Obturator Intraneural Ganglion Cysts: Joint Connected and Underdiagnosed

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BACKGROUND: **Intraneural ganglion cysts of the obturator nerve are rare. Our aim is to review cases of obturator intraneural ganglion cysts at our institution and those reported in the literature.**

METHODS: **We reviewed all cases evaluated by the senior author. A literature search was performed using the PubMed database and Google Scholar with the following terms: "obturator cyst," "obturator intraneural ganglion cyst," and "obturator intraneural ganglia." All cases underwent a retrospective review. Patient demographic data, including age, sex, and presenting signs and symptoms were recorded. Imaging studies were re-evaluated by 2 musculoskeletal radiologists experienced in the diagnosis of intraneural ganglion cysts.**

RESULTS: **We identified 2 cases of obturator intraneural ganglia at our institution; both were connected to the hip joint. We found 4 cases that were clearly diagnosed as intraneural ganglia in the literature, of which only 1 was recognized by the original authors as being joint connected, but based on our reinterpretation, 3 of 4 were joint connected. An additional 9 cases identified in the literature did not definitely report the nerve–cyst relationship, but based on our reinterpretation, were believed to be intraneural; 8 were joint connected.**

CONCLUSIONS: **We believe that obturator intraneural ganglion cysts adhere to the principles of the unifying articular theory. They arise from the anteromedial hip joint and extend into an articular branch and can reach the parent obturator nerve. Surgery should address the hip disease and/or the articular branch connection. Not appreciating the pathoanatomy of these cysts can lead to persistent or recurrent cysts.**

INTRODUCTION

Intraneural ganglion cysts, once believed to be rare entities, are increasingly being reported in the literature.[1] Based on the unified articular (synovial) theory,[2] they are benign nonneoplastic mucinous cystic lesions that originate from synovial joints, propagate within the epineurium of small articular branches innervating the synovial joints, and extend via the path of least resistance to reach the parent nerve. They cause predictable symptoms and signs of peripheral neuropathy in the territory of the parent nerves. Intraneural ganglion cysts arising from the hip joint are unusual, especially those involving the obturator nerve.[3] We reviewed cases of obturator intraneural ganglion cysts seen at our institution and in the literature to understand their pathoanatomy and apply these principles to cases of cystic lesions around the hip joint and obturator nerve reported with alternative diagnoses.

METHODS

We collected all cases evaluated by the senior author (R.J.S). A literature search was performed using the PubMed database and Google Scholar. Search terms included "obturator cyst," "obturator intraneural ganglion cyst," and "obturator intraneural ganglia." Cases at our institution and those reported in the literature were reviewed in detail. Patient demographic data, including age, sex, side of the body affected, and presenting symptoms and signs were recorded. Details of preoperative and postoperative investigations, including electrodiagnostic and imaging studies, were reviewed. Imaging studies were re-evaluated by 2 fellowship-trained musculoskeletal radiologists experienced in the diagnosis of intraneural ganglion cysts (B.M.H. and K.K.A).

RESULTS

We identified 2 cases of obturator nerve intraneural ganglion cysts evaluated by the senior author at our institution (Table 1). Both cysts were connected to an anterior/anterosuperior acetabular

Key words
- Intraneural ganglion cyst
- Obturator cyst
- Obturator nerve
- Unified articular theory

Abbreviations and Acronyms
EMG: Electromyography
MR: Magnetic resonance
MRI: Magnetic resonance imaging

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Table 1. Summary of Cases with Obturator Intraneural Ganglion Cysts Identified at Our Institution

Case Number	Gender, Age (Years)	Presenting Symptoms and Signs	Preoperative Imaging	Joint Connection	Electromyography/Nerve Conduction Study	Procedures and Findings	Outcome
1	Male, 46	2 months of severe pain in left groin and medial thigh	Plain film: cam morphology of the hips with mild degenerative changes	Yes	Severe left obturator mononeuropathy	Repair labral tear and debride chondral defect with an offset procedure at the head and neck junction The obturator nerve and the cyst were not exposed	At 4-month postoperative follow-up Improvement of adductor strength (Medical Research Council grade 4) Pain was minimal Electromyography showed significant improvement and evidence of ongoing reinnervation of the left adductor longus muscle Magnetic resonance imaging at 4 months postoperatively showed complete resolution of the cyst
		Severe weakness of adduction of left thigh with no sensory loss	Magnetic resonance imaging: a multiloculated ganglion cyst intimately associated with the left obturator nerve measured 4.3 × 2.5 × 1.9 cm				
		A Tinel sign was present in the groin.	There was an associated defect of the inferior joint capsule, complex tearing of the superior acetabular labrum and increased signal within the hip adductor muscles representing subacute denervation change.				
2	Female, 59	2 years of severe right medial groin pain that radiated to medial thigh after hernia repair	Plain film: mild hip and sacroiliac joints degenerative changes	Yes	Chronic right obturator neuropathy, no evidence of lumbar radiculopathy	Procedure performed at an outside institution: anterior retroperitoneal approach to right lumbar plexus showed a dense lipomatous mass firmly attached to L3 nerve root. Debulking of the mass and L3 neurolysis was performed	Pain free after operation
		Normal motor and sensory examination	Magnetic resonance imaging: T2 hyperintensity lesion followed the course of obturator nerve from obturator canal up to pelvic brim with sausage-like enlargement (6.5 × 0.8 cm), no gadolinium enhancement				
		No palpable mass	Initially believed to be a neurofibroma (reinterpreted by our senior author to be an obturator intraneural ganglion cyst)			Pathology: dense fibrous connective tissue and fibroadipose tissue and minute fragment of nerve with no evidence of nerve tumor	

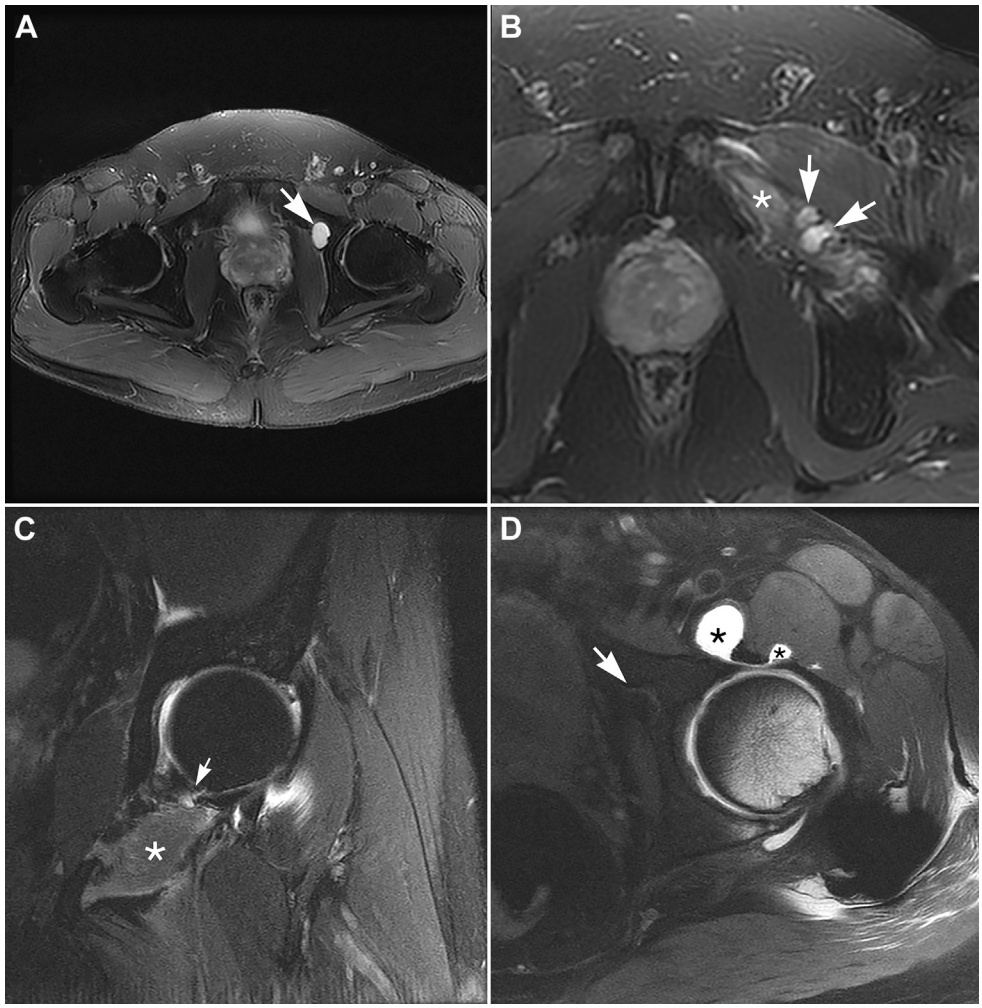

Figure 1. Case illustration 1. (**A**) Axial T2-weighted fast spin echo magnetic resonance (MR) image with fat suppression shows the obturator intraneural cyst (*arrow*) within the obturator foramen. (**B**) Axial T2-weighted fast spin echo MR image with fat suppression inferior to (**A**) showing the multiloculated intraneural cyst (*arrow*) and the associated subacute denervation of the adjacent obturator externus muscle (*asterisk*). (**C**) Coronal T2-weighted MR image with fat suppression showing the connection from the joint to the cyst as well as the defect in the joint capsule (*arrow*). Note increased T2 signal in the muscle (*asterisk*), indicating subacute denervation. (**D**) Axial T1-weighted MR image with fat suppression and intra-articular gadolinium obtained after surgical repair of the labrum showing contrast within the joint and iliopsoas tendon sheath (*asterisk*). No cyst material or intra-articular contrast is seen in the obturator foramen (*arrow*).

labral tear (Figures 1 and 2). These cysts propagated into the parent obturator nerve in the pelvis. Degenerative changes of the hip were present in both cases.

Case Illustration 1

A 46-year-old man with a history of HLA-B27 spondyloarthropathy presented with 2 months of pain in the left groin and medial thigh and progressive weakness of his proximal left leg, especially with walking (Figure 1). The pain did not radiate below the knee and was so severe it sometimes awoke him from sleep (visual analog scale score 8–9). There was no sensory loss. Examination showed severe weakness of adduction of the left thigh. A Tinel sign was present in the groin. Plain films of the left hip showed cam morphology of the hips with mild degenerative arthritis. Magnetic resonance (MR) examination of the pelvis and left hip MR arthrography showed a multiloculated ganglion cyst (4.3 × 2.5 × 1.9 cm diameter) involving the obturator nerve. There was an associated defect of the inferior joint capsule, a complex tear

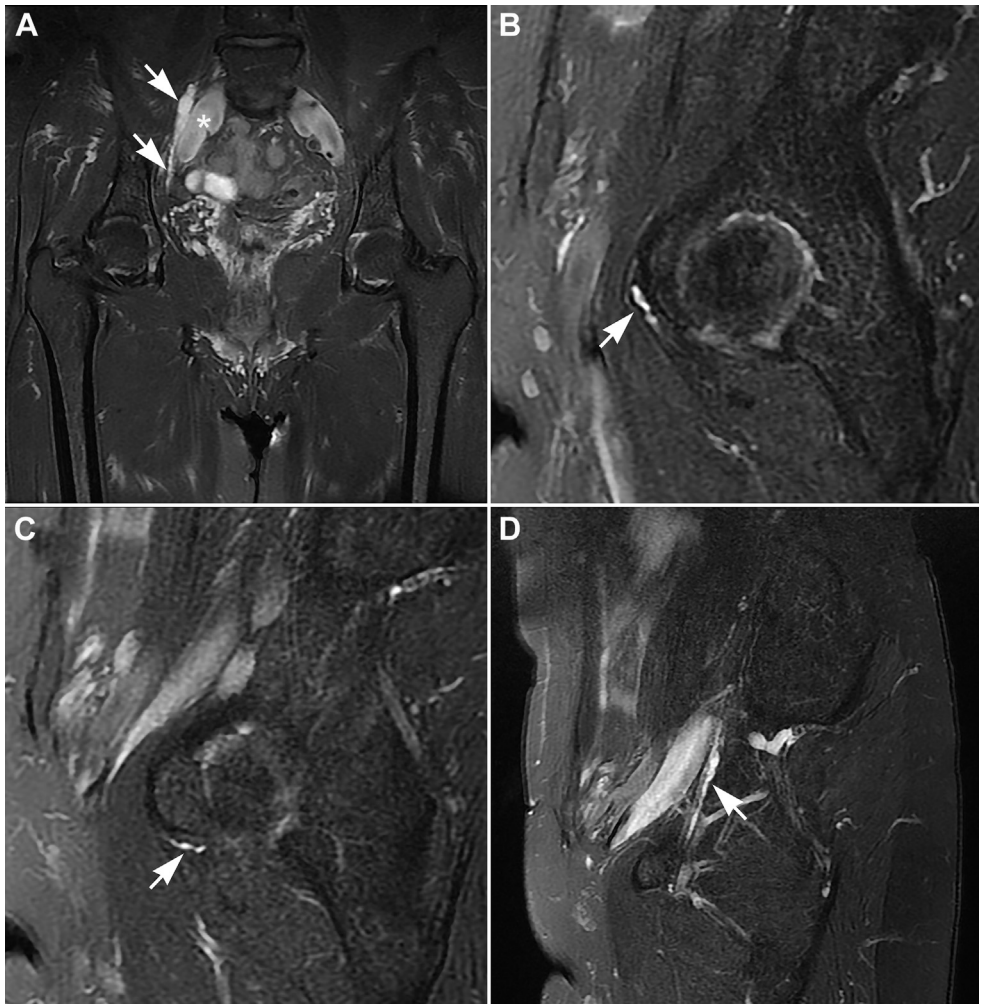

Figure 2. Case Illustration 2. (**A**) Coronal T2-weighted magnetic resonance image with fat suppression showing the proximal extension of the obturator intraneural cyst (*arrows*). Note the adjacent common iliac vein (*asterisk*). (**B**–**D**) Sequential sagittal T2-weighted magnetic resonance images with fat suppression showing the cyst arising from the joint and extending along the obturator nerve (*arrows*).

of the superior and anterosuperior acetabular labrum, diffuse chondromalacia of the hip, and increased T2-weighted signal within the hip adductor muscles, representing subacute denervation change. Electromyography (EMG) showed a severe left obturator mononeuropathy.

The left hip was exposed via a lateral incision. The joint was opened and the hip was dislocated. A labral tear was repaired and 2-cm × 1-cm chondral defect was debrided. An offset procedure at the femoral head and neck junction was performed. The obturator nerve and the cyst were not exposed. At 2 months postoperative follow-up, the patient's thigh pain was significantly diminished (visual analog scale score 2–3) and there was a trace of adduction. Postoperative EMG showed evidence of minimal reinnervation of the adductor longus. At 4 months postoperative follow-up, the patient had considerable improvement of his adductor strength (Medical Research Council grade 4). His pain was minimal. EMG showed significant improvement and evidence of ongoing reinnervation of the left adductor longus muscle. MR imaging (MRI) showed complete resolution of the cyst. Hip arthrography showed that the intra-articular contrast did not extend into the obturator nerve. At 1 year follow-up, the patient had minimal pain down the leg and minimal adductor dysfunction. MRI showed no evidence of cyst recurrence.

Case Illustration 2

A 59-year-old woman presented with a history of right anterior groin pain after hernia repair (Figure 2). The pain radiated down the anterior and medial aspect of thigh toward the knee. The pain was so severe that the patient could not even stand or walk and it also affected her sleep. Examination showed that there was no particular hip maneuver or position that reproduced the pain. No mass was palpable. Her motor power and sensation were intact.

Table 2. Summary of Reported Obturator Intraneural Ganglion Cysts in the Literature

Reference	Gender, Age (Years)	Presenting Symptoms	Initial Diagnosis	Preoperative Imaging	Joint Connection		Electromyography/ Nerve Conduction Study	Procedures and Intraoperative Findings	Outcome
					Data from Original Reports	Reinterpretation			
Uchida, 2006[3,9]	Male, 71	right leg pain	Mucoid pseudocyst of obturator nerve (intraneural)	MRI, computed tomography, urography, cystography: pelvic cyst, no contrast enhancement	N/A	Yes	N/A	Exploration with resection of cyst and obturator nerve and vessels; the cyst was visualized to the right of urinary bladder, the mass extended to obturator foramen and could not be freed from right obturator nerve	Adduction was impaired and partial loss of sensation of inner thigh, pain resolved completely
Kitagawa, 2009[10]	Male, 31	Weakness of adductor muscle with intractable left obturator neuralgia (not improved after multiple nerve blocks) and the cyst recurred after 2 surgical resections	Intraneural ganglion cyst of obturator nerve, intractable left obturator neuralgia	N/A	N/A	N/A	Atrophy and denervation of obturator-innervated adductor muscles	Exploration with gross total resection of intraneural ganglion cyst; resection of cyst and nerve, proximal nerve stump was buried into psoas muscle, distal stump was sealed with coagulation	Decreased 3 points in pain intensity on visual analog scale, no change in gait function, adductor motor power not reported
Sureka, 2012[11,19]	Male, 26	Adductor muscle weakness with thigh pain	Intraneural ganglion cyst of obturator nerve	MRI: multiple small cysts along the course of right obturator nerve extending along the articular branch to communicate with the ipsilateral anteromedial hip joint with evidence of denervation of adductor muscles	Yes	Yes, with evidence of labral tear	N/A	N/A	N/A
Heinem, 2016[18]	Female, 24	Severe left groin pain that led to immobility and hip adductor atrophy	Intraneural ganglion cyst of left obturator nerve	MRI: multiloculated ganglion cyst of obturator nerve that ascended up to L4 nerve	N/A	Yes, with evidence of labral tear	N/A	Surgical exploration: retroperitoneal and medial thigh approaches with cyst decompression, preserving the obturator nerve	N/A

MRI, magnetic resonance imaging; N/A, not available.

Table 3. Summary of Possible Reported Cases Reinterpreted as Obturator Intraneural Ganglion Cysts

Reference	Gender, Age (Years)	Presenting Symptoms	Initial Diagnosis	Preoperative Imaging	Joint Connection		Electromyography /Nerve Conduction Study	Procedures and Intraoperative Findings	Outcome
					Data from Original Reports	Reinterpretation			
Schwabegger, 2003[6]	M, 34	Thigh adduction weakness, moderate adductor muscle atrophy, unspecific pain at pelvic region	Obturator nerve ganglion	MRI and ultrasonography (details and images not provided); ultrasonography-guided biopsy confirmed mucous content of cyst	N/A	N/A	Isolated obturator motor neuropathy	Surgical exploration and decompression of obturator nerve and removal of ganglion; the cyst was visualized in obturator foramen, compressing the obturator nerve between the pubic ramus and obturator externus muscle	Motor function improved in 4 months
Campeas, 2003[7]	M, 33	Left groin pain radiating down the medial thigh to the knee	Hip joint ganglion cyst that impinged on the obturator nerve	Plain film: normal MRI: hip joint was normal; a well-circumscribed cystic mass with fluid signal in the lower left pelvis along pelvic side wall extended through the obturator canal	Yes	Yes, with evidence of labral tear	N/A	Surgical exploration with complete remove of cyst; obturator nerve was noticeably deviated by the mass, which was dissected away from the nerve	N/A
Yukata, 2005[8,20]	F, 75	Right groin and anteromedial thigh pain, which was exacerbated in abduction and external rotation of the hip, no motor weakness or sensory change	Acetabular labral cyst causing obturator nerve entrapment	MRI: a cystic lesion arising from the anterior aspect of right acetabulum, extending medially into the lateral wall of lesser pelvis with signs of denervation in obturator externus, adductor, and gracilis muscles	Yes	Yes, with evidence of labral tear	N/A	Ultrasonography-guided aspiration: yellow thick gelatinous fluid	Diminished pain after 4 days of operation and asymptomatic at 8 months follow-up
Botchu, 2013[4]	F, 67	Dull left buttock and groin pain aggravated by weight bearing and walking. No muscle weakness	Ganglion arising from transverse acetabular ligament	MRI: a multiloculated cystic lesion in the obturator foramen Magnetic resonance arthrography: a ganglion arising from the transverse acetabular ligament without communication to the hip joint	Yes	Yes	N/A	Ultrasound-guided aspiration of the ganglion and injection of triamcinolone and bupivacaine	Hip pain had resolved and there was no recurrence at 1 year follow-up
De Bruijn, 2013[12]	M, 70	Right groin pain radiated to inner thigh without weakness or paresthesias	Ganglion cyst in the obturator foramen (extraneural)	MRI: a well- circumscribed cystic mass in the obturator foramen, indicative of a ganglion cyst	Yes	Yes	N/A	Computed tomography—guided aspiration with steroid injection	Pain completely resolved after the procedure. No symptom recurrence at 1 year and 3 months

Kim, 2014[13]	M, 63	Right medial thigh pain with grade 4 weakness of right hip adductors	Acetabular paralabral cyst causing obturator neuropathy (extraneural)	MRI: a well-defined lobulated cystic lesion in the anteroinferior aspect of acetabulum, which extended to the right obturator nerve and lateral wall of lesser pelvis with evidence of denervation of adductor muscles	Yes	Yes	Decreased compound muscle action potential of right obturator nerve with denervation change of adductor muscles	Conservative therapy and follow-up	Pain was relieved within a month, but adductor muscles weakness persisted
Vidoni, 2018[5]	M, 35	Mild to moderate degree of hip adduction weakness, pain in right buttock and groin	Ganglion cyst arose from transverse acetabular ligament with entrapment of obturator nerve	MRI: a multiloculated ganglion cyst arising from transverse acetabular ligament, extending anteromedially causing marked compression on the obturator nerve with evidence of denervation of adductor muscles	Yes	Yes	N/A	Computed tomography—guided aspiration	Complete resolution of symptoms
Munugani, 2018[14]	F, 59	Left groin pain below the inguinal ligament radiating to inner thigh	Obturator nerve ganglion cyst	MRI: a T2 hyperintense lesion in the left obturator canal with multiple thin internal septa compatible with ganglion cyst	No connection	Yes, with evidence of labral tear	N/A	Surgical exploration with complete cyst removal, preserving the obturator nerve	Asymptomatic and no cyst recurrence on MRI at 6 months follow-up
Bachar Avnieli, 2018[15]	M, 52	Right groin and medial thigh pain and reduced sensation of medial thigh with abnormal gait pattern with right leg in an external rotated and abducted position	Obturator nerve ganglion cyst	MRI: intrapelvic ganglion cyst medial to right ilio-ischial line. The cyst stalk communicated directly with the medial hip joint with denervation and atrophy of right obturator externus muscle	Yes	Yes, with evidence of labral tear	N/A	Hip arthroscopy for decompression of the ganglion cyst and dilatation of stalk opening	Pain free and resumed normal gait pattern in 3 weeks MRI at 6 months showed complete elimination of cyst

M, male; MRI, magnetic resonance imaging; F, female; N/A, not available.

Figure 3. Reinterpretation of other cases in the literature. (**A**–**C**) Fluid-sensitive (T2-weighted) magnetic resonance images with fat suppression from 3 previously reported cases. (**A**) Oblique coronal image showing the multiloculated cyst arising from an inferior labral tear and extending proximally along the obturator nerve (*arrows*). The normal left obturator nerve is indicated as *ON* (*arrowheads*) (modified with permission from Ref.11). (**B**) Straight coronal image of the pelvis shows intraneural cyst arising from an inferior labral tear (*small arrow*) with proximal cyst extension on the obturator nerve (*arrows*) (modified with permission from Ref.15). (**C**) Straight coronal image showing the intraneural cyst arising from a labral tear (*small arrows*) and extending through the obturator foramen (*large arrow*) (modified with permission from Ref.7).

Plain films showed mild degenerative changes in the hip and sacroiliac joints. EMG showed a chronic right obturator neuropathy. Ultrasound-guided nerve block significantly improved her pain. MRI of the pelvis and lumbar spine showed a markedly T2 hyperintense lesion that followed the course of the obturator nerve from the obturator canal up to the pelvic brim with sausage-like enlargement (6.5 cm × 0.8 cm) of the nerve just below the edge of the pelvic brim. There was no gadolinium enhancement in the lesion and no denervation changes in the adductor muscles. The patient was diagnosed with an obturator neurofibroma. A year after the diagnosis, the nerve tumor was removed at another hospital. An anterior retroperitoneal approach to the right lumbar plexus showed a dense lipomatous mass firmly adherent to the L3 nerve root approximately 3 cm long as it emanated from the L3 foramen and into the lumbar plexus. Debulking of the mass encasing the right L3 nerve and L3 neurolysis was performed. Pathologic examination showed dense fibrous connective tissue and fibroadipose tissue and a minute fragment of nerve with no evidence of a nerve sheath tumor. The patient was pain free at 2-year postoperative follow-up.

Literature Review

Fifteen cases of cystic lesions involving the obturator nerves were found in our search.[4-18] These cases included 4 intraneural ganglion cysts, of which only 1 was identified as joint connected by the original authors (Table 2); and 11 nonspecific cysts that affected the obturator nerve (1 compressed the femoral nerve as well) (Table 3); the nerve–cyst relationship was not clearly described.

Of the 4 reported cases suggestive of being intraneural cysts, the 3 cases with reported MRIs were re-reviewed; each of these 3 cases was confirmed as an intraneural ganglion cyst with a joint origin based on the images included in the reports. As expected, all cysts arose from the anteromedial hip joint and propagated into the main obturator nerve. All reported cases had similar clinical presentations to our cases. In those cases with MR results, the imaging features were also the same. Of these cases, we identified 2 others with clear evidence of an (unrecognized) connection between the cyst and a labral tear in this group. One case had radiologic evidence of subacute and chronic denervation in the adductor muscles.

Of the 11 nonspecific lesions (Table 3), 9 cases were reinterpreted to be intraneural ganglia, of which 7 were reported to be joint related by the original investigators. From our imaging review, 8 were joint related, 4 were associated with labral tears, and 4 had radiologic evidence of adductor muscle denervation, with similar radiologic features to the other intraneural cyst cases (Figure 3). The remaining 2 cases were believed to represent an enlarged iliopsoas bursa, which caused external nerve compression,[16] and an extraneural ganglion cyst affecting the obturator nerve.[17]

DISCUSSION

Although intraneural ganglion cysts are increasingly reported in the literature, those arising from the hip joint are rare.[3] Among the reported cases and those from our institution, we found examples that were previously unrecognized as intraneural ganglion cysts or misdiagnosed as other entities (e.g., an isolated acetabular paralabral cyst, a cystic neurofibroma [case illustration 2 discussed earlier], and a groin hernia).[14] We also found another case of an intraneural ganglion cyst in the pelvis, but the report did not specifically identify which nerve was affected.[21] There are other types of cystic lesions around the hip from various pathologic factors that can lead to misdiagnoses.[19,20] MRI interpretation by an experienced musculoskeletal or neuroradiologist familiar with intraneural ganglion cysts is important.

Pathoanatomy

The formation of obturator intraneural ganglion cysts is consistent with the proposed unified articular (synovial) theory (Figure 4).[2]

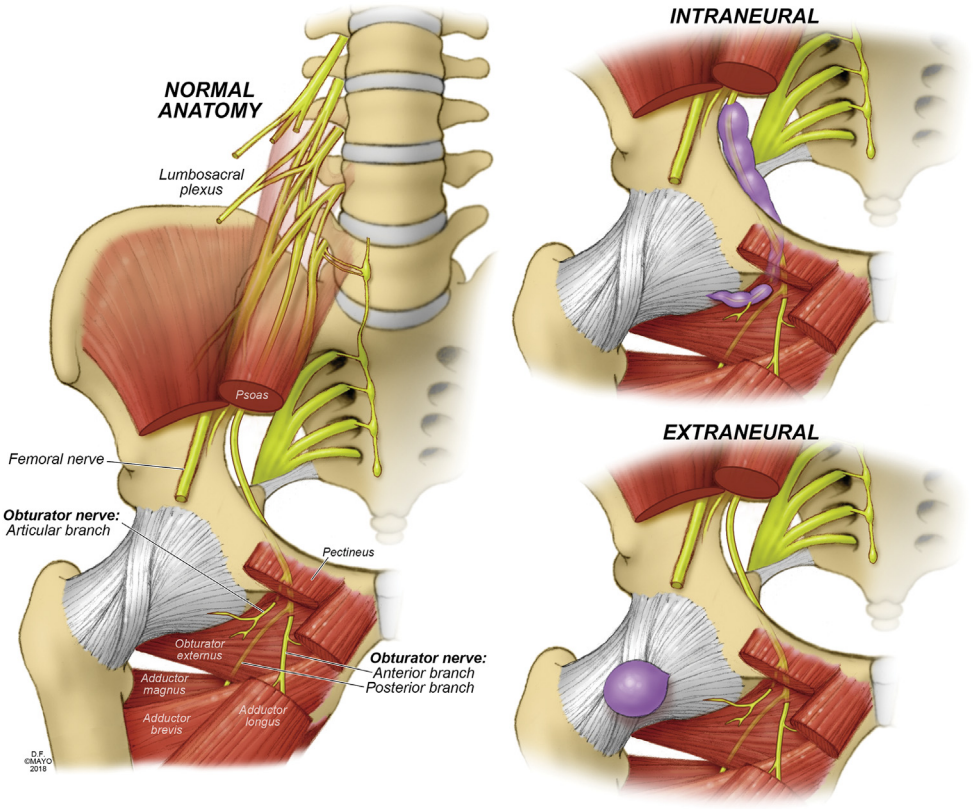

Figure 4. Normal anatomy and pathoanatomy of obturator intraneural and extraneural cysts (with permission, Mayo Foundation, 2018). (*Left panel*) The normal anatomy of the articular branch of the obturator nerve innervates the anteroinferomedial part of hip joint. (*Right upper panel*) Proposed pathways for obturator intraneural cysts: all are joint-connected, ascend along an articular branch, to the obturator nerve, through the obturator canal and into the pelvis with the characteristic balloon sign. (*Right lower panel*) An anterior hip extraneural ganglion cyst.

The hip joint, a synovial joint, is the origin. The hip is a common site of degenerative arthritis, and labral tears typically occur as part of the degenerative process. An articular branch supplying the hip joint serves as the conduit for the fluid to pass from a labrocapsular defect into the obturator nerve. Propagation of the fluid occurs within the epineurium; fluid may extend to the parent nerve via a path of least resistance, typically in a proximal direction, which depends on pressure and pressure fluxes. The appearance of the intraneural cyst often produces a balloon sign on MRI.[22] Most cases have cystic involvement of the obturator nerve at the obturator canal and an ascending pattern into the intrapelvic region of the obturator nerve. The hip joint is innervated in territories by the femoral nerve, obturator nerve, superior gluteal nerve, the sacral plexus through the nerve to the quadratus femoris, the accessory obturator nerve (when present), and possibly by branches of the lumbar sympathetic ganglia.[23,24] Any of these nerves can be sites of intraneural ganglion cysts.[3]

Another common characteristic in both our cases is the presence of some degree of articular disease. The plain films show degenerative changes of both hip joints and 1 case (case 1) had cam-type femoroacetabular impingement (FAI) morphology characterized by features such as a dysplastic bump at the head–neck junction, a synovial herniation pit, and a pistol-grip deformity of the hip joint, which can cause primary chondral injury and lead to degenerative joint disease.[25,26] It is important for an orthopedic surgeon to evaluate the hip joint and obtain radiographs of the hip as well as MRI of the cyst.[3] Joint disease was not mentioned in most reported cases. We believe that it is critical to evaluate for joint disease in patients with periarticular cystic lesions.

A joint connection was mentioned in most reported cases; however, many are not aware of the articular branch anatomy and are not knowledgeable about the pathoanatomy of intraneural ganglion cysts and their MRI features, leaving the relationship of the cyst and involved nerve unclear in the original reports. These joint connections are not always obvious; they may be small, easy to miss depending on the MRI technique, or located seemingly remote from the cysts.[2,27]

From an anatomic standpoint, reinterpretation of the limited published preoperative images in 11 of 13 cases in the literature

(imaging was not provided in 2 reports)[6,10] and both our cases showed evidence of a joint connection. Labral tears were also identified at the origin of the cyst in some cases.[7,8,11,14,15,18-20] In 2 cases,[4,5] the cysts were reported to originate from the transverse acetabular ligament as a cause of the obturator nerve entrapment. The transverse acetabular ligament is a part of the hip joint; thus, from our reinterpretation, the cysts originated from the joint capsule and an intraneural cyst is a more plausible diagnosis. We believe that a joint connection is present in all these cases, even when not identified/reported by the investigators.

Treatment Implications

Different treatment options have been described over the years. Kim et al.[13] reported a patient managed with conservative treatment and subsequent follow-up. Pain was relieved within a month, but the adductor muscles weakness and atrophy persisted. Computed tomography–guided aspiration was performed in 2 cases[5,12] and ultrasound-guided cyst aspiration was also performed in 2 cases,[4,8] all leading to complete resolution of symptoms. Cysts are dynamic and their dimensions and symptoms may fluctuate over time; cyst size does not necessarily correlate with the presence of or severity of symptoms.[27] We do not believe that nonoperative treatment produces predictable opportunities for maximal pain and neurologic improvement or cyst resolution at long-term clinicoradiologic follow-up.

In some reported cases, attention was first directed at the cyst. Removal of the cyst and resection of the obturator nerve was reported in 2 cases[9,10]; both subsequently developed persistent postoperative adductor muscles weakness and sensory abnormality; in 1 case, the obturator vessels were also resected.[9] In 3 cases,[6,7,14] surgical exploration was performed, the cyst was successfully separated and removed, and the obturator nerve in each case was preserved. This approach needs more invasive surgical exploration and extensive neurolysis. In our experience, separation of the cyst from the nerve cannot be easily achieved without risk of nerve damage. From personal communication, a combined groin exposure and retroperitoneal dissection was performed to decompress the cyst in a case reported by Heinen et al.[18] The investigators did not mention a joint connection (but one can be appreciated in an unpublished MRI). The surgical result was not discussed.

Attention more recently has been directed to identify and disconnect the joint connection from the cyst and/or to treat the joint disease via a joint-based open or a minimally invasive (endoscopic or arthroscopic) approach.[28-32] Joint and capsular repair without cyst decompression or disconnection of the articular branch also showed promising results in one of our cases (case 1). The joint and joint capsule repair procedures were solely performed without exploration of the cyst, nerve trunk, or joint connection of the obturator nerve. Several cases treated via minimally invasive joint-based approaches were believed to involve extraneural disease,[15,30] but from our review, they are intraneural cysts. In a recent study,[15] an obturator intraneural ganglion cyst was treated by hip arthroscopy for decompression of the ganglion cyst and dilatation of the stalk opening. The patient was pain free after the operation, and MRI at 6 months showed complete elimination of cyst. These approaches correct the primary pathogenesis of the formation of the cyst and also decrease the risk of nerve injury from extensive neurolysis or nerve–cyst resection.

Knowledge of the pathoanatomy that can help guide recommendations for the hip are based on this review and inference from outcome-based treatment in other more common joint-related cysts at another analogous site (e.g., shoulder or knee).[28,29,31] The unified (synovial) articular theory supports addressing the joint or the articular branch rather than the cyst. Intraneural recurrence occurred in 1 reported case after multiple previous resections of a ganglion cyst.[10] We believe that intraneural or extraneural recurrences can occur when joint/capsule disease exists.[3,10] Data from a previous systematic review of joint-related cysts[1] suggested that failure to disconnect the articular branch (cystic joint connection) or address the joint is a statistically significant risk factor for cyst recurrence.

CONCLUSIONS

Based on our literature review and clinical experience, we believe that the articular theory can explain all cases of intraneural ganglion cysts and also all periarticular cysts, including those near the hip. Future experience with treatment targeted to address the pathogenesis will further expand our knowledge of this rare entity.

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