EXCISION OF THE GANGLION CYST

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INTRODUCTION

The first description of the ganglion cyst is credited to Hippocrates, who described these lesions as "...flabby ganglionic tumors, containing only mucoid flesh..." Interestingly, this original description was quite accurate, and little more has been discovered about these soft tissue masses in recent medical times.

Ganglion cysts have been reported extensively in the medical literature. Controversy, with respect to the pathogenesis of these lesions is reflected in the variety of terms used to describe them, as many synonymous terms have been used to describe a similar condition. (Table 1)

Table 1

TERMS FOR GANGLION CYSTS

Ganglion Ganglion Cyst Ganglionic Cyst Bursal Cyst Synovial Cyst Tendosynovial Cyst Baker's Cyst Cystic Myxoma

Ganglion cysts are benign, tumor-like lesions which contain a translucent, viscous fluid and are derived from tendo-synovial tissue. The appearance of these cystic lesions has been attributed to inflammatory conditions which cause effusion of the synovial fluid. Therefore, the lesions are believed to be reactive and not neoplastic.

PATHOGENESIS

The pathogenesis of ganglion cyst formation has been widely debated over the last century. The most commonly accepted theory is the "hernial hypothesis." This theory describes the formation of a ganglion cyst as an out-pouching or distention of a weakened portion of a joint capsule or tendon sheath. This theory is supported by the fact that these lesions occur in close proximity to tendons and joints, and microscopic analysis of the cyst wall and fluid within the cyst closely resemble normal anatomy of tendosynovial tissue and joint fluid. Controversy as to whether or not there is direct communication with a joint capsule or tendon sheath has been the main opposition to this theory, as surgical exploration of these lesions does not consistently demonstrate a direct communication.

Various diagnostic studies have been performed which support this theory, most notably Arthrography and Gangliography. In these studies, a radiopaque contrast dye has been injected into either the cyst itself (Gangliography), or the suspected communicating joint capsule (Arthrography). Dye injected into a cyst does not usually demonstrate retrograde flow into a joint capsule, however, when a contrast dye is injected into the suspected adjacent joint capsule, there is frequently demonstrated communication with the cyst. An explanation to this observed pattern is that of the "valve phenomenon," where there exists a pressure differential within the potential space of a joint capsule that encourages effusion of the contrast dye into the cyst. This unidirectional flow of fluid, based on differential pressures of the fluid in the cyst and joint fluid, prevents the low pressure cystic fluid from re-entering the joint capsule. This theory is also supported by the frequently observed enlarging of a cyst following an increase in activity, such as ambulation. In addition, the observed refilling of a ganglion cyst following aspiration supports this theory, as there is a persistent communication through a stalk or pedicle.

LOCATION

Ganglion cysts are commonly observed in association with the joints and tendons of the appendicular skeleton. The cysts are frequently found in communication with the multiple small joints of the hand and wrist (88%), and the foot and ankle (11%). In addition, superficial tendons in these anatomic locations are frequently subject to local trauma, and can be the site of ganglion cysts arising from a tendon sheath. In the foot and ankle, the most common sites of ganglion cysts are the anterior ankle, sinus tarsi, dorsum of the foot (great tarsal synovial cavity), and extensor tendon sheaths. It has been reported that more than onethird of all patients with ganglion cysts relate the appearance of the cyst with a local trauma or an increased use of the part in question.

The female to male ratio has been reported to be from 2-3:1, and 10-15% of all patients with a ganglion cyst report a bilateral condition. The average size of the lesion is 2.0 cm, and excised cysts have been measured in excess of 5.0 cm. Less frequently, intraosseous ganglion cysts have also been described, as either solitary lesions, or in association with overlying soft tissue cysts.

COMPONENTS, ANATOMY, AND STAGES OF DEVELOPMENT

Ganglion cysts may appear as either a solitary, fluid-filled mass, or they may be multi-lobed or multilocular. There may be ganglial pseudopods, which are cystic offshoots from the main cyst, or smaller microcysts which are present between the main cyst and the joint capsule or tendon sheath. The microscopic anatomy of the cyst wall reveals a structural similarity to the normal lining of a tendon sheath or joint capsule. The wall consists of collagen-rich fibrous tissue of varying thickness, which is lined by fibroblasts and is secretory in nature. The fluid within the cyst, which is synthesized by fibroblasts, is clear to amber colored, and may appear hemorrhagic secondary to trauma. The fluid is gelatinous in texture, and contains hyaluronic acid and mucopolysaccharides, resembling the joint fluid of an inflammatory condition.

Three stages of ganglion cyst development have been described. The stage of formation occurs when the cyst first appears, with the lesion being hard, tense, and tender. The stationary phase is marked by the enlargement and reduction of the cyst's size based on activity level, and the stage of diminution follows with softening of the cyst and occasional, gradual disappearance. It has been reported that up to one-half of all ganglion cysts spontaneously disappear with time.

SIGNS AND SYMPTOMS

The patient, with a ganglion cyst, typical presents with localized swelling with or without accompanying pain. Pain is usually secondary to a spaceoccupying condition, and may present as a simulated compartment syndrome, sinus tarsi, or tarsal tunnel syndrome. In cases where the lesion is in close proximity to a peripheral nerve, the patient may present with a neuropraxia or neuritis-type pain. These lesions may also cause difficulty in finding shoes that fit. Palpation reveals an extremely hard to fluctuant mass, which is often movable beneath the skin. In addition, the overlying soft tissue and integument is usually freely mobile over the mass.

DIAGNOSIS

The diagnosis of a ganglion cyst is one which is made through a combination of assessment modalities. As with any mass of unknown origin, a list of differentials must be considered and systematically ruled out, based on the frequency of their appearance in a particular anatomic location. (Table 2)

Table 2

COMMON SOFT TISSUE AND OSSEOUS LESIONS

Soft Tissue	Osseous
Bursae	Exostosis
Epidermal Inclusion Cyst	Unicameral Bone Cyst
Neuroma	Giant Cell Tumor
Fasciitis	Benign
	Chondroblastoma
Fibromatosis	Fibrous Dysplasia
Myxoma	Enchondroma
Xanthoma	Brodie's Abscess
Gouty Tophus	Subchondral
	Bone Cyst
Benign Synovioma	
Giant Cell Tumor (PVS)	
Well-Demarcated EDB Muscle	

In addition to this list, one must also suspect a lesion of vascular origin, such as a thrombosed superficial vein.

A thorough and detailed history of the presentation of the lesion will direct the examination. Special attention should be paid to the onset of symptoms and the subsequent course of the lesion. The patient may recall a history of trauma to the area, or increased activity prior to the onset of symptoms. The patient often notices that the mass enlarges after ambulation, and decreases in size with inactivity.

The location of the lesion is also important in the diagnosis of a ganglion cyst, especially if the mass presents on the dorsum of the foot or anterior ankle region. The extensor tendons and peroneal tendons are also common sites of involvement, as the tendons in this region of the foot are superficial structures which are prone to blunt trauma and irritation from shoes.

The history and location of the lesions will direct the initial differential diagnosis, however, the physical examination will prove more beneficial in making an accurate diagnosis. Palpation of the mass often reveals a subcutaneous mass which is not adherent to the overlying integument. The mass may be firm to soft in texture and may fluctuate upon lateral palpation. In cases where the lesion is associated with a superficial tendon, the mass may move with the tendon upon range of motion examination.

Transillumination

Depending on whether or not the mass has perforated through the deep facial layer, an osseous lesion may be suspected. However, when the lesion appears as a superficial structure, an additional test may be performed to determine whether or not the mass is fluid filled. Transillumination of the mass can be performed with little discomfort to the patient, using a penlight to provide a narrow beam of light. In a dimly lit examination room, it is possible to view the light as it passes through the fluid-filled lesion. This test can help differentiate between a fluid-filled and a more dense structure.

Radiography

Plain film or soft tissue sensitive radiography can be performed as an adjunctive study to determine if there is an osseous structure producing the observed findings. Secondarily, arthritic conditions may predispose to joint inflammation and it is not uncommon to observe osteophytic formation of adjacent joint surfaces in cases where a ganglion cyst protrudes from an arthritic joint. This fact is also important in preoperative planning, as the stalk or pedicle of the cyst is often not directly beneath the central portion of the mass. As an out-pouching of a joint capsule or tendon sheath, these lesions will follow the path of least resistance and may be directed away from the involved tendosynovial communication. A surgical attempt to locate the stalk may be aided if a particular joint is suspected, thus directing incision placement and subsequent dissection.

MRI

If a more obscure lesion is suspected, or if the extent of the mass is in question, a magnetic resonance image (MRI) can be obtained to further characterize the lesion. MRI offers superb resolution of soft tissue densities, and should be considered to be the definitive non-invasive diagnostic test. Since these cystic lesions are fluid filled, an increased signal on the T-2 weighted image, which is similar to that which is seen in synovial fluid, would be expected.

Gangliography

Another diagnostic tool in the evaluation of a ganglion cyst is the use of a radiopaque contrast dye. Gangliography is a method of evaluating the size and extent of a ganglion cyst, and is performed as an adjunct to aspiration. After the injection of a few milliliters of contrast dye, a radiograph is obtained, and the extent of the lesion is more easily visualized. This method has also been used to demonstrate the relationship between a ganglion cyst and the adjacent joint capsule through a communicating stalk. However, this observation is variable since the "valve phenomenon" prevents retrograde flow of the dye back into the joint. Arthrography, or the injection of a contrast medium into the adjacent articular capsule, is more likely to demonstrate communication through a stalk, due to the pressure differential which exists between the potential space of a joint capsule and the out-pouching cyst. A positive study, demonstrating communication with the cyst, is predicated on the placement of the contrast medium into the correct joint, which may be difficult in cases where the cyst overlies multiple small joints. Both studies carry the risk of an allergic reaction to the contrast dye and arthrography carries a greater risk of infection.

TREATMENT

Conservative

The treatment of ganglion cysts can be divided into conservative, semi-invasive, and surgical categories. Historically, the preferred method for treatment of a ganglion cyst involved using a sharp blow with a heavy object to burst the mass. A book was commonly used, and the Bible appears to have been favored for this procedure.

Joint inflammation appears to aggravate and stimulate the enlargement of ganglion cysts, thus it is reasonable to suspect that immobilization of the involved part will provide relief. In addition, biomechanical support through the use of an orthosis has been advocated in reducing the inflammatory state. Applying digital pressure to the cyst has been described as a means of reducing the size of ganglions in the wrist, with this technique providing a 66% cure rate. Radiotherapy has also been used historically, however this technique is no longer advocated due to the potential effects of radiation exposure.

Semi-Invasive

A variety of non-surgical, semi-invasive techniques that have been used diagnostically, can also be used therapeutically to treat ganglion cysts. These techniques focus around the use of cyst aspiration, either as a solitary means of reducing the fluid content within a cyst, or in combination with adjunctive modalities such as the injection of agents intended to reduce the inflammatory condition. The most commonly used agent is a local acting corticosteroid, which is usually a combination of long and short acting substances (acetate and phosphate). These techniques provide cure rates from 40-86%, however most of these studies have been reported with ganglion cysts of the hand and wrist. The procedure is performed in an office setting under local anesthesia, under sterile conditions. A large bore needle (12-18 gauge) in combination with a large syringe (20 cc) aids in the evacuation of the cyst. Since these cystic lesions are often multi-lobed (or multilocular), it is important to redirect the needle in several planes to ensure penetration and evacuation of all cavities. This technique can be facilitated by the use of lateral compression from an assistant, thus increasing the intralesional pressure. The collected fluid is then submitted for cytologic examination, and a compression dressing applied. Several variations to this method have been described in the literature, such as injecting a sclerosing agent or hyaluronidase, either in combination with corticosteroids, or as a solitary means of treatment. Another method describes needle irritation of the inner lining of the cyst wall to encourage fibrosis and prevent recurrence.

Another technique described involves the placement of a transfixation suture around the cyst, followed by daily retraction of the suture. The risk of infection was the major contraindication to the use of this technique.

Surgical

Surgical excision of the ganglion cysts remains the mainstay of treatment, with the most common complication being recurrence. The cure rate from surgical excision ranges from 75-85%. The use of a properly placed incision will facilitate a layered surgical exposure. Surgical exposure should not be limited at the expense of an incomplete excision. A tourniquet can be used to aid in hemostasis, thus providing a dry surgical field. Meticulous dissection with the use of fine instruments will aid in the location of the communicating stalk, which should be exposed and ligated with an appropriate suture. Maintaining the integrity of the cyst's wall will prevent rupture of the cyst and extravasation of its contents. This rupture is the most common intraoperative complication. Rupture of the cyst can prevent the surgeon from delineating the margins of the mass, and can lead to an incomplete excision and a greater chance of recurrence. In cases where a stalk is identified protruding from a joint capsule, it is not uncommon to observe osteophytic formation from adjacent articular surfaces. In this setting, appropriate osseous resection is warranted.

A layered closure will eliminate dead space formation and reduce the chance of hematoma formation. In addition, reapproximation of the deep facial layer will act as an anatomic barrier to subsequent recurrent cyst formation. The injection of a short-acting corticosteroid agent can reduce local inflammation, and an appropriate compressive dressing should be applied.

SUMMARY

The ganglion cyst is a common soft tissue mass which presents in a variety of anatomic locations in the foot and ankle. It is one which will challenge even the most experienced diagnostician, in that it often presents in uncommon locations and with varied symptoms. Although benign in nature, the differential diagnosis of a ganglion cyst is quite extensive and must be systematically evaluated. Treatment of the ganglion cyst varies from conservative to surgical, and is patient specific. Through careful surgical dissection, location and extirpation of the communicating stalk, preservation of vital structures, and a layered closure of tissue planes, the chance of recurrence will be greatly reduced.

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