SURGICAL MANAGEMENT OF OBTURATOR NERVE LESIONS

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OBJECTIVE: Obturator neuropathy is a rare condition that may result from orthopedic, gynecological, or urological procedures or injuries. These pathologies are amenable to surgical intervention, and an accurate physical examination and electromyography are necessary before treatment.

METHODS: Six patients with obturator nerve lesions underwent surgical exploration and decompression or primary repair. Their charts were retrospectively reviewed, and the electromyographic, surgical, and follow-up data were recorded.

RESULTS: Postoperatively, all patients reported improved symptoms in the form of pain relief, numbness resolution, or improved adductor muscle strength.

CONCLUSION: Obturator nerve injury is a treatable condition with minimal surgical complications and morbidities.

KEY WORDS: Obturator neuropathy

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Obturator neuropathy is a rare condition that presents as pain or loss of sensation over the upper medial thigh with or without hip adduction weakness. This neuropathy originates from obturator nerve injury or compression as it courses deep within the pelvis and medial thigh and can result from orthopedic, gynecological, or urological procedures. Orthopedic complications associated with this condition include poor acetabular screw placement, cement extrusion, direct trauma, and injury during the surgical approach (1, 7, 14, 23, 24). Gynecological procedures associated with obturator nerve injury include tubal ligation, vaginal delivery, and total abdominal hysterectomy (2, 9, 12, 21, 22, 25). Urological procedures that have led to nerve injury include trans-obturator sling procedures, transurethral collagen injections, endoscopic extraperitoneal radical prostatectomy, and pelvic lymph node dissection (3, 6, 18, 19). Additionally, masses of the obturator nerve and surrounding tissues such as neurofibromas, lipomas, and ganglion cysts can cause significant symptoms.

Obturator nerve injury can result from sectioning, stretching, or crushing of the nerve. Also, electrocoagulation, ligation, entrapment, and neuroma formation are common injury mechanisms. Diagnosing these injuries on the basis of history and physical examinations can be challenging because the presenting symptoms are difficult to distinguish from other neuropathies, including the ilioinguinal, iliohypogastric, genitofemoral, pudendal, or lateral femoral cutaneous nerve injuries. Additionally, testing the adductor muscle group is not simple or reliable. Electromyography is a vital tool for diagnosing obturator neuropathy.

Surgical intervention is an effective treatment for obturator neuropathy. Herein, we report our experiences in the causes, diagnosis, management, and outcomes of isolated obturator injuries.

ABBREVIATIONS: EMG, electromyography; **VAS**, visual analog scale

PATIENTS AND METHODS

Patient Population

Between 1970 and 2006, 6 patients with obturator nerve lesions underwent surgical exploration and repair at the Louisiana State University Health Sciences Center. The patients' charts were retrospectively evaluated to determine the cause of injury. All patients underwent pre- and postoperative electromyography including the obturator nerve-innervated adductors of the thigh. Intraoperative nerve action potentials were recorded in cases of simple decompressions. Adductor muscle strength as well as pain relief based on the visual analog scale (VAS) were evaluated after surgical repair. Patient follow-up was conducted by chart review over a period of 6 to 42 months (mean, 21 months).

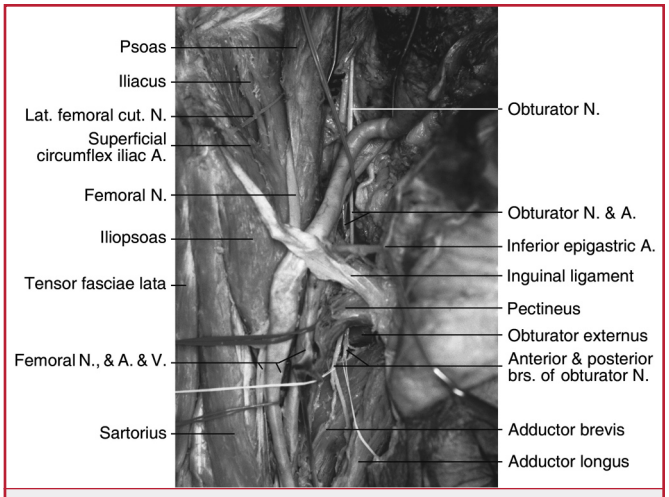

FIGURE 1. *Cadaveric dissection of the right obturator nerve from pelvis to groin. In this dissection, the obturator nerve passes from the medial border of the psoas major muscle to the lateral wall of the lesser pelvis. The nerve then exits the pelvis through the obturator foramen. The division of the anterior and posterior branches is seen at the obturator externus and adductor brevis muscles. Lat, lateral; N, nerve; A, artery; V, vein; brs, branches.*

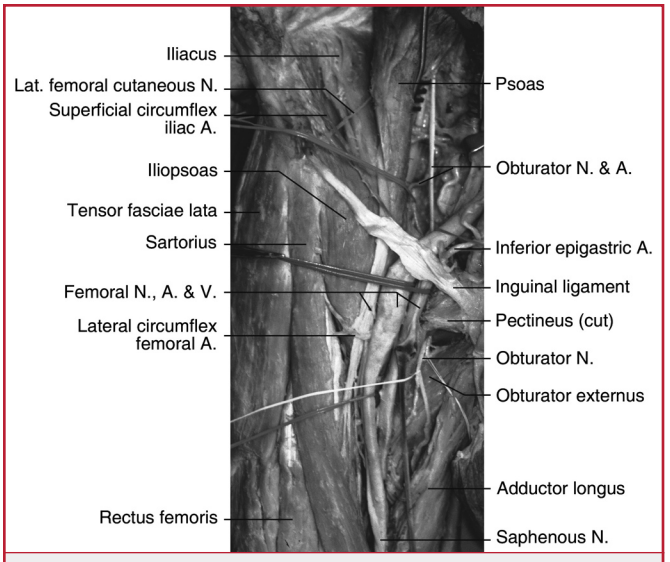

FIGURE 2. *Cadaveric dissection of the right obturator nerve and anterior branch. This dissection demonstrates the pathway of the anterior branch as it passes over the superior border of the obturator externus and deep to the pectineus and adductor longus muscles. This image also demonstrates the relationship of the obturator nerve with the femoral nerve and its saphenous branches. Lat, lateral; N, nerve; A, artery; V, vein.*

Surgical Anatomy

The obturator nerve is a mixed nerve that arises from the ventral portions of L2, L3, and L4, with the largest portion of the nerve originating from L3. The obturator nerve emerges along the medial border of the psoas major muscle near the pelvic brim. It courses retroperitoneally within the obturator fossa along the lateral wall of the lesser pelvis and exits the pelvis through the obturator foramen along with the obturator vessels. Upon reaching the thigh, the obturator externus and adductor brevis muscle fibers divide the nerve into anterior and posterior branches (Fig. 1).

The anterior branch communicates with the accessory obturator nerve and gives off an articular branch to the hip joint near the obturator foramen. This branch then courses over the superior border of the obturator externus and continues deep to the pectineus and adductor longus muscles and superficial to the adductor brevis muscle. Finally, this nerve communicates with the anterior cutaneous and saphenous branches of the femoral nerve to form the subsartorial plexus, which ends in filaments that travel along the femoral artery (Fig. 2). Occasionally, a cutaneous branch extends from this plexus, surfaces from underneath the inferior border of the adductor longus, and follows along the posterior margin of the sartorius to the medial side of the knee. This cutaneous branch then communicates with the saphenous nerve and supplies sensory innervation to the medial side of the knee. Muscular fibers from the anterior branch of the obturator nerve supply the adductor longus, gracilis, and usually the adductor brevis muscles. Rarely, they supply the pectineus muscle.

The posterior branch of the obturator nerve courses through the anterior part of the obturator externus then continues downward posterior to the adductor brevis and anterior to the adductor magnus. The nerve then splits into muscular and articular branches. Muscular fibers from the posterior branch innervate the obturator externus and adductor magnus muscles; they also innervate the adductor brevis muscle when it is not supplied by the anterior branch. The articular branch of this nerve supplies the knee joint. It perforates the adductor magnus and enters the popliteal fossa along with the popliteal artery and supplies it with filaments. Upon reaching the back of the knee joint, it pierces the oblique popliteal ligament then provides innervation to the synovial membrane (4, 5, 10, 20).

The accessory obturator nerve is present in a small number of cases. In 1980, Katritsis et al. (13) reported a 13.2% frequency of this nerve with a left-sided predominance based on dissections of 500 cadavers. When present, the accessory obturator nerve originates from the ventral part of L3 and L4, courses along the medial border of the psoas major, and crosses over the superior ramus of the pubis. This nerve then passes deep to the pectineus muscle, supplies it with branches, communicates with the anterior branch of the obturator nerve, and sends a branch to the hip joint (20).

Surgical Technique

There are many options for the surgical treatment of obturator neuropathy, including the transabdominal, laparoscopic, inguinal, and extraperitoneal approaches. Many of these procedures were first described in the treatment of obturator hernias. The incision can be a transverse, a paramedian, or an oblique incision at the inguinal crease. The transabdominal route allows for complete visualization of the nerve from its origin at the psoas muscle to the obturator foramen. The nerve may also be visualized via the laparoscopic approach, which is an effective method for uncomplicated obturator neuropathy (17). For the inguinal approach, the nerve is traced proximally by dissecting the obturator muscle to the foramen (Fig. 3) (4, 5). In the extraperitoneal approach, the oblique muscles are divided, and the peritoneum and bladder are retracted after blunt dissection. The intrapelvic course of the nerve is then explored and exposed (7).

Upon visualization of the nerve, the membrane of the canal can be divided or the scar tissue resected (1). Additionally, nerve grafting or

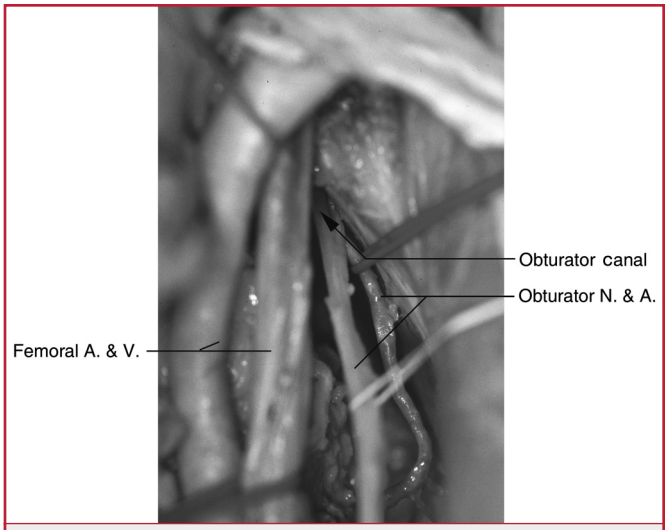

FIGURE 3. *Cadaveric dissection of the right obturator nerve via the inguinal approach. In this dissection, the obturator artery and nerve pass proximally into the obturator canal as would be seen in an inguinal decompression. N, nerve; A, artery; V, vein.*

resection can be performed when direct decompression is not an option. In many cases, obturator nerve injury may be attributable to sharp dissection of the nerve at the time of initial surgery. These cases are often amenable to direct end-to-end anastomosis (2).

RESULTS

Patient 1

After a cesarean section, a 48-year-old woman developed clinical symptoms of obturator neuralgia associated with burning pain along the left groin and medial thigh without associated motor weakness. The patient previously underwent neurolysis of the obturator nerve by an outside surgeon resulting in adequate pain relief for 8 years. After an abdominal hysterectomy, the patient developed worsening burning pain in the medial thigh, as well as a limp while walking. Because of severe pain unresponsive to pain management including multiple obturator nerve blocks, oral narcotics and Neurontin (Pfizer, Inc., New York, NY), the patient underwent a transabdominal exploration of the obturator nerve. The nerve was found to be of small caliber with minimal recordable adductor muscle contractions during nerve stimulation. The proximal portion of the scarred obturator nerve was resected and buried into the psoas muscle.

The patient initially had good pain relief at both the groin and medial thigh, but pain redeveloped in the groin region 10 months postoperatively. At this time, the patient underwent a re-exploration of the area. This exploration included a more extensive dissection around the previous surgical area, identifying what appeared to be an accessory obturator nerve as well as a scarred genitofemoral nerve. These nerves were both resected. At the 42-month follow-up evaluation, the patient reported a 2-point decrease in pain intensity on the VAS. There was no change in hip adductor functioning.

Patient 2

A 31-year-old man who had 2 previous resections of a ganglion cyst arising from the obturator fossa developed progressive intractable left obturator neuralgia. His presenting symptoms included burning pain in the medial thigh as well as atrophy and denervation electromyography (EMG) findings of the obturator-innervated adductor muscles of the thigh. On physical examination, hip adductor strength was 2/5 to 3/5. Despite multiple obturator nerve block attempts, the patient experienced no relief of his medial thigh hyperalgesia. The patient underwent re-exploration of the obturator nerve in the region of the obturator foramen including gross total resection of an intraneural ganglion cyst and burial of the proximal neural stump into the psoas muscle. The distal stump was also resected and sealed with bipolar coagulation. At a follow-up evaluation 38 months after the resection, the patient reported a 3-point decrease in pain intensity on the VAS. There was no change in gait function.

Patient 3

A 30-year-old woman developed postoperative walking difficulty after a pelvic lymphadenectomy for cervical cancer staging. She presented with weakness in right thigh adduction as well as decreased sensation in the right medial thigh. On physical examination, she demonstrated 0/5 strength of hip adduction. Her initial EMG findings demonstrated abnormal spontaneous activity with denervation electrical findings in the thigh adductor muscles. After no return of adductor function 9 months postoperatively despite medical therapy, the patient underwent transabdominal exploration of the obturator nerve, which demonstrated that the obturator nerve was not in continuity and had associated neuroma formation of both the proximal and distal stumps. After resection of the neuroma stumps, a 4-cm sural nerve graft was used to repair the nerve gap. At a follow-up evaluation 20 months postoperatively, the patient demonstrated 3/5 thigh adductor strength as well as improved sensation of the medial thigh.

Patient 4

A 76-year-old woman presented with an intrapelvic neurofibroma arising from the right obturator nerve associated with severe pelvic and groin pain and 4+/5 right hip adductor strength. The patient underwent a transabdominal exploration and gross total resection of the neurofibroma. At a follow-up examination 14 months postoperatively, the patient reported significant improvement of pelvic and groin pain but demonstrated a decrease in adductor muscle strength to 4/5.

Patient 5

A 55-year-old woman presented with a 2-year history of left medial thigh pain associated with left hip adductor weakness of 3/5. After failure of medical therapy, the patient underwent

a transabdominal resection of a fibrous lipoma mass measuring 3 × 1.5 × 1 cm located in the left obturator fossa. Six months postoperatively, the patient reported a 4-point decrease in pain intensity on the VAS. The patient also demonstrated an improvement in adductor function to 4+/5.

Patient 6

An 81-year-old man sustained a sharp transection of the left obturator nerve during a radical cystectomy for high-grade transitional cell carcinoma of the bladder. The injury was identified immediately by the primary surgical team and end-to-end suture repair of the transected proximal and distal stumps of the obturator nerve was performed by the consulting neurosurgical team. At the time of the 6-month follow-up evaluation, the patient demonstrated 3/5 adductor muscle strength with minimal walking difficulty.

DISCUSSION

Obturator neuropathy is a rare mononeuropathy that occurs most frequently after gynecological, urological, or orthopedic surgery or as a result of prolonged lithotomy positioning. This pathology can also be associated with pelvic trauma, as well as tumors of the nerve or pelvis. Injury is the direct result of sectioning, stretching, crushing, electrocoagulating, or ligating the nerve. Identifying an isolated obturator nerve lesion can be difficult based on history and physical examination alone because other nerve injuries in the lower abdomen and pelvic region also present with groin and thigh pain. For this reason, additional data from preoperative EMG studies are necessary. Postoperative EMG studies were also performed, although the patient's clinical improvement was the best outcome measure. However, obturator nerve injury is a treatable, surgical condition with minimal long-term morbidity.

Most of our patients with chronic obturator neuropathy had undergone previous surgery. Orthopedic procedures or fractures of the hip result in obturator neuropathy because of the nerve's proximity to this region (1, 7, 14, 23, 24). These lesions have been reported to result from acetabular screws that have perforated the medial and posterior wall of the pelvis (7, 14), extrapelvic extrusion of cement during total hip arthroplasty (16), complications of the surgical approach (23), or from the pelvic fracture itself (1, 24). Many of these reported cases were treated with surgical interventions with favorable results.

Gynecological procedures also place the nerve in danger because of their anatomic proximity (2, 12, 21, 25). These procedures include laparoscopic tubal occlusion (12), forceps delivery (21), and radical hysterectomy (2, 25). Additionally, obturator neuropathy is a reported complication of vaginal delivery as well as the lithotomy position (9, 22).

Urological procedures that endanger the nerve include the transobturator sling (3), transurethral collagen injections (6), radical prostatectomy (18), endoscopic extraperitoneal radical prostatectomy (19), and pelvic lymph node dissection. The obturator nerve is an important landmark during pelvic lymph node dissections to stage genitourinary malignancies such as prostate, bladder, and cervix. During pelvic lymphadenectomy, the obturator nerve can undergo thermal injury by heat dissipation to adjacent nerve structures with monopolar electrocautery or direct injury by blunt or sharp dissection. We recommend bipolar electrocautery to minimize potential thermal injury as well as meticulous dissection of the nerve with clear visualization.

Many patients experience obturator neuropathy as a result of a mass of the nerve or surrounding tissues. In our series, lesions such as neurofibromas, lipomas, and ganglion cysts were present. Preoperative imaging and an accurate history are essential to appropriate surgical planning.

Injuries to the ilioinguinal, iliohypogastric, genitofemoral, pudendal, and femoral cutaneous nerves may mimic obturator neuropathy clinically. Additionally, adductor strength testing may be inaccurate because of the dual innervation to several of these muscles, and isolated obturator nerve injury may cause only limited gait problems in the form of mild spasticity and scissor gait. This abnormal gait is attributable to outward movement of the leg during the swing phase from adductor weakness.

The clinical diagnosis is further complicated by the possible presence of an accessory obturator nerve. This accessory nerve originates from L3 and L4, gives off branches to the pectineus muscle and the hip joint, and anastomoses with the anterior branch of the obturator nerve (13, 20). Katritsis et al. (13) reported a 13.2% frequency of this nerve.

The complicated clinical diagnosis makes EMG a vital diagnostic tool to definitively localize the lesion. In all of our cases, EMG was used preoperatively for diagnosis and postoperatively for follow-up. The diagnosis of obturator neuropathy was based on fibrillation potentials or high-amplitude, long-duration complex motor unit potentials that were limited to muscles innervated by the obturator nerve. Our patients' EMG studies demonstrated abnormal spontaneous activity and polyphasic motor unit action potentials in the adductor longus muscle with no evidence of plexus or radicular nerve injuries. The lesion severity was difficult to assess with EMG, and therefore other tools such as the VAS and close follow-up were necessary.

Conservative management of obturator neuropathy is available, and analgesics, physiotherapy, and selective obturator nerve blockage have been used (4, 5, 20). The chronic neuropathy of the patients in our series failed these measures, and surgery was indicated. Selective obturator nerve blockage can be both diagnostic and therapeutic. House et al. (11) reported a technique for infiltration of the nerve with local anesthetic via the posterior computed tomographic-guided approach. These authors reported that this technique provided some short- to medium-term relief in many of their patients. Fujiwara et al. (8) also described obturator nerve blockage using ultrasonic guidance as a possible new technique under further investigation.

In the majority of our cases, we used the transabdominal approach with minimal difficulty in locating the nerve. This approach allowed for maximum visualization of the nerve and surrounding structures (Figs. 1 and 2). This visualization is particularly important when scar tissue is present from a previous surgery. Other approaches include total extraperitoneal, inguinal, and laparoscopic approaches. Rigaud et al. (17) reported a case

of idiopathic obturator neuralgia that was treated with a laparoscopic approach. Bradshaw and McCrory (4) and Bradshaw et al. (5) used the inguinal approach for obturator neuropathy in athletes with groin pain (Fig. 3). Knowledge of the nerve anatomy as well as the pathology is essential for adequate surgical planning and success. All of our patients who initially presented with pain had a significant decrease as demonstrated by the VAS, and 2 of our patients had improvement in adductor functioning. Although improved outcomes were present in this series, motor weakness may not always improve.

CONCLUSION

Obturator neuropathy is a rare condition that may result from a wide variety of orthopedic, gynecological, and urological procedures. Surgical treatment of this condition is a safe and viable option for patients. Anatomic knowledge and meticulous attention to detail are essential to the success of this procedure.

Disclosure

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this article.

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