



Relationship between dorsal ganglion cysts of the wrist and intraosseous ganglion cysts of the carpal bones

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Soft tissue ganglion cysts are the most common benign tumours of the wrist; their pathogenesis remains controversial.

We prospectively screened the radiographic appearance of the wrists of 51 patients presenting to a single surgeon with dorsal wrist ganglions during a one-year period. Postero-anterior and lateral radiographs were systematically performed looking for possible associated intraosseous ganglion cysts. There were 51 dorsal soft tissue ganglion cysts in 51 patients. We detected 29 associated intraosseous ganglia in 24 patients (47%): 16 ganglia in the lunate bone (55%), 5 in the capitate bone, 7 in the scaphoid and 1 in the trapezoid. Mean size of the intraosseous ganglia was 3 mm (range, 2 to 5 mm). This high prevalence of intraosseous ganglia in association with soft tissue ganglia has to our knowledge never been reported previously. A common aetiology for these two types of ganglion cysts may explain this high association rate.

Keywords: ganglion cyst; wrist; intraosseous.

INTRODUCTION

Although ganglia are the most common benign tumours of the wrist, their pathogenesis remains controversial. The extra-capsular part of the dorsal ganglia is well known, but little is known about the intra-capsular part and its aetiology, which is controversial. Even if reputed rare, intra-osseous ganglia are the most common bone tumours about the

wrist. As for soft tissue ganglia, there is no agreement about their aetiology. Three mechanisms have been proposed: idiopathic intramedullary metaplasia, microvascular disorder with focal ischaemic necrosis and penetration of synovial structures secondary to some mechanical causes (3, 12). While the histopathological presentation of intraosseous and soft tissue ganglia is similar, there is astonishingly, to our knowledge, no study looking for a possible correlation between these two kinds of ganglia. The aim of our study was to assess the prevalence of intraosseous ganglia in the wrists of patients presenting with dorsal soft tissue ganglia.

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MATERIAL AND METHODS

We prospectively screened the radiographic appearance of the wrists of all the patients presenting to a single surgeon with dorsal wrist ganglia during a one-year period. Postero-anterior and lateral radiographs were systematically performed by the same radiologist at the time of the first visit. Further imaging by arthro-CT scan was performed in only 5 patients. We limited the investigation to radiographs in most of the patients to avoid investigations which are not clinically justified.

An intraosseous ganglion was defined according to Schrank *et al* (12) as "a cyst-like subchondral bone defect without joint pathology", as opposed to a degenerative cyst in which the adjacent hyaline cartilage is eroded. There was no wrist with arthritic changes in which distinction between ganglia and degenerative cysts would have been difficult.

Fifty one patients were included in the study, 17 male and 34 female. Mean age was 31 years, ranging from 9 to 61 years.

RESULTS

Twenty-nine associated intraosseous ganglia were detected in 24 patients (47%). There were 16 ganglia in the lunate (55%), 5 in the capitate, 7 in the scaphoid and 1 in the trapezoid. The mean size of the ganglia was 3 mm, ranging from 2 to 5 mm.

In the five patients who underwent arthro-CT scan, the lesions seen in the radiographs were confirmed. Moreover, in one case where radiographs only showed a ganglion cyst in the proximal pole of the scaphoid (fig 1), another ganglion cyst of 3 mm was demonstrated in the radial part of the lunate in the arthro-CT (fig 2).

The ganglia were painful (or disturbing) in 29 patients, with a painful Watson's shift test. However, there was no clear correlation between pain and the presence of the intra-osseous ganglion : pain was present in 15 patients with intraosseous ganglia (62%) and in 14 patients without (53%).

DISCUSSION

Intraosseous ganglion cysts are reputedly rare. Most series report only a small number of cases, as this pathology is seldom seen in clinical practice. The largest series included 80 ganglia, most of



Fig. 1. — Radiological appearance of an intraosseous ganglion cyst of the proximal pole of the scaphoid.

which occurring in the lunate or scaphoid bone (3). In an anatomical study, Schrank *et al* (12) using the same criteria as ours found suspicion of intraosseous ganglia in 17% of the cadaveric wrists studied. This is the highest rate of intraosseous ganglia found in normal wrists. The present rate of 47% is likely to be far higher than in the general population. As in one out of five patients with CT scan examination we detected an intra-osseous ganglion which was hidden on radiographs, we can also expect that our rate underestimates the real rate of intraosseous ganglion cysts in this population. The question is then : why are patients with dorsal soft tissue synovial cysts prone to also develop intraosseous bone cysts ?

In a large study of 303 operated cysts, Razemon (10) found a high frequency of multiple satellite microcysts in the joint capsule. Microscopic examination confirmed this operative observation by finding numerous intracapsular infiltrations of a myxoid substance, which was



Fig. 2. — Arthro-scan of the same patient as in figure 1 (Radiocarpal injection), demonstrating a second cyst in the lunate not seen in the AP radiograph.

already demonstrated by Angelides and Wallace (1). In Kuhlman's pathology study (6), the stalk's implantation base was always located in the bone in the intermediate area situated outside the synovial cavity, between the synovium and capsule, just distal to the distal fold of the radiocarpal capsule. Histological examination of these lesions showed the same type of tissue remodeling that is observed in other connective tissues exposed to overuse or repeated microtrauma (sports, occupational exposure) (6).

We observed a predominant location at the scapho-lunato-capitate crossover. These data correspond to those found in the literature (3, 12). The lunate was most frequently affected, followed by the capitate, scaphoid and triquetrum bones (2, 12). Most of the time these ganglia were found to be eccentric in the periphery of the bone : most of the ganglia in the lunate were on its scaphoid side and most of the ganglia found in the scaphoid were on its lunate side. Schrank *et al* (12) frequently found

intraosseous carpal ganglia at the sites of attachment of extrinsic and intrinsic carpal ligaments affected by degenerative changes. Furthermore dissection evidenced small canals at the ligamentous insertion extending to the ganglia, or even a true communication. Histopathology is identical to soft tissue ganglia : a wall with a fibrous collagen and myxoid degeneration. The mucin found within the cyst is thought to be secreted by fibroblasts after trauma or myxoid degeneration of the wall of the cyst (17).

Mechanical sheer stress or degeneration of the insertion of these ligaments is probably the process that initiates the formation of ganglion cysts. This might explain the central distribution of the intraosseous and soft tissue ganglia at the scapho-lunato-capitate crossover where the forces are concentrated. Soft tissue or/and intraosseous ganglia may arise from the same ligamentous degeneration. Surgical findings in the series of 9 intraosseous ganglia operated by Tham and Ireland (14) showed a combination of intraosseous lunate ganglion with occult intracapsular scapholunate ganglion, with intra-articular scapholunate joint ganglion, and with both. Similarly, Uriburu and Levy (15) in a series of 13 patients with 15 intraosseous ganglia found 6 patients with associated soft tissue ganglia. These are to our knowledge the only two studies making such a correlation between soft tissue and intra-osseous ganglia.

The absence of a synovial lining noted in histopathology studies disproved the valvular theory until recent arthroscopic findings. Indeed, the valvular theory may apparently be rehabilitated by the arthroscopic evidence of an intra-articular stalk in about two thirds of the cases (7). However, this "stalk" is maybe just the appearance of a ruptured ganglion cyst into the joint cavity. Luchetti *et al* (7) indeed described two cases of intra-articular expansion of the ganglion, which may then be the "pseudo-stalk" before rupture into the cavity.

Patients with painful ganglia often demonstrate pain on palpation of the scapho-lunato-capitate crossover and a painful scaphoid shift test (5).

Some patients present with a typical "ganglion pain syndrome", i.e. pain on extreme dorsiflexion of the wrist, exacerbated during periods of

sustained activity, together with painful palpation of the SLC crossover (13). Some authors believe that this “ganglion pain syndrome” may be explained by some kind of posterior interosseous nerve compression by the ganglion itself however, some patients complain of this “ganglion pain syndrome” without ganglia. This theory is not able to explain pain due to occult ganglia and intraosseous ganglia. When other causes of wrist pain such as Kienböck’s disease have been ruled out, ultrasonography and MRI are frequently able to demonstrate occult ganglia, usually just dorsal to the lunate (11, 8, 9, 13). We believe with Gunther (4) that in these cases, pain is secondary to pressure or inflammation in the ligament. At surgery, these ganglia were found adjacent to the distal part of the scapholunate ligament beneath the dorsal intercarpal ligament, which corresponds to the junction between the articular capsule and the intrinsic ligaments (4, 16). The common location of the occult ganglia, of the soft tissue ganglia’s stalk and of the intraosseous ganglia’s origin is one more argument for a common aetiology.

Watson *et al* went one step further than Angelides and Wallace in the degenerative traumatic theory by linking dorsal wrist ganglion, dorsal wrist syndrome and scapholunate instability (17, 1). They reported indeed a series of 10 patients seen with rotatory subluxation of the scaphoid, several years after excision of a dorsal soft tissue ganglion in another institution. In these patients, pain appeared after a mean postoperative time interval of 35 months. In the same paper, when reviewing 10 patients 10 years after ganglion surgery performed by one of the authors, 5 had evidence of static scaphoid instability and 3 were considered to have dynamic rotatory subluxation of the scaphoid. It is today well accepted that the terms “scapholunate instability” or “rotatory subluxation of the scaphoid” do not refer to an “all or nothing” phenomenon and include a wide spectrum of disorders. In spite of these elements, and as proposed by Weinzweig and Watson (18), all kinds of wrist ganglia could be considered as a secondary manifestation of this primitive clinical spectrum (predynamic instability or dorsal wrist syndrome). According to Weinzweig and Watson (18) an occult ganglion

is often found at surgery for dorsal wrist syndrome and soft tissue ganglia are present in 60% of these patients. Unfortunately, the presence of intraosseous ganglion cysts was not looked for in this paper. The authors warn about the possible evolution from dorsal wrist syndrome to SLAC wrist and advocate that patients with dorsal soft tissue or occult ganglia should be followed clinically and radiologically on a regular basis to detect any early sign of dynamic or static scapholunate instability. Interestingly, the case example presented in the book to illustrate this evolution presents an intraosseous ganglion cyst in the lunate (18).

As in Watson’s research (17), most of the papers about soft tissue ganglia do not mention the possible presence of intraosseous ganglion cysts. This paper is to our knowledge the first to study the correlation between soft tissue and intra-osseous ganglia. This can be explained considering that these cysts are of limited size and are therefore not obvious on the routine radiographic examination. We can assume that most of the times these intraosseous ganglion cysts are not seen if the examiners are not focused on their identification as we were indeed before engaging into this study.

This study showed a correlation between intraosseous ganglia and dorsal soft tissue ganglia. These findings, as well as data in the literature concerning dorsal soft tissue ganglia, occult ganglia and intraosseous ganglia, suggest that these three types of ganglia are different expressions of the same pathological entity : myxoid degeneration of intracapsular ligamentous insertions. This condition is probably the first stage of a ligamentous insult or chronic overload at the dorsal wrist ligaments, corresponding to Watson’s dorsal wrist syndrome which may lead in some cases to scapholunate instability.

REFERENCES

1. Angelides AC, Wallace PF. The dorsal ganglion of the wrist : its pathogenesis, gross and microscopic anatomy, and surgical treatment. *J Hand Surg* 1976 ; 1-A : 228-235.
2. Calcagnotto G, Sokolow C, Saffar P. Intra-osseous lunate ganglia : diagnostic problems. *Chir Main* 2004 ; 23 : 17-23.

3. **Eiken O, Jonsson K.** Carpal bone cysts : A clinical and radiographic study. *Scand J Plast Reconstr Surg* 1980 ; 14 : 285-290.
4. **Gunther SF.** Dorsal wrist pain and the occult scapholunate ganglion. *J Hand Surg* 1985 ; 10-A : 697-703.
5. **Hwang JJ, Goldfarb CA, Gelberman RH, Boyer MI.** The effect of dorsal carpal ganglion excision on the scaphoid shift test. *J Hand Surg* 1999 ; 24-B : 106-108.
6. **Kuhlmann JN, Luboinski J, Baux S, Mimoun M.** Ganglions of the wrist : Proposals for topographical systematization and natural history. *Rev Chir Orthop* 2003 ; 89 : 310-319.
7. **Luchetti R, Badia A, Alfarano M, Orbay J, Indriago I, Mustapha B.** Arthroscopic resection of dorsal wrist ganglia and treatment of recurrences. *J Hand Surg* 2000 ; 25-B : 38-40.
8. **Ogino T, Minami A, Fukada K, Sakuma T, Kato H.** The dorsal occult ganglion of the wrist and ultrasonography. *J Hand Surg* 1988 ; 13-B : 181-183.
9. **Osterwalder JJ, Widrig R, Stober R, Gachter A.** Diagnostic validity of ultrasound in patients with persistent wrist pain and suspected occult ganglion. *J Hand Surg* 1997 ; 22-A : 1034-1040.
10. **Razemon JP.** Surgical treatment of ganglions of the wrist by partial excision of the joint capsule. Report on 303 cases. *Ann Chir Main* 1983 ; 2 : 230-243.
11. **Sanders WE.** The occult dorsal carpal ganglion. *J Hand Surg* 1985 ; 10-B : 257-260.
12. **Schrank C, Meirer R, Stabler A, Nerlich A, Reiser M, Putz R.** Morphology and topography of intraosseous ganglion cysts in the carpus : An anatomic, histopathologic, and magnetic resonance imaging correlation study. *J Hand Surg* 2003 ; 28-A : 52-61.
13. **Steinberg BD, Kleinman WB.** Occult scapholunate ganglion : a cause of dorsal radial wrist pain. *J Hand Surg* 1999 ; 24-A : 225-231.
14. **Tham S, Ireland DC.** Intraosseous ganglion cyst of the lunate : diagnosis and management. *J Hand Surg* 1992 ; 17B : 429-432.
15. **Uriburu IJ, Levy VD.** Intraosseous ganglia of the scaphoid and lunate bones : report of 15 cases in 13 patients. *J Hand Surg* 1999 ; 24-A : 508-515.
16. **Vo P, Wright T, Hayden F, Dell P, Chidgey L.** Evaluating dorsal wrist pain : MRI diagnosis of occult dorsal wrist ganglion. *J Hand Surg* 1995 ; 20A : 667-670.
17. **Watson HK, Rogers WD, Ashmead D.** Reevaluation of the cause of the wrist ganglion. *J Hand Surg* 1989 ; 14-A : 812-817.
18. **Weinzeig J, Watson HK.** Dorsal wrist syndrome. Predynamic carpal instability. In : Watson HK, Weinzeig J (eds). *The Wrist*. Lippincott Williams & Wilkins, Philadelphia, 2001, pp 483-490.