surgery is higher (21,22,25,26).

Radiographs may be normal or demonstrate soft tissue masses that may appear dense due to high hemosiderin deposition. It virtually never calcifies. Preservation of bone mineralisation and joint spaces until late in the disease is characteristic (1,2,21). Bony erosions are frequent in joints with a tight capsule, such as the hip, ankle and elbow (1,2,22). MR images of diffuse PVNS show typical lobulated mass-like synovial proliferation, appearing hypointense on T1 and T2-weighted images (1,2,21) and showing characteristic "blooming" on gradient echo images due to hemosiderin deposition (1,21) (Figure 6). The "blooming artefact" is very effective in distinguishing it from other entities such as gout, amyloid arthropathy, chronic rheumatoid arthritis, chronic granulomatous disease, synovial sarcoma, and synovial chondromatosis. Haemophilic arthropathy may also show hemosiderin deposition but can be easily distinguished clinically (1,21,22,27). However, hemosiderin deposition is less pronounced in older fibrotic lesions and focal forms of PVNS, rendering the diagnosis more difficult. T2W images may also show hyperintense areas due to inflamed synovium and joint effusions (21,22,24, 28–31).

Synovial osteochondromatosis

Synovial osteochondromatosis is a benign condition of uncertain aetiology, characterised by proliferation and metaplastic transformation of the synovium and formation of multiple cartilaginous or osteocartilaginous nodules within the joints, bursae or tendon sheaths (1,2,32–34). It usually occurs in the third to fifth decade of life and is twice as common in men. Clinical manifestations include pain, swelling and limitation of motion (1,2,32,33). It most commonly involves the knee joint followed by the elbow, hip and shoulder (1). The nodules may contain only cartilage, both cartilage and bone or mature bone with fatty marrow. Calcification and ossification of nodules is noted in 70–95% of cases
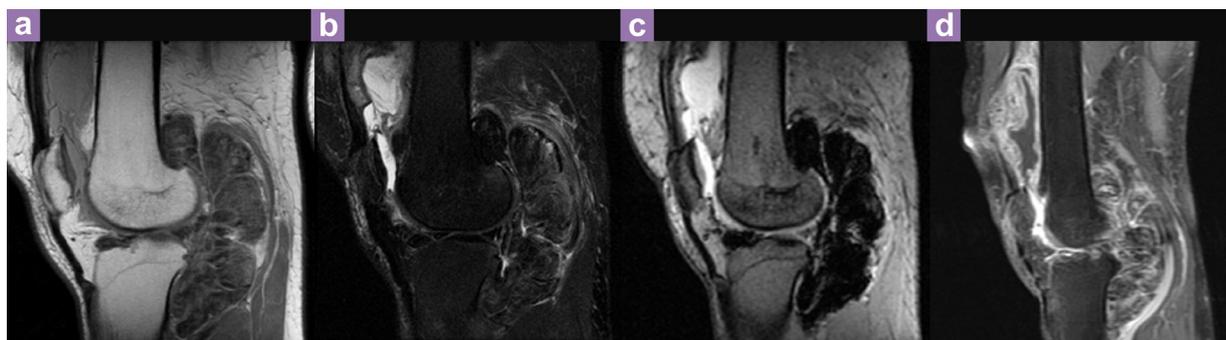
Figure 6: A 34-year-old man with a large fluctuant right knee swelling. Sagittal T1 and fat suppressed T2-weighted images of the knee (a and b respectively) demonstrate a lobulated profoundly hypointense mass in the knee joint, predominantly along posterior aspect with evidence of magnetic susceptibility artifacts (blooming) on sagittal gradient image (c), consistent with the diagnosis of a pigmented villonodular synovitis which was confirmed on histopathology examination. Post-gadolinium T1-weighted image, (d) reveals intensely enhancing, marked nodular thickening of the synovium.

(1,32). When the nodules are ossified, radiographs are diagnostic (2,32) (Figure 7). MRI is superior to conventional radiography for assessing disease extent due to its ability to demonstrate early intra-synovial metaplastic nodules and non-mineralised loose bodies (32). MR appearance is variable depending on the relative proportion of synovial proliferation and nodule mineralisation (2). Non-calcified nodules are observed as conglomerate masses of isointense signal relative to muscle on T1W images and bright signal on T2W images. Calcified nodules are observed as hypointense foci with all pulse sequences while ossified loose bodies display central hyperintense fatty marrow and peripheral hypointense cortical bone (2) (Figure 8). On post-gadolinium images, the metaplastic cartilaginous nodules may show the characteristic peripheral and septal enhancement of chondral lesions (1). Associated synovial effusion and bony erosions are better depicted with MR imaging (32). The condition is treated with surgical synovectomy, but recurrence is common (32). Secondary osteoarthritis is a late complication (32).

Lipoma arborescens

Lipoma arborescens is a rare non-neoplastic intra-articular lesion characterised by villous synovial proliferation and replacement of subsynovial tissue by mature fat cells (2,35,36). It usually occurs in the fifth to sixth decade of life and is more common in men (2). The condition is usually monoarticular and most frequently involves the knee, particularly the suprapatellar pouch (2,35,36). It presents clinically as a long-standing, painless and slowly progressive joint swelling (2,36). Lipoma arborescens has been
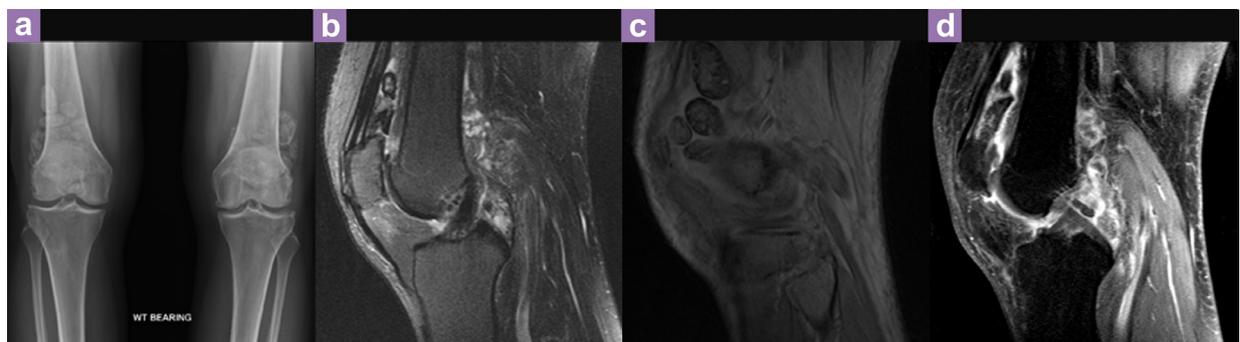
hypothesised to represent a non-specific synovial reaction to inflammatory (2,36,37) or traumatic stimuli (2,36). It is treated with surgical or arthroscopic synovectomy (2,37). Radiographs

Figure 7: Synovial osteochondromatosis in a 40-year-old man presenting with right shoulder joint pain and restriction of movement. Antero-posterior radiograph of shoulder reveals innumerable, uniform sized, ossified intra-articular loose bodies at the glenohumeral joint and its synovial recesses. Note is made of preserved joint space and absence of significant degenerative joint changes.

Figure 8: Synovial chondromatosis in a patient with bilateral knee pain. Frontal radiograph of both knee joints (a) reveals multiple similar sized intra-articular loose bodies. Sagittal PD (b), gradient (c), and fat suppressed T2-weighted images (d) reveal synovial proliferation with intra-articular calcified and ossified loose bodies demonstrating uniformly hypointense signal and central marrow signal intensity with well corticated profoundly hypointense margins respectively.

are non-specific (2). On ultrasound, it is observed as a hyperechoic frond-like synovial mass within an effusion; the mass may move with joint manipulation (2). MR allows a specific diagnosis by demonstrating characteristic villous lipomatous synovial proliferation and mass-like subsynovial fat deposits associated with joint effusion (35,38) (Figure 9). Differential diagnosis should include synovial lipoma and synovial haemangioma.

## Chronic Infectious Arthritis

Tubercular arthritis

Musculoskeletal tuberculosis may manifest as osteomyelitis, spondylitis, arthritis, tenosynovitis or bursitis (2). Tubercular arthritis usually results from haematogenous spread of infection to the synovium or, less commonly, by direct intra-articular extension from an adjacent focus of osteomyelitis (2,39). It is usually a chronic monoarthritis and most commonly affects a weight-bearing joint such as the hip, knee and ankle (39).

No radiographic feature is pathognomonic for tubercular arthritis (40). Juxta-articular osteoporosis, marginal erosions, gradual narrowing of intra-articular space, soft-tissue swelling and joint effusions are the most commonly described findings (2,39–41). In contrast to rheumatoid arthritis, the joint space is relatively preserved in early tubercular arthritis due to gradual late destruction of the articular cartilage (40). MRI reveals synovial hypertrophy, typically with intermediate to low T2W signal intensity and intense contrast enhancement (41). It can also demonstrate associated marrow oedema, osteomyelitis, cortical erosions, myositis, cellulitis, abscesses, and skin ulceration/sinus formation in the adjacent bone and soft tissue (Figure 9) (41). Rice bodies may also be observed in tuberculosis (42). MRI may be helpful in distinguishing rheumatoid from tubercular arthritis (40). Although there is significant overlap in MR appearances between the two conditions, tubercular arthritis tends to have more uniform synovial thickening (Figure 10) with larger bone erosions, rim enhancement at the site of erosion and extra-articular cystic components. Clinical imaging differentiation between tuberculosis and pyogenic arthritis may be difficult. Aspiration of synovial fluid is often insufficient to make the distinction, and an accurate diagnosis usually requires synovial biopsy and histopathology or culture (39).

Deposition Diseases

Gout

Gout is a metabolic disease that results from longstanding hyperuricemia, leading to deposition
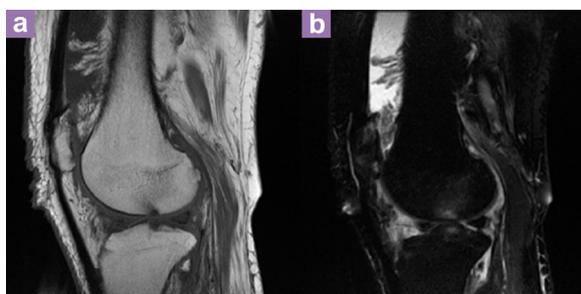
Figure 9: Lipoma arborescence in a 46-year-old man with recurrent knee joint swelling and pain. Sagittal T1 (a) and fat suppressed T2-weighted (b) images of the knee joint reveal mild synovial effusion and prominent subsynovial fat along with frond-like projections into the synovial space of suprapatellar bursa, showing hyperintense signal on T1W image and signal loss on fat suppressed image compatible with fat containing villi.
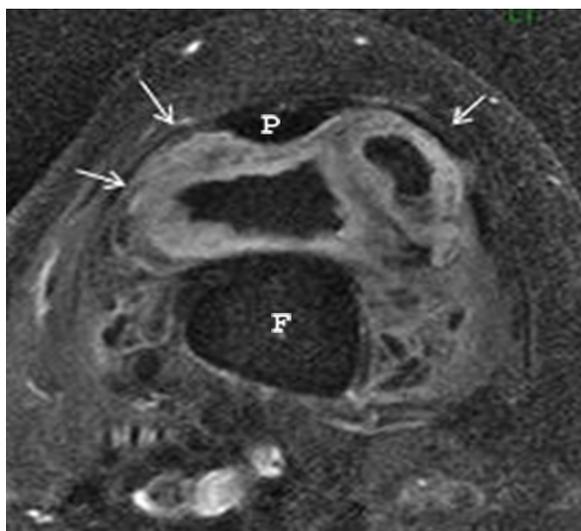

Figure 10: Tuberculous arthritis. Axial fat suppressed post gadolinium T1-weighted image of the knee joint reveals markedly thickened and enhancing synovium (arrows) with effusion and loculations. Abbreviations: P = patella, F = femur.

of monosodium urate (MCU) crystals in joints and soft tissues (43–45). It occurs usually in the 5th to 7th decades of life with a male preponderance (43,44). The first metatarsophalangeal (MTP) joint is involved in half of the cases at the first attack and is the most frequently involved joint. First presentations are usually monoarticular in nature. The frequency and duration of attacks as well as number of affected joints increase with disease progression. Gout has a predilection for joints of the extremities; feet, elbows and wrists are affected most commonly. However, no peripheral joint is exempt. The disease affects the lower extremities more than the upper extremities and small joints more than large joints. Gout may manifest radiographically as acute, intermediate or chronic forms. Tophus is a hallmark of chronic gout (44). It represents deposition of urate, protein matrix, inflammatory cells and foreign body giant cells in intra-articular space, peri-articular subcutaneous tissues, tendons, ligaments, cartilage, bone and other soft tissues including bursae and other synovial spaces in patients with long standing disease. Chronic tophaceous gout may present clinically as intra-articular or peri-articular masses (45). Characteristic radiographic features of chronic gouty arthritis include juxta-articular erosions with overhanging margins, eccentric soft tissue swelling and preservation of joint space until late in the disease (43–45). On MRI, tophi characteristically show homogenous or heterogeneous low to intermediate signal intensity on both T1 and T2W images, although the signal intensity on T2W images may be variable (Figure 11). Gadolinium-enhanced images demonstrate an intense homogenous, heterogeneous or peripheral enhancement of tophi (1,46,47). Computed tomography (CT) is more specific in diagnosis of tophi, which are typically observed as hyper-dense masses of approximately 160 HU attenuation values or above, corresponding to MSU crystal deposits (43,47–49).

Amyloid arthropathy

Amyloid arthropathy is characterised by amyloid deposition in intra-articular and peri-articular tissues (1,2). It is most commonly observed in amyloidosis related to long-term haemodialysis or plasma cell dyscrasia and less commonly with chronic inflammatory conditions (2). Amyloid arthropathy is manifested by erosive and destructive osteoarthropathies, most frequently affecting the hips, wrists, shoulders, knees, and spine. Destructive spondyloarthropathy and carpal tunnel syndrome occur predominantly in dialysis-related amyloidosis (1,2,50). Well-defined non-mineralised cystic lesions with thin sclerotic rims, representing osseous amyloidomas, are typically observed in bilateral peri-articular bones and at ligamentous insertion sites (Figure 12) (50). Characteristic findings of amyloid arthropathy include juxta-articular soft tissue masses, peri-articular osteopenia, subchondral cysts, and joint effusions and preservation of joint space until late in the disease. Other radiographic abnormalities include joint destruction, subluxations and dislocations and digital contractures (50). On
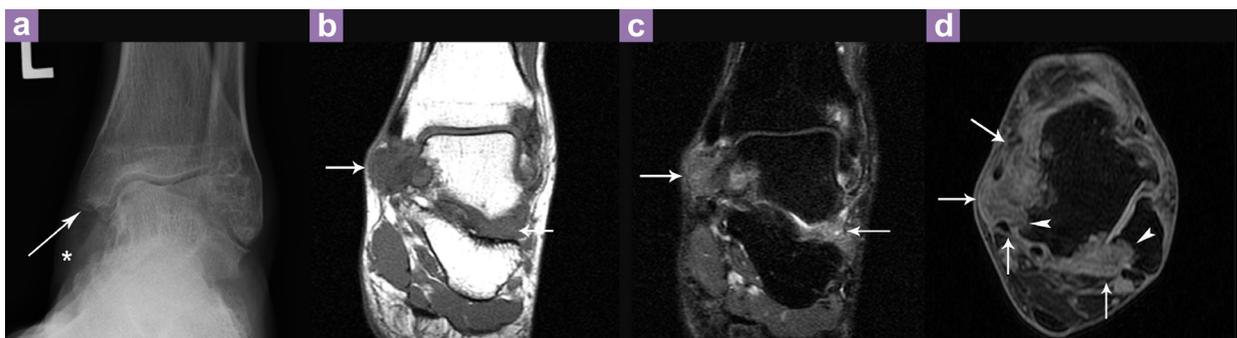
Figure 11: Known case of chronic tophaceous gout presenting with left ankle swelling. Frontal radiograph of the left ankle (a) reveals soft tissue swelling (asterisk) in medial submalleolar region with well-defined erosion (arrow) of the tip of medial malleolus. Soft tissue fullness is also noted on the lateral aspect. Coronal T1 (b), T2-weighted (c) and axial gradient echo (d) magnetic resonance images demonstrate juxta-articular erosions of medial and lateral malleolus and talus (arrowheads in d) with preserved joint space and associated eccentric intra-articular tophaceous deposits (arrows) showing characteristic heterogeneous low signal intensity on T1 and T2-weighted images with absence of "blooming" on gradient image.

MRI, the amyloid deposits characteristically exhibit intermediate to low signal intensity on both T1 and T2W images, although signal intensity on T2 sequence may be variable (1,2). MRI allows assessment of the extent and distribution of intraosseous, peri-articular and intra-articular soft-tissue involvement. Biopsy, although confirmatory for diagnosis, is not always possible. Hence, clinical radiologic correlation is used for making an early and precise diagnosis before serious complications arise, such as pathologic fracture or compressive myelopathy (50).
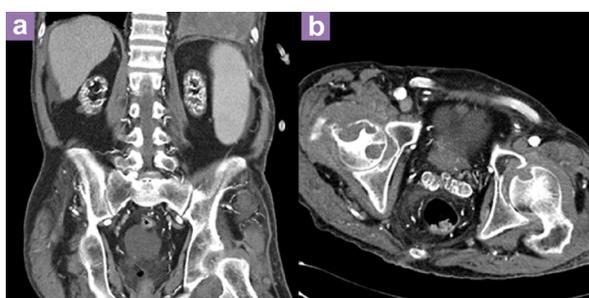
Inflammatory Conditions

Various non-infectious inflammatory conditions such as rheumatoid arthritis, chronic aseptic synovitis, bursitis and tenosynovitis of peri-articular tendons may also present as joint-related swelling. Rheumatoid arthritis manifests as bilateral symmetrical erosive polyarthritis, most commonly affecting hands, wrists and feet (2,51) in the fourth to sixth decades with a female preponderance (2). Diagnostic criteria include typical clinical radiographic findings and serum rheumatoid factor levels (51). Radiographs demonstrate a diffuse, usually

Figure 12: Biopsy-proven dialysis related amyloidosis in a 70-year-old man on hemodialysis for 21 years for diabetic nephropathy. Coronal computed tomography (CT) image of abdomen (a) reveals end stage renal disease with severe atherosclerotic vascular calcification. Axial CT image at the level of hip joints (b) demonstrates well-defined cystic lesions with sclerotic rim in both femoral heads and right femoral neck communicating with the joint space and intra-articular amyloid deposits.

multi-compartmental, symmetric narrowing of the joint space associated with marginal or central erosions, peri-articular osteoporosis and soft-tissue swelling, not usually associated with subchondral sclerosis or osteophyte formation (2). The inflammatory response in rheumatoid arthritis results in proliferative, hyperplastic and hypervascular synovium called pannus that causes bony erosions. It is observed as low to intermediate signal intensity intra-articular mass with both T1 and T2W MR images. Unlike joint effusion, active pannus shows intense contrast enhancement (2,51). Patients with rheumatoid arthritis may demonstrate synovial rice bodies (Figure 13), representing detached synovial villi within the joint cavity that resemble grains of rice and contain coarse collagenous fibres, reticulin and elastin (51).

Vascular Malformations

Synovial haemangioma is an uncommon benign vascular tumour of children and young adults which can involve the joint in a focal or diffuse fashion (2,52). It may be either synovial and/or juxta-articular in location (53). Patients present with joint pain, swelling and spontaneous haemarthrosis (2). Conventional radiographs may rarely demonstrate phleboliths allowing the diagnosis to be made (2,54). More commonly, however, they are either normal or demonstrate non-specific findings such as soft tissue swelling/mass, advanced maturation of the epiphysis, muscle atrophy and limb length discrepancy (55). MRI features, however, are highly characteristic. It is observed as a lobulated intra- or juxta-articular mass of intermediate signal intensity on T1W images and hyperintense signal T2W images due to pooling of blood in vascular spaces with typical internal linear low intensity within, most likely due to flow voids or fibrous septa (Figure 14) (2,54–56). A fluid-fluid level may be noted in cavernous-type lesions (56). MRI is therefore the procedure of choice in a suspected case of vascular intra-articular lesions and can obviate the need for conventional angiography. It can precisely delineate the location and extent of the lesion for surgical planning (54).

Arterio-venous malformations (AVMs) (arterio-venous malformations) are congenital lesions characterised by an abnormal connection between arteries and veins. There is a central confluence of tortuous vessels, called a nidus, through which arterial blood is shunted directly into veins. Diagnosis of intra-articular AVMs on various imaging modalities is based on

demonstration of a hypervascular lesion with a large feeding arterial vessel. Intra-articular AVMs are less common than extremity AVMs (2,56).

Miscellaneous

Neuropathic osteoarthropathy

Neuropathic osteoarthropathy refers to the destruction of bones and joints associated with a central or peripheral neurosensory deficit, mainly loss of proprioception. This subjects the joint to chronic, unrecognised wear and tear. The causative conditions include diabetes mellitus, syringomyelia, syphilis, leprosy, spinal cord lesion or extrinsic compression and various other neuropathies (1,57,58) . It occurs more frequently in the lower extremity than in the non-weight bearing joints of the upper extremity. Long-standing poorly controlled diabetes mellitus and syringomyelia are the most common cause in upper and lower extremities, respectively. Neuropathic spondyloarthropathy may affect the spine in the setting of traumatic spinal cord injury, amyloidosis, tabes dorsalis, congenital insensitivity to pain and occasionally diabetes mellitus (1,57).

The disease can manifest radiologically as hypertrophic, atrophic or mixed form of arthropathy or as neuropathic fractures. Hypertrophic joints reveal joint destruction,
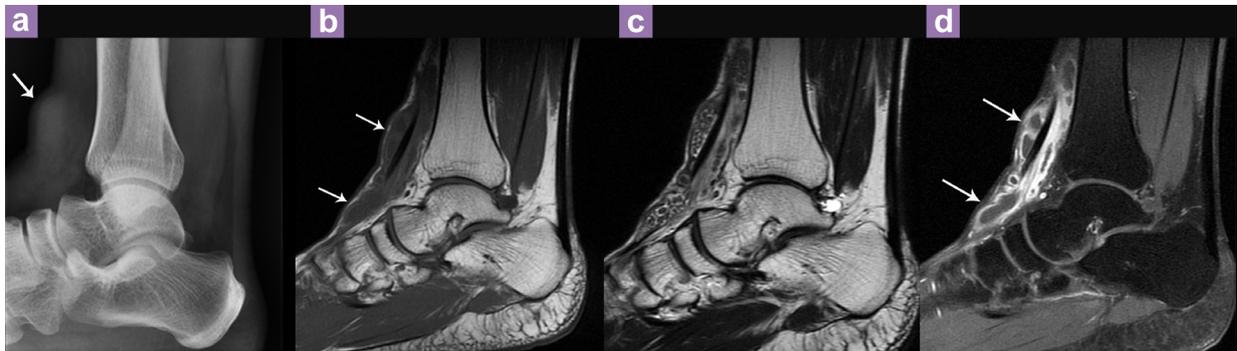
Figure 13: Known case of rheumatoid arthritis with rice bodies. Lateral radiograph of the ankle (a) reveals a lobulated soft tissue swelling on its anterior aspect. Sagittal T1 and T2-weighted images (b and c) demonstrate fluid distension of the extensor digitorum longus tendon sheath (arrows) with intact tendon. Post-gadolinium fat suppressed T1-weighted image (d) reveals synovial thickening and intense enhancement of the tendon sheath. Features are consistent with tenosynovitis. Numerous uniform sized, tiny miliary T2 hypointense nodules noted within the synovial fluid are suggestive of rice bodies.
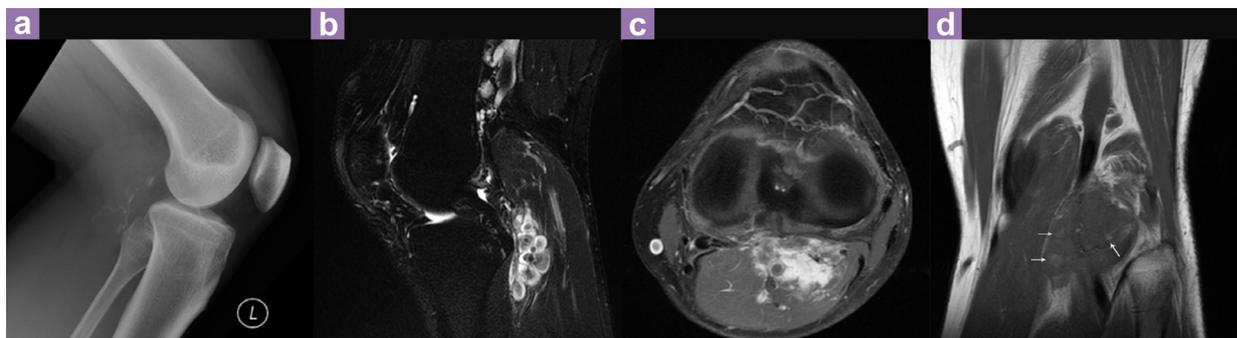
Figure 14: A 17-year-old boy with a palpable lump on the posterior aspect of the left knee. Lateral knee radiograph (a) reveals a soft tissue mass with bizzare calcification on its posterior aspect. Sagittal STIR MR image (b) shows a juxta-articular hyperintense mass with multiple round well-defined hypointense foci within suggestive of phleboliths. Axial post-gadolinium T1-weighted image (c) demonstrates avid contrast enhancement within the mass with infiltrative margins. Coronal T1-weighted image reveals few hyperintense foci within the mass (arrows). Biopsy demonstrated a synovial hemangioma.

disorganisation and fragmentation, sclerosis, effusion, osseous debris and osteophyte formation. Osteophytes related to neuropathic arthropathy reveal ill-defined and rounded margins at early stages and may attain enormous sizes at later stages compared to osteoarthritis. The atrophic form, which is more common than the hypertrophic form, is characterised by osseous resorption, resulting in an appearance of surgical amputation (Figure 15), or licked candy stick appearance. The atrophic type may mimic septic arthritis. Joint disorganisation & large persistent bloody joint effusion are observed in both the forms. Osseous fragmentation and debris, a hallmark of neuropathic osteoarthropathy, may be confused with tumour matrix on radiographs, particularly as chondroid mineralisation of chondrosarcoma. Neuropathic fractures may occur in long bones spontaneously or with minor trauma. They are typically transverse in orientation and may heal with exuberant callus formation (57,58).

Haemophilic arthropathy

Haemophilia is associated with recurrent bleeding in joints, bones and soft tissues with consequent synovial hyperplasia, chronic inflammatory changes, fibrosis, and siderosis of the synovial membrane, joint contractures and soft tissues and intra-osseous pseudotumors (1,27,59,60). Haemophilic arthropathy most often occurs in the 1st or 2nd decade of life (1). An acute bleeding episode is usually mono-articular (frequently affecting the knee, ankle, elbow, and shoulder), but the condition tends to involve different joints and become poly-articular with time.

Radiographic features include joint effusion, osteoporosis, epiphyseal overgrowth, bony erosions and cysts, joint space narrowing, intraosseous pseudotumors and secondary osteoarthritis. Chronic haemarthrosis of the knee is characterised by widening of the intercondylar notch, flattening of the condylar surface or squaring of the patella. MRI demonstrates synovial hypertrophy with characteristic intermediate to low signal intensity in all pulse sequences and blooming on gradient-echo sequences, due to the magnetic susceptibility effect caused by hemosiderin. The differential diagnoses for synovial lesions with low T2 signal intensity have been discussed earlier in this article (1,27,59,60). Unlike PVNS, which shows lobulated intra-articular synovial masses with hemosiderin (Figure 16) deposition, haemophilic arthropathy reveals a more linear deposition of hemosiderin and characteristic abnormalities of bone shapes as described in the text. MRI is useful for the selection of patients needing early
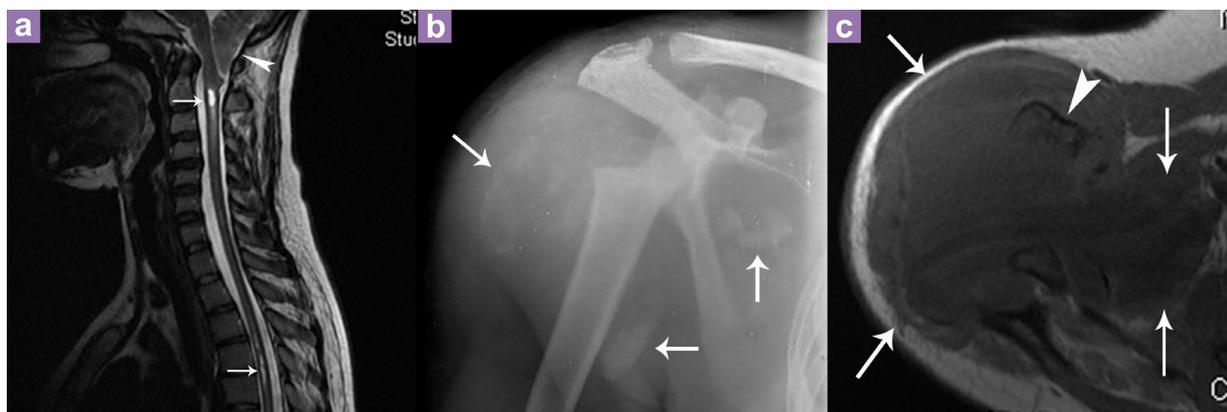
Figure 15: A 42-year-old man with type I Arnold Chiari malformation, now presenting with a painless right shoulder mass. Sagittal T2-weighted image (d) of the cervical spine demonstrates tonsillar herniation (arrowhead) with a benign syrinx in upper cervical and upper thoracic cord (arrows). Antero-posterior radiograph of the right shoulder joint (a) reveals resorption of the upper end of humerus resembling surgical amputation associated with joint disorganization and large soft tissue swelling containing calcareous debris (arrows). Axial T1-weighted (b) and coronal fat suppressed T2-weighted (c) images confirm the radiographic findings (arrowhead = resorbed humerus) and reveal a large joint effusion (arrows). Aspiration of shoulder joint with a thick needle showed thick hemorrhagic aspirate with calcareous material which was negative for micro-organisms on staining and cultures. In the given clinical context, the imaging features are compatible with neuropathic joint.

treatment of haemophilic arthropathy and in monitoring response to therapy. Prophylaxis (infusion of factor concentrate on a regular basis) and synovectomy are used to prevent or delay destructive changes (27).

Others

Cyclops lesion, or localised anterior arthrofibrosis, is a focal fibrous tumour in the anterior joint space of the knee and is viewed as a potential complication of anterior cruciate ligament reconstruction. It shows intermediate to low signal intensity with all MR imaging pulse sequences. The condition is managed with arthroscopic resection (61).

Degenerative joint disease may present as non-specific synovitis, ganglions, (62,63) synovial cysts, parameniscal or paralabral cysts and intra-articular loose bodies.

Abnormal suprapatellar plicae may lead to compartmentalisation of the joint and distention of the suprapatellar bursa manifesting as a soft-tissue mass (64). Lipohaemarthrosis results from an intra-articular fracture leading to release of marrow fat into the joint. On MRI, it is observed as fluid-fluid levels showing non-dependent fat and dependent haemorrhage layer. The layer of blood may further show a haematocrit effect due to serum separating from the blood cells (Figure 17) (65).

Conclusion

A myriad of conditions may present as articular swelling. Figure 18 summarises the diagnostic approach in patients presenting with suspected tumour-like swelling in and around joints. Familiarity with the differential diagnoses of masses and mass-like conditions involving intra- and peri-articular soft tissues, along with the typical imaging characteristics as described in this article, permits a confident radiological diagnosis of many of these diseases.
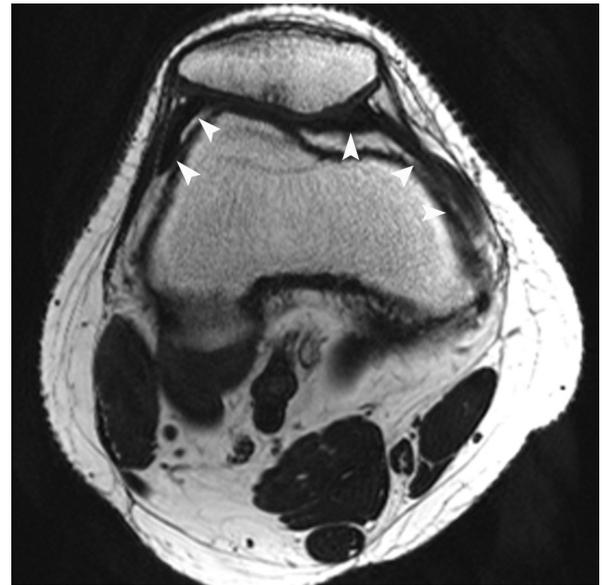
Figure 16: Axial gradient echo image of knee joint in a known case of hemophilia reveals synovial thickening with profound signal hypointensity (arrowheads) suggestive of hemosiderin deposition from recurrent intra-articular bleeds.

Figure 17: Lipohemarthrosis in a patient with twisting knee injury. Lateral radiograph of the knee shows a fat-fluid level (arrowheads). Coronal T1-weighted image (b) reveals an intra-articular lateral tibial plateau fracture (arrow). Sagittal fat suppressed T2-weighted image (c) demonstrates three layers showing hematocrit effect (black arrow) and non-dependent fat layer (asterisk).
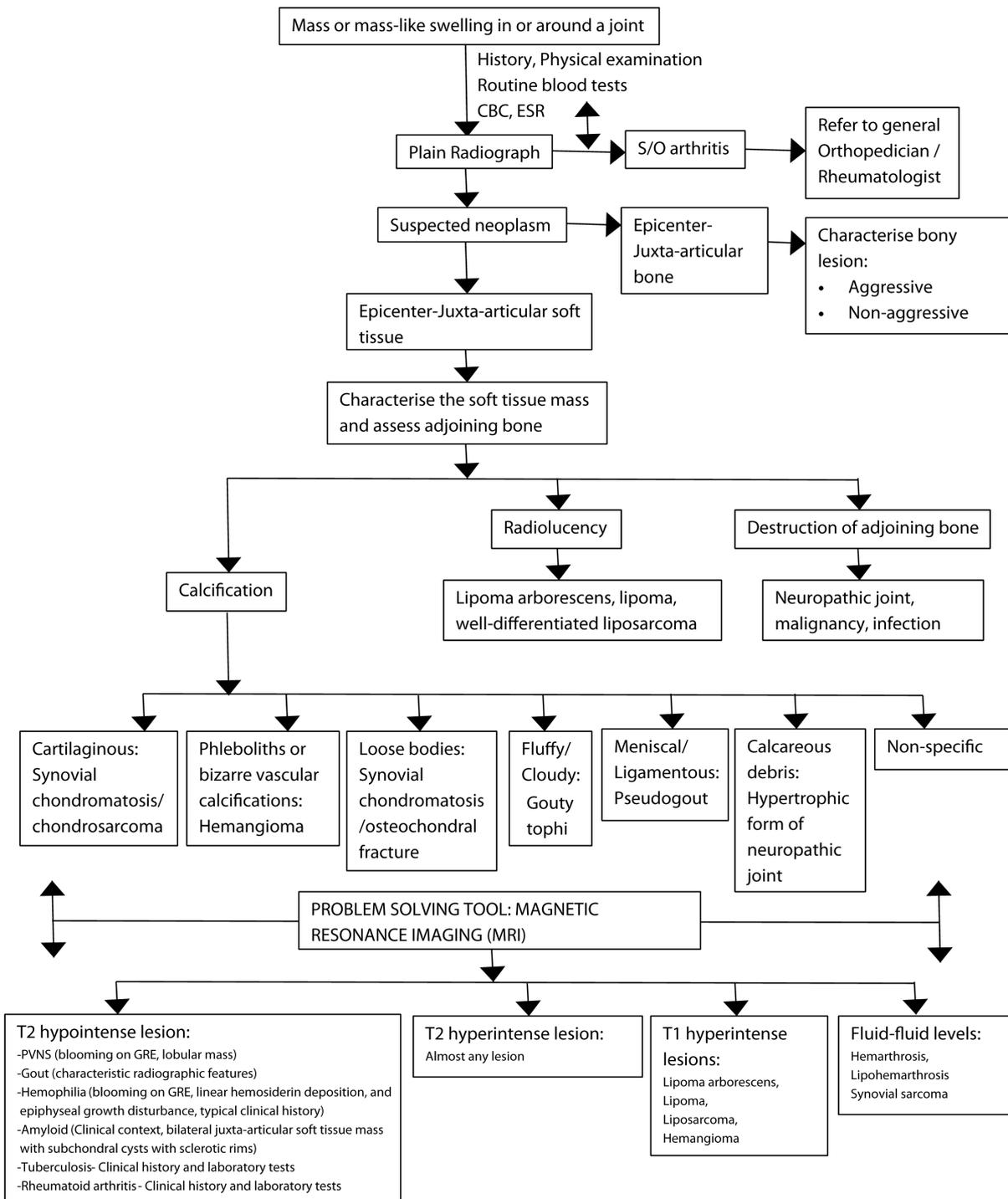
Figure 18: Diagnostic approach in patients presenting with suspected tumour-like swelling in and around joints.

Acknowledgement

Conflict of Interest

None.

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