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Original Research

Comparison of the Complication Incidence in Open Versus Endoscopic Gastrocnemius Recession: A Retrospective Medical Record Review

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ABSTRACT

Gastrocnemius recession is a practical and effective procedure to address gastrocnemius equinus. It has been shown that an equinus deformity can lead to the development of plantar fasciitis, osteoarthritis, and foot ulcerations. The 2 approaches to gastrocnemius recession are open and endoscopic. Both are viable options; however, both also have associated complications. We compared and evaluated the postoperative complications associated with these procedures. The electronic database of our orthopedics division at the University of Florida College of Medicine, Jacksonville, was retrospectively searched to identify all cases of gastrocnemius recession (Current Procedural Terminology [CPT] code 27687), and unlisted arthroscopy (CPT code 29999) from February 2006 to February 2016. The difference in the outcome variable, the incidence of postoperative complications, was assessed using Fisher's exact test. A total of 39 patients (41 procedures) were in the open gastrocnemius recession group and 35 (39 procedures) were in the endoscopic gastrocnemius recession group. The median follow-up time was shorter in the open gastrocnemius recession group than in the endoscopic gastrocnemius recession group (9 versus 12 months; $p < .001$). Postoperative complications developed after 12 of the 80 procedures (15%), with a greater incidence after open than endoscopic procedures (26.8% versus 2.6%; $p = .003$). The complications associated with the open technique included 1 case of scar pain (2.4%), 5 of dehiscence (12.2%), 1 of infection (2.4%), 2 of calf abscess (4.9%), and 2 cases of nerve injury (4.9%). A single complication occurred with the endoscopic technique—1 case of dehiscence (2.6%). To the best of our knowledge, ours is the first study to compare the postoperative complications between these 2 techniques. We found the incidence of postoperative complications was significantly lower in the endoscopic group, emphasizing the benefit of using the endoscopic approach. These findings could prove invaluable when addressing gastrocnemius equinus in those with a greater risk of postoperative complications.

Gastrocnemius, the term attributed to a muscle in the superficial posterior compartment of the lower leg to convey its appearance, derives from Latin and translates to "stomach of the leg." The gastrocnemius extends across 3 joints and plays a role in both flexion of the knee and plantarflexion of the foot and ankle. This muscle originates from the medial and lateral femoral condyles, inserting into the soleus aponeurosis. This 3-headed muscle of the calf continues inferiorly as the Achilles tendon and inserts into the posterior middle region of the calcaneus (1). The components of the triceps surae include the soleus muscle, composed of predominately slow twitch or type I fibers (slow twitch range 64% to 100%), and the gastrocnemius, which contains a more balanced fiber mixture composition (slow twitch range 34% to 82%) (2). Either muscle or both can play a part in an equinus deformity. This contracture can arise from a central neurologic deformity, such as cerebral palsy, traumatic brain injury, or stroke, or from a peripheral neurologic deformity, such as diabetic neuropathy (3). It has been shown that an equinus deformity can lead to the development of plantar fasciitis (4–6), osteoarthritis (7,8), metatarsalgia (4,9,10), and foot ulceration (11–13) secondary to increased strain throughout the foot.

To choose the correct surgical procedure, the components of the triceps surae contributing to an equinus contracture should be differentiated using the Silfverskiöld maneuver (14). This is important because unnecessary Achilles lengthening can result in weakening

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of the entire musculotendinous unit (15,16). Compared with an Achilles tendon lengthening procedure, gastrocnemius recession might be preferred owing to the shorter recovery time and decreased residual weakness (17). However, gastrocnemius recession is not without its own risks, with 1 of the more common being injury to the sural nerve. Also, a risk exists with an open technique of requiring an enlarged incision to fully identify the gastrocnemius–soleus junction, which will negatively affect cosmesis (18,19).

Vulpius and Stoeffel (20) described the first distal open gastrocnemius recession for correction of spastic contractures more than 1 century ago. The first description of a transverse recession was by Strayer (21) in 1950 and is essentially the same technique used in the patients undergoing open gastrocnemius recession in our study. Pinney et al (22) demonstrated successful correction of a gastrocnemius equinus contracture using the Strayer procedure, with a mean average correction of 18.1° (range 8.4° to 31.3°). Many other investigators have also detailed techniques and modifications in regards to the open gastrocnemius recession.

Regardless of the technique used for open gastrocnemius recession, one must have a firm understanding of the lower extremity anatomy. As reported previously, the location of the gastrocnemius tendon insertion point into the Achilles tendon is, on average, 18 mm distal to the visible indentation. Thus, the incision should be initiated ~2 cm distally to this location (23). Tashjian et al (24) determined that the mean average width at the gastrocnemius–soleus junction was 58 mm and occurred ~11 to 20 cm proximally to the lateral malleolus. They also found that the sural nerve was found 12 mm medially to the lateral border of the gastrocnemius–soleus junction or ~20% of the total width from the lateral border. Similarly, understanding the sural nerve anatomy is paramount to be able to adequately protect this structure. The sural nerve is entirely sensory and can be traced back to spinal nerve roots S1 and S2. It is formed by a fusion of the medial sural cutaneous nerve (branch of the tibial nerve) and the peroneal communicating branch of the lateral sural cutaneous nerve (branch of the common peroneal nerve). However, variants do exist, exemplified in 20% of the population in whom the sural nerve is formed entirely by the medial sural cutaneous nerve. The sural nerve is typically found in close proximity to the Achilles tendon at a level ~7 to 9.8 cm proximally to the tip of the lateral malleolus (25). Even knowing this, one must be wary owing to the significant individual variation possible.

Although an endoscopic gastrocnemius recession is a novel technique to address gastrocnemius equinus, the endoscopic modality has been previously used to address other ailments, including carpal tunnel syndrome and plantar fasciitis. Palmer et al (26) reported a quicker recovery of grip strength and wrist range of motion and an earlier return to work associated with the endoscopic carpal tunnel release. Similarly, endoscopic plantar fasciotomies have shown to be effective and safe, with faster return to activity (27–29). Chou et al (30) compared the outcomes after endoscopic versus open plantar fasciotomy. They found that patients who had undergone endoscopic plantar fasciotomy experienced significantly greater improvement in the subjective and objective functional outcomes, with less pain and greater satisfaction. Trevino and Panchbavi (31) first detailed the endoscopic gastrocnemius recession technique in 2002. They used a single portal technique at the lateral outline of the triceps surae aponeurosis, ~1 to 2 cm inferior to the musculotendinous junction. A 0.5-cm portal was described, with the blade introduced facing the aponeurosis and advanced medially, with the back protecting the sural nerve. As the functioning endoscopic knife is withdrawn, one is able to visualize the cut on the monitor, with the resulting 2-cm gap filled by the bulging soleus muscle. They expanded on their work with a retrospective study to evaluate the safety and efficacy of endoscopic gastrocnemius recession through a single medial portal, the technique used in this patient population (32). From that study, they found the initial incision for portal entry was placed incorrectly in 2 of 31 procedures (6.5%) and that the recession could not be accomplished in 1 of the 31 (3.2%) procedures. A superficial wound infection was noted in 1 (3.2%) patient. Similar to their cadaver study, no damage to the sural nerve was noted nor was any damage noted to the Achilles tendon. Their subsequent study revealed a statistically significant improvement in pain, stiffness, swelling, and overall mean average score with the endoscopic technique. A 2-portal technique was described by Tashjian et al (24) in a cadaver study. They initially found an 83% transection rate of the gastrocnemius aponeurosis; however, with technique modifications, such as clamping the tendon margins with hemostats to convert the natural curve of the gastrocnemius to a more linear segment, the complete transection rate increased to 100%. The sural nerve was only definitively identified in 5 of 15 specimens (33%); however, sural nerve injury only occurred in 1 specimen (7%) despite the poor visualization. Thus, complete transection can be obtained but visualization of the sural nerve is poor, with the risk of iatrogenic nerve injury. They also assessed the incision size, which ranged from 12 to 22 mm, and postoperative ankle dorsiflexion, which demonstrated a mean 20° improvement. Subsequent endoscopic gastrocnemius recession studies have demonstrated a successful increase in ankle dorsiflexion and a decrease in morbidity (33–38).

The mean average procedure time for the aforementioned endoscopic technique was documented and found to be 20 minutes (24). The time necessary to perform a procedure in the operating room is of the utmost importance when considering the cost. A study of 100 U.S. hospitals found that operating room charges averaged $62/1 minute (range $22 to $133/1 minute) (39). Thus, any procedure that can better control hospital spending and improve overall efficiency will be viewed favorably. (Of course, we realize that a thorough cost effectiveness analysis requires rigorous attention to perspective, quality adjusted life-years, and incremental cost differences, and requires special expertise.) Data demonstrating the advantages of performing gastrocnemius recession endoscopically instead of using the traditional open technique are scarce. Also, to the best of our knowledge, no study has directly compared the postoperative complications. However, an association exists between cosmetically unattractive scars and tethering of the skin to the underlying fascia in the open technique, precipitating patient dissatisfaction. It stands to reason that if one could minimize the inevitable trauma associated with surgery the patient would have a better outcome.

Patients and Methods

From February 2006 through February 2016, all patients who had undergone gastrocnemius recession by the podiatric surgery department were identified from our medical department orthopedics division electronic database using the Current Procedural Terminology codes 27687 (gastrocnemius recession) and 29999 (unlisted arthroscopy). This study period was chosen because it represented the duration that our podiatric residency program has been in existence. Our institutional review board approved the present study. The medical records of the patients were then reviewed for descriptions of the surgical technique and postoperative complications. The collected data revealed that gastrocnemius recession was performed in 75 consecutive patients (81 lower extremities) with a diagnosis of an isolated soft tissue gastrocnemius contracture. The open gastrocnemius recession technique and postoperative management were performed similarly, with only slight variations. The endoscopic gastrocnemius recession technique was identical for each patient undergoing the procedure. The preoperative surgical plan was enacted in every case, and no patient required conversion from the endoscopic technique to an open approach. Also, no patient in the present study required a return to the operating room for revision of the gastrocnemius recession. Patients with ≥6 weeks of follow-up data available were included in the present study. Gastrocnemius recession was performed by 1 of 4 podiatric surgeons (J.P., K.S., J.S., S.M.) with podiatric resident assistance in all cases. Two of the podiatric surgeons (J.P., K.S.) have been affiliated with the residency program for ~3 years and have been responsible for most of the cases. All 4 podiatric surgeons performed open gastrocnemius recession and 2 (J.P., J.S.) performed endoscopic gastrocnemius recession. The technique used was determined by surgeon preference. Patient factors were not considered in the decisions regarding the surgical technique. The necessary surgical instrumentation to perform gastrocnemius recession using either technique was available to each surgeon for every case.