

GANGLIONS

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Ganglion cysts are benign, fluid-filled soft tissue masses commonly treated by the podiatric physician. Originally described by Hippocrates¹ as a knot of "mucoid flesh," this lesion is typically found in the subcutaneous tissue with deeper attachments to joint capsule or tendon sheath.²⁻⁴ Far less commonly, this lesion may be found to be intraosseous.^{5,6} While treatment plans are fairly well-established, debate over the finer details concerning etiology and histopathology continues.

Ganglions are commonly found on the wrist, although they have been reported to exist near any joint of the appendicular skeleton.^{7,8} In the foot, which is the second most common location, 70% to 82% of ganglion cysts have been demonstrated to occur dorsally.^{2,9} Patients can present at any age, and women are affected two to three times more often than men.^{3,7-10} No predilection for race has been reported. An association between inflammatory disease states and popliteal cysts (Baker's cysts) has been noted.¹¹

ETIOLOGY

Debates concerning the etiology of ganglion cysts are unresolved. Practically, the pursuit of determining the actual mechanism of formation is largely academic, as treatment recommendations vary little from source to source. Similarities between adventitious bursae, synovial membranes and some ganglions have added to this confusion.^{12,13} A chronological summary of some of the more commonly mentioned causes of ganglion cyst formation are presented.

In 1746, Eller began the controversy concerning etiology of these lesions. After finding a ganglion adhered to a tendon sheath, he concluded that the fluid found within the cyst was retained after closure of a traumatic rupture of a tendon sheath.¹²

The similarity of ganglions and anatomical or adventitious bursae was noted in 1881. Vogt believed that the ganglion cyst was merely a distension of an anatomical bursa due to serous

inflammation. Criticism of this idea is based on lack of explanation for the tendency of ganglions to be multilobular or attached to tendon sheaths.¹²

Herniation of joint synovium or tendon sheath is one of the more commonly mentioned etiologies. This could explain the observation of some authors that the cysts are lined by a synovial-like membrane. It also explains the size fluctuations commonly observed. Herniation would also favor the affinity to occur near synovial membranes and the synovial-like fluid found within the ganglion. Observations against herniation are that rarely is a communication or neck found between the main cyst and the joint. These lesions do not always empty under direct pressure and rarely do they occur as a unilobular structure.¹² Falkson, who looked at 13 cases and found no connection with the joint, is in company with many other authors who reject the theory of herniation.¹²

Ledderhose, in 1893, offered support in favor of a traumatically induced degenerative process involving periarticular connective tissue structures. In examining eight ganglia about the wrist, he concluded that the lining of these cysts was endothelial in some places and connective tissue in other places.¹² None of his cases demonstrated communication with any joint space. Based on this, he determined that these cysts could be found either in close relation or at remote distances from any joint or tendon sheath. Thorn also supported a degenerative mechanism, although he took issue with the notion that these cysts could have an endothelial lining.¹² Clarke firmly stated that he denies the presence of a true endothelial lining.¹² McEvedy later offered the observation that the synovial-like collagen lining seen in the capsular portion of the cyst might be the source of confusion as to whether or not there is an endothelial lining.³

A true valvular theory was supported in 1970.¹¹ This was offered to explain observations that arthrography resulted in filling of the cyst with contrast dye. Jayson and Dixon used arthrograms

and pressure measurements at the knee to find differences between popliteal cysts and the knee joint itself. After some ingenious work, they were able to demonstrate a true valvular mechanism in only one patient.

An active metabolic theory was most recently proposed in contrast to myxoid degeneration of connective tissue.² This is based on the secretion of hyaluronic acid by fibroblasts which are known to compose a portion of the ganglion lining. Although the stimulating factor resulting in abnormal production of hyaluronic acid remains unknown, evidence of cyst refilling after joint aspiration is offered in support of this theory. Slavitt et al. have recently supported this type of active mechanism.²

MORPHOLOGY

Ganglion cysts, which typically measure 1 to 2 cm in diameter, are usually multi-lobular.^{1,4,7-12} Upon gross examination it is difficult to appreciate the distinct components that comprise an individual cyst. According to McEvedy, the larger body, or main cyst is gently lobulated and smooth in appearance. This main cyst is connected to smaller pseudopod cysts which can branch in multiple directions. These two components of the cyst are found in the subcutaneous tissues. The capsular cysts are the smallest of the three components. They are located within the wall of the joint capsule or tendon sheath. These have been termed "millet-seeds" to help describe their small, bunched appearance.⁵ This relationship of the capsular cysts and the joint capsule or tendon sheath has been referred to as the ganglion's "base-plate."⁸

There is little controversy as to whether communication exists between the individual components of the ganglion. Whether or not there is a connection between the lumen of the cyst itself and the neighboring joint is a concept greatly debated. A majority of reports favor the theory that no natural communication exists.^{1,3,8,10,12} Still, some authors contend that there is a true connection with the joint cavity.¹¹

HISTOPATHOLOGY AND FLUID ANALYSIS

Histologic examination reveals similarities between the main cyst and pseudopod cysts. These are typically thick-walled, with a lining of irregularly oriented collagen fibers and fibroblasts. Typically the main cyst wall is thicker than that of the pseudocyst. Neither the main cyst or the pseudopod cysts have a definite lining membrane. The small capsular cysts are described to have a cuboidal or flattened lining which gradually disappears as the capsular cyst merges with the main and pseudopod cysts.³ Carp and Stout reported evidence suggesting degenerative changes of the wall of the main cyst.¹⁰ This was evidenced by destruction or disappearance of the collagen fibrils. Nerves are typically found in close relation to the cyst, but have not been found to penetrate the ganglia.¹⁴ Rarely are inflammatory cells found within the area of the ganglion.¹⁰

Aspiration of the ganglion shows a clear liquid which is straw or amber in color. Occasionally, the fluid will be darker secondary to heme pigments. Comparisons between fluid found in bursae and synovial joints reveals similarities.¹² Typically, however, the fluid of a ganglion cyst is said to have a higher viscosity and mucin content.^{3,12}

PRESENTATION

McEvedy described the natural history of the ganglion. Patients generally present with complaints of either pain or concern of a lump in the foot. This initial phase is the Stage of Formation. Occasionally, an ache in a joint will precede the onset of swelling. Growth of the cyst occurs during this period. Appearance of the lesion is typically soft and freely mobile early on. Progression then continues to the Stationary phase. During this time, the lesion will remain fairly constant in size, with changes in size relating to the amount of activity occurring in the particular area. The consistency can be more firm than in the initial phase. Lastly, is the stage of Diminution in which the cyst will decrease in size. Rupture in this stage will typically not be followed by recurrence of the lesion.³ No time frame has been described regarding typical progression through the stages.

DIAGNOSIS

Identification is based mainly on clinical impression. Ganglions are well-defined masses which trans-illuminate in the subcutaneous tissues. These cysts are self-limiting and relatively slow growing and have not been known to develop into malignant neoplasms.¹⁰ Because of the relatively benign nature of these lesions, many patients do not present during the initial stage of formation when the cyst is fluctuant, but in the later stages when the lesion is more firm. Therefore, texture alone cannot be used to confirm the diagnosis. Aspiration will reveal the classic mucinous fluid as previously described (Figs. 1A-1D). Differential

diagnoses include aneurysm, bursitis, capsulitis, fibroma, lipoma, myxoma, neuroma, osteoma, sarcoma and tuberculosis of the joint.^{1,2,4}

Radiographs generally only show an increase in soft tissue density and/or volume, but can be helpful in ruling out concern of bony neoplasms. Computed tomography (CT) and magnetic resonance imaging (MRI) have also been advocated in establishing the diagnosis. T1-weighted MRI shows decreased intensity in the area of the lesion while T2-weighted MRI reveals a focal area of high-intensity. Long TR and TE images have been found useful in demonstrating relationships between the cyst and joint capsule.¹³ Gangliography has also been performed with the injection of radio-opaque dye.¹⁵

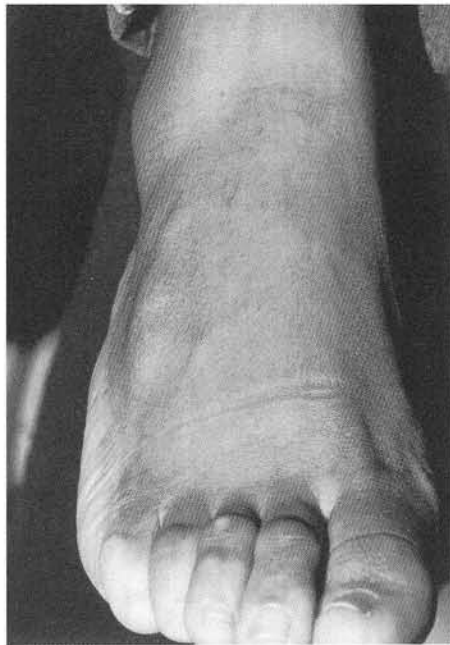


Figure 1A. Ganglion on the lateral aspect of the right foot

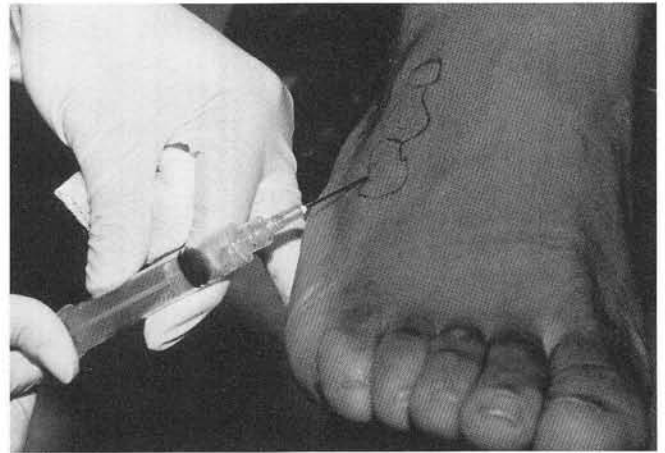


Figure 1B. Aspiration of the ganglion



Figure 1C. Appearance of mucinous fluid aspirated from the ganglion.



Figure 1D. The appearance of the ganglion after aspiration

TREATMENT

The great number of widely varying treatments which have been attempted in the past point to the fact that ganglions are difficult to manage conservatively. At one time or another, just about everything known to man has been employed in the hopes of effectively treating these lesions. Even the most bizarre methods have not been withheld in attempts at conservative management. These include massage with the hand of a corpse, binding with lead plates, and tying on a projectile which had killed a stag.⁸ Other outdated methods of treatment include irradiation, transfixion with a silk seton, and rupture with the spine of the family bible.¹⁰ Rupturing of cysts has fallen out of favor due to recurrence rates of 50%-78%.⁸ At least one case of fracture has been reported with this form of treatment, which fails to rupture the lesion half of the time.³

Aspiration with injection is a mainstay of current treatments (Figs. 2A-2D). Alone, aspiration has shown poor success, with recurrence rates reported as high as 100%.¹⁶ Injection of sclerosing fluids, with recurrence rates less than 25% preceded the current use of corticosteroids.^{5,12} Aspiration with injection of 0.5 ml of Kenalog-10 (Westwood-Squibb, Buffalo, NY) has shown a 33% recurrence rate.^{2,7}

Spontaneous regression of these lesions is well documented.^{10,17} Ten of 128 ganglion cysts resolved without treatment in one study.¹⁷ Others have documented similar findings, with up to 50% regression in one small sample of untreated patients.¹⁰ The final treatment option is surgical excision of the cyst. This, too, is not without recurrence. Two of the largest reports focusing on ganglion cysts of the foot and ankle report 27% and 43% percent recurrence.^{2,7} Surgical technique is of great importance if excision without recurrence is to be achieved. Removal of the main cyst, although relatively simple, is not enough. Excision of the pseudopod cysts as well as the capsular cysts must also be performed. In many instances, this will require invasion of a neighboring joint or tendon sheath. Hansen described this as removal of the base plate. Hansen's results support this approach. He removed only the main cyst in 41 patients, 29 of which had recurrence. None of the patients who had the cyst, stalk and base plate removed showed recurrence.⁸

COMPLICATIONS

Treatment of ganglion cysts is not without complication. Surgical excision has produced infection, joint stiffness, neuritis, paresthesias, keloids and loss of tendon function.^{2,7,9,10} Aside from recurrence, surgical complications are uncommon.^{2,17} Even less common are the minor complications associated with injection therapy.

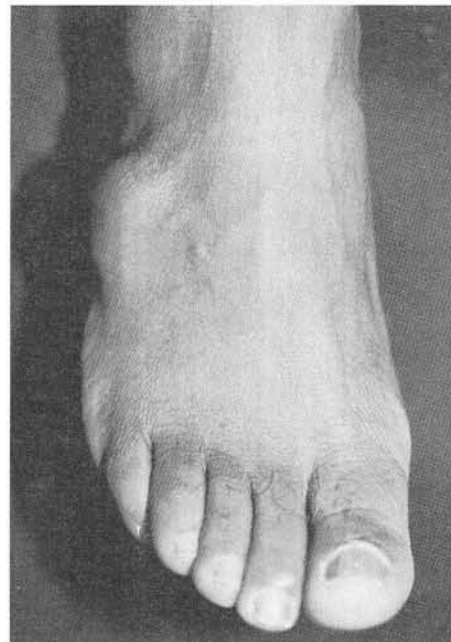


Figure 2A. Dorsal view of a ganglion on the lateral aspect of the right foot and ankle.

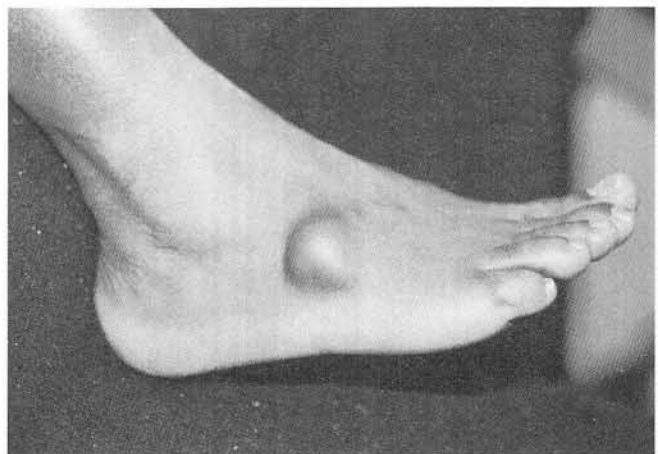


Figure 2B. Lateral view.



Figure 3C. Radiograph demonstrating an increase in soft tissue density and volume on the lateral aspect of the right foot and ankle.



Figure 4D. Clinical appearance of the ganglion after aspiration.

CONCLUSION

Ganglions are benign lesions which less commonly have a tendency to resolve themselves. Treatment should begin with a conservative approach. Padding of the lesion to avoid pressure in shoes can be effective if the goal is pain relief. Commonly, these cysts are more of a cosmetic or emotional concern to the patient. Aspiration and injection of a steroid is recommended in these cases as an initial method of treatment. Should the lesion prove recalcitrant to conservative treatment, surgical excision is an option for the patient seeking definitive treatment. Wide excision should be performed so as to assure the least chance of recurrence.

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