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REVIEW

Intraosseous ganglion cysts of the carpus: current practice

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Abstract Intraosseous cysts of the carpal bones are an infrequent cause of chronic wrist pain. The main body of work has investigated their occurrence in the proximal carpus, with limited incidence in the distal row. We review the current literature on the treatment of symptomatic carpal cysts following the report of a 17-year-old male with a 12-month history of progressive right wrist pain due to an intraosseous ganglion of the trapezoid. This review explores the pathology of carpal cysts, their varying presentation and current treatments.

Keywords Intraosseous · Ganglion · Carpus

Intraosseous carpal cysts are infrequently reported in the literature as a cause of wrist pain [2, 4]. Case reports most commonly identify proximal row lesions and identify pathological fracture and tendon involvement as disease sequla [3, 5, 8]. Intraosseous ganglia are commonly asymptomatic and identified incidentally on radiographs. Yet when symptomatic, patients typically present with generalised non-specific wrist pain thus, leading to a delay in diagnosis and appropriate management. Once identified, initial conservative measures are often ineffectual, with definitive treatment often necessitating operative intervention. We report a case of an intraosseous ganglion within the trapezoid and capitate and present a review of current practice in the management of carpal cysts.

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Case Report

A 17-year-old right-handed male student presented with a 1-year history of progressive right wrist pain. There was no history of trauma or preceding systemic inflammatory disease. On visual analogue scoring, the pain progressed over 12 months to 8/10, rising to 10/10 during light activity. Examination of the wrist revealed no clinical deformity, swelling or erythema. There was point tenderness to palpation over the dorsum of the trapezoid. Range of movement remained unaffected, though there was pain on dorsiflexion and radial deviation. Jamar hand dynometer scores of the right hand were 14 kgF compared to 32 kgF on the contralateral non dominant side. Laboratory studies including inflammatory markers, urate and autoimmune profile were normal.

Initial plain radiographs were unremarkable, though subsequent magnetic resonance imaging revealed cystic change within both the trapezoid and capitate, with possible cortical breech of the trapezoid. Further CT imaging was sought to delineate the bony anatomy and confirmed a well-defined lucent lesion with a sclerotic rim within the trapezoid and an associated capitate lesion; no fracture was seen (Fig. 1).

Initial treatment with splinting and analgesics for a period of 5 months failed to resolve symptoms; thus, the decision to proceed with surgical intervention was taken.

The proximal carpus was explored via a curved dorsal incision. The lesions within the trapezoid and capitate were thoroughly explored and found to be continuous with the wrist synovium. After thorough curettage, a defect of 6–7 mm remained (Figs. 2 and 3). Due to the size of the remaining defect, bone graft was harvested from the ipsilateral iliac rest and cancellous bone used to pack the cavity.

Subsequent microscopy of the lesion revealed a cystic cavity lined by altered synovial tissue, in keeping with a metaplastic synovial cyst. The wrist was maintained in cast immobilisation for 6 weeks.

Fig. 1 T1-weighted CT coronal image of intraosseous lesion within the trapezoid

One week postoperatively, the patient experienced a significant reduction in pain. Subsequent radiographs showed incorporation of the bone graft with DASH scores of 24 at 6 weeks and 42 at 12 weeks.

Discussion

The presentation of benign cystic lesions within the carpal bones with non-specific progressive wrist pain results in a vast differential diagnosis. Lipomas, unicameral bone cysts and to a lesser extent Kienbock's disease of the lunate may present in a similar manner, with an inconclusive radiographic picture. Typically, plain radiographs demonstrate a mixed cystic-sclerotic picture, though definitive confirmation requires histological section. Studies

Fig. 2 Intraoperative image of defect

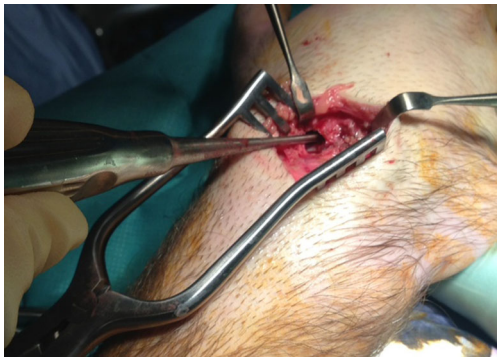

Fig. 3 Intraoperative image of curettaged lesion

suggest up to 80 % of intraosseous cysts are asymptomatic and identified incidentally on plain radiographs [4, 9]. Yet, of those which do precipitate chronic wrist pain, only four cases of trapezoid ganglia exist in the literature; conversely, their presence in the scaphoid is a more frequent occurrence. Magee et al. [2] identified intraosseous ganglia of the scaphoid in 38 % of insidious chronic wrist pain on MRI; yet, despite the evidence associating these lesions with increasing morbidity, little is known about their underlying pathology.

Pathology

The majority of carpal cysts are reported within the proximal row; authors have suggested the underlying mechanism being similar to extraosseous lesions, be they from scapholunate or scaphotrapezial regions. Two mechanisms are proposed for the underlying lesion pathology [6]. The *penetration* theory describes extraosseous ganglia penetrating the adjoining carpal cortices, leading to increased incidence in the scaphoid and lunate [7]. Subsequently, studies have associated 47 % of the soft tissue ganglia with an intraosseous ganglion cyst due to juxta-cortical infiltration [8]; this penetrating form remains the most commonly reported.

The second described form is a result of repetitive stress or microtrauma leading to metaplastic change of intramedullary mesenchymal stem cells into synovial type cells. This is preceded by traumatic bone necrosis, which following bone resorption results in a cavity containing the metaplased cells [2, 6]. This *idiopathic* theory and the supposed intramedullary mucoid degeneration would explain the absence of extraosseous ganglia or joint involvement in some literature reports. Moreover, the increased incidence in the proximal row may also be explained by this theory; whereby, both the scaphoid and lunate are subject to increased load during the power grip, which may lead to microtrauma that disturbs their already vulnerable blood supply.

Presentation

Unlike unicameral bone cysts or juxta-articular osteoarthritic cysts, intraosseous ganglion cysts seldom present in childhood or the elderly [3, 4]. And unlike subchondral carpometacarpal cysts, no correlation has been found between lesion incidence and patients exposed to high-pressure repetitive actions or vibrating tools [7].

Unless presenting with a pathological fracture, it is unusual for patients to recall the specific onset of pain; instead, symptoms are typically insidious and in some instances intermittent. The penetrative form may be accompanied by dorsal or volar soft tissue masses, which illicit tenderness on palpation [5, 8, 10]. Logan et al. [1] suggests these soft tissue masses may represent associated extraosseous ganglia or the spread of intraosseous cyst contents into the adjoining joint space following rupture.

Both pinch and grasp strength are sporadically affected, though most notable reductions are in wrist range of movement and pain at the extremes of movement [1, 2, 6]. Reports do not suggest a correlation in ganglion site and reduced motion in a specific plane, though no comparative study exists.

Diagnosis and Investigation

Diagnostic features are best delineated preoperatively with combined imaging, as laboratory studies remain within normal limits.

Plain radiographs may denote a medullary radiolucency within the affected carpus and associated peripheral sclerosis. Depending on the extent of the lesion, associated fracture may also be identified. Veseley et al. [9] highlighted the poor sensitivity of plain radiographs for the smallest of intramedullary defects and thus advocates the use of thin-slice computer tomography in order to delineate lesion orientation and preoperative planning as required. While some authors have advocated the primary use of magnetic resonance imaging to identify soft tissue involvement, with diagnosis further supported with nuclear bone scans [2, 5, 8]. We feel in the absence of extraosseous ganglia or tendon involvement, CT is the imaging technique of choice, allowing the most effective demarcation of the lesion location and architecture.

Cyst Progression

Authors have described cases of pathological fracture through intraosseous cysts [2, 9]; and though this phenomenon has not proven a regular occurrence in the literature, it does allude to the possible destructive nature of these benign lesions. It is not uncommon for the associated pathological fracture to be the primary presentation, as patients may have adopted lifestyle modifications and simple analgesics to manage the chronic symptoms.

In addition to articular involvement, tendon involvement has also been reported. Cysts have been found to communicate with the flexor carpi radialis [9]; moreover, the tendon sheath may be continuous with the ganglion and synovial membranes of the adjoining joint, again highlighting the need for careful clinical monitoring once identified.

Management

Treatment modalities of symptomatic intraosseous ganglia vary depending on clinical presentation and the evolution of radiographic changes. Asymptomatic incidental lesions should be monitored to assess for cortical destruction and changes in size or symptomatology. Conservative management has been advocated for symptomatic lesions without fracture or cortical erosion [2, 4, 6, 7, 9]. Anecdotal evidence has exalted the benefit of localised steroid injections [2, 3], though the general consensus supports the use of systemic anti-inflammatories for symptomatic relief, and lifestyle modifications to offload the effected side.

In cases where conservative measures offer no relief, 6 months is the accepted timescale after which surgical intervention is considered. In the presence of pathological fracture or cortical erosion and rapid progression, surgical intervention is indicated earlier [2, 6, 9, 10]. Regardless of location, the literature suggests intralesional curettage, copious irrigation and autologous cancellous bone grafting to the remaining cavity as the treatment of choice [2, 3, 10]. The use of bone graft (be it from the radius or iliac crest) is pivotal in preventing carpal collapse and/or fracture. The type of graft remains contentious, with some advocating vascularised bone graft or autogenous fibrin clot graft to further improve union rate particularly in cases of fracture [2, 10]. Ultimately, surgical intervention necessitates intralesional curettage and filling of the resultant cavity with a source somewhat dictated by defect size and exact location.

Intraosseous carpal bone cysts are a rare though important cause of chronic wrist pain. Lesions of the scaphoid and lunate are the most common, though reports such as this of trapezoid and capitate lesions are emerging. When symptomatic, intraosseous ganglion cysts can reduce patient functionality and progress to pathological fracture and tendon compromise; thus, once identified, they require careful clinical and radiographic assessment. The use of CT and MRI are instrumental in differentiating these ganglia from other carpal cysts, as well as delineating the character of the defect. As more work emerges, the underlying pathology of these lesions must further be explored to identify predisposing factors as well as aid early diagnosis and ultimately optimise management.

Conflict of Interest Liza Osagie declares that she has no conflict of interest.

Samantha Gallivan declares that she has no conflict of interest.

Neil Wickham declares that he has no conflict of interest.

Shamim Umarji declares that she has no conflict of interest.

Statement of Human and Animal Rights This article does not contain any studies with human or animal subjects.

Statement of Informed Consent Informed consent was obtained from all individual participants included in the study.

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