Operative Techniques in Sports Medicine

Management of Chronic Proximal Hamstring Ruptures: Surgical Treatment

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Proximal hamstring ruptures are often associated with a delay in diagnosis. Patients with continued disability for months or even years after this injury, present the surgeon with unique treatment dilemmas. Several studies have shown inferior results with primary repair or tenodesis of chronic ruptures when compared with acute surgical intervention. Reports after distal fractional lengthening with proximal repair and allograft reconstruction of chronic ruptures have shown improved outcomes, approaching those seen after acute repair. The current article describes the typical presentation, treatment options, and outcomes after surgical management of chronic proximal hamstring ruptures. In addition, a specific technique for Achilles allograft reconstruction is outlined in detail.

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There have been several studies reporting surgical treatment for proximal hamstring ruptures.\(^1\)-\(^{16}\) Surgical treatment is generally recommended for acute complete ruptures in active individuals to avoid the potential disability associated with this injury. Despite the increasing awareness of this injury, proximal hamstring ruptures still frequently go undiagnosed early on. As a result, it is not uncommon to have patients presenting months or even years after injury with continued disability. Management of patients presenting with symptomatic chronic proximal hamstring ruptures can be challenging with respect to surgical treatment. Primary repair with or without fractional lengthening, tenodesis, allograft augmentation, and allograft reconstruction have all been described for this injury.\(^2\)-\(^9\),\(^12\),\(^15\),\(^16\) The current article presents the typical presentation, surgical treatment, postoperative rehabilitation, and outcomes after management of chronic proximal hamstring ruptures. In addition, a specific technique of allograft reconstruction, which has been previously reported, is described in detail.

History

Proximal hamstring ruptures can occur in multiple settings, but are most frequently reported because of water-skiing accidents.\(^1\),\(^8\),\(^10\),\(^11\),\(^14\),\(^15\) These injuries can also be sustained because of a sporting injury or less frequently from simply an awkward fall. Lower energy injuries may be associated with a greater degree of pre-existing proximal hamstring partial tear and tendinopathy. The typical mechanism involves an injury with the affected hip flexed and the knee extended. Many patients will note an audible pop with extreme pain in the proximal thigh and buttock region. These injuries can be quite disabling, and bruising often results over 24-48 hours. When eliciting a history for a patient with a remote history of injury to the posterior, proximal thigh, the above findings are highly suggestive for a previous complete proximal hamstring rupture.

Most patients will improve with respect to daily activities over several weeks to months. Generally, the more active the patient, the more pronounced the eventual disability because of an untreated complete proximal hamstring injury. Patients presenting late after injury will typically note poor leg control through the eccentric hamstring phase of gait with running and brisk walking.\(^2\)-\(^5\),\(^8\),\(^12\),\(^14\),\(^15\) In addition, patients may note posterior thigh cramping, subjective weakness, feelings of "giving way," and sciatica or radicular type symptoms. One study reported a mean of 61% hamstring strength deficit and an inability to return to sporting activities in 5 patients with chronic proximal hamstring ruptures.\(^14\) A unique situation is the history of injury of adolescents with an apophyseal avul-
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Although most of these do well with conservative management, significant retraction can lead to the same symptoms noted earlier in the text, in addition to significant discomfort with sitting secondary to the retracted bony fragment.

Physical Examination

The physical examination of a patient with a chronic proximal hamstring rupture is less dramatic on first inspection than an acute rupture. Examination is begun in the prone position. With the knee in 90° of flexion, resisted hamstring strength is tested and compared with the contralateral side. The proximal thigh is inspected and palpated for an obvious “popeye” deformity and lack of proximal tendon contraction near the ischium with resisted new flexion. Passive hamstring tension is then evaluated by passively extending the knee from a position of 90° hip and knee flexion in the supine position. Markedly decreased tension in the medial greater than lateral distal hamstrings is consistent with a chronic proximal hamstring rupture.

Imaging

Plain radiographs are typically unremarkable with the exception of the chronic apophyseal avulsion in adolescents. Magnetic resonance imaging is the study of choice and can accurately reveal the degree of retraction and changes with the musculature, such as fatty atrophy (Fig. 1). It is helpful to accurately define the location of the sciatic nerve with respect to the retracted hamstring tendon as well as the specific length of tendon retraction. We have found that a chronic tendon retraction of more than 5 or 6 cm may limit the ability to primarily repair the chronic rupture and ultimately require other procedures, such as distal fractional lengthening or allograft augmentation/reconstruction.

Surgical Indications

The indications for surgery in the setting of a chronic complete proximal hamstring rupture include continued weakness that limits activity, poor leg control through the eccentric phase of gait, recurrent spasm or cramping, and occasionally associated sciatica. Weakness and poor leg control are the author’s primary indications for surgery. We have not found that particular lengths of time from injury or degree of muscle atrophy and tendon retraction are strict contraindications for surgery. We have performed surgery in the presence of severe tendon retraction, significant magnetic resonance imaging evidence of muscle atrophy, and up to 8 years postinjury with significant improvements still noted postoperatively in a limited number of patients. Despite these promising outcomes, we remain very careful to realize expectations with patients when considering surgical management in the chronic setting.

Surgical Technique for Chronic Ruptures

The patient is placed prone on the operating room table. We typically use a laminectomy frame. Other frames or alternatively 2 large rolls, 1 under the chest and 1 under the pelvis, can be used, thus providing approximately 20° of hip flexion. The entire leg from the posterior pelvis to the foot is prepped and draped. The foot is prepped and not covered to better assess sciatic nerve function intraoperatively.

For chronic ruptures, a longitudinal incision starting at the gluteal crease is made with the length based on the degree of hamstring retraction (Fig. 1). Sharp dissection is carried through the skin, subcutaneous tissues, and down to the hamstring fascia. At this point, the sciatic nerve is identified and a neurolysis is performed to protect the nerve proximally and distally. A nerve stimulator is used to further identify the
nerve and differentiate from the surrounding scar tissue (Fig. 3). The retracted hamstring tendon is then dissected out and mobilized (Fig. 4). The ischial tuberosity is identified, and if the tendon does not reach the ischial tuberosity, an Achilles allograft is prepared, leaving an 8 × 20 mm bone plug attached (Fig. 5). The ischial tuberosity is cleared of soft tissue and a guidewire for an 8-mm reamer is placed in the ischial tuberosity (Fig. 6). It is helpful to verify that at least 20 mm of the guide pin is within the tuberosity before reaming to verify that the entire Achilles bone plug and interference screw will fit within the tunnel and not be prominent. The bone plug of the Achilles allograft is then placed within the tunnel in the tuberosity and secured with a 7 or 8 × 20 mm interference screw (Fig. 7). With the hip flexed 20° on the laminectomy frame, the knee is then flexed up to 45°, and tension is placed distally on the Achilles tendon and proximally on the hamstring tendon. Under tension, absorbable sutures are used to secure the Achilles allograft to the hamstring tendon and tension is evaluated. Evaluation of tension is somewhat subjective. In general, the allograft hamstring tendon complex should be taught in 45° of knee flexion but allow for further knee extension to at least 10° short of full knee extension. If too little or excessive tension is noted, the previous step is repeated until appropriate tension is achieved. Nonabsorbable sutures are then used to secure the final construct in a locking type manner (Figs. 8 and 9). The wound is copiously irrigated, and routine skin closure is performed. A hinged knee brace locked at 90° of knee flexion is then applied at the conclusion of the case.

For the less common symptomatic chronic proximal apophyseal injury with significant retraction, continued weakness, and/or difficulty sitting, we use the same exposure as that noted earlier in the text. Typically, the bony avulsion is easily identified and mobilized. We have not performed open reduction and internal fixation of these apophyseal injuries in the chronic setting as the bony fragment is typically over-
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Figure 6 Intraoperative image after exposure of the ischial tuberosity (white arrow) and placement of a guidewire into the tuberosity before reaming the tunnel for graft placement.

grown and deformed. In this situation, we simply excise the bony fragment from the tendon stump, taking care to protect the sciatic nerve. These injuries are rarely retracted more than 4-6 cm, and a primary repair to the ischium is usually possible after removal of the bony fragment.

Postoperative Rehabilitation

Postoperatively, we have found that a hinged knee brace allows for adequate protection for allograft reconstruction of chronic proximal hamstring ruptures. We have not found that a hip or knee orthosis is necessary in this situation with secure fixation. The brace is typically worn for 6 weeks, with the knee locked at 90° of flexion for 2 weeks, 60° of flexion for 2 weeks, and 30° of flexion for the final 2 weeks. The brace is kept on at all times with the exception of showering. A drop-lock type brace can be used to allow for an extension stop and free passive flexion for ease of sitting and standing.

Figure 7 This intraoperative image shows the Achilles allograft (black arrows) after the Achilles bone plug has been secured into the ischial tuberosity with a metal interference screw.

We do not use physical therapy in the first 6 weeks after surgery. At 6 weeks postoperatively, the brace is discontinued and crutches are weaned.

We begin physical therapy with gentle range of motion and core strengthening at 6-8 weeks postoperatively, and implement resisted hamstring strengthening at around 10 weeks. Although riding a stationary cycle is permitted without toeclips at 6-8 weeks postoperatively, we generally avoid functional sports until 4-6 months after surgery. Most patients are able to return to jogging and other sporting activities by 6 months and continue to improve for at least a year with respect to strength and function.

Figure 8 Intraoperative image of the final Achilles tendon/proximal hamstring construct (solid arrows) secured with nonabsorbable sutures in a locking-type fashion. The sciatic nerve is also shown (dashed arrows).

Figure 9 Postoperative anteroposterior radiograph demonstrates the interference screw (black arrow) in the ischial tuberosity with the Achilles tendon bone plug placed lateral to the graft.
Outcomes

Although there has been an increase in the number of studies regarding surgical treatment of proximal hamstring ruptures, the results after treatment of chronic ruptures are limited to case reports and small series. There are even fewer reports comparing the outcomes between acute and chronic surgical repair of proximal hamstring ruptures.

Cross et al. evaluated 9 patients who underwent direct repair of chronic proximal hamstring ruptures at a mean 36 months after injury. The repairs were only possible after flexing the knee to nearly 90° and immobilization in this position of flexion for 8 weeks postoperatively. This technique resulted in a 40% strength deficit at most recent follow-up. In another study, 4 chronic proximal hamstring ruptures were treated with direct repair or tenodesis, with poor results noted in 75%. Sarimo et al. reported on 41 proximal hamstring ruptures that were surgically repaired. Twenty-two patients underwent repair within 3 months, whereas 19 underwent repair with greater than 3-month delay. The risk for a poor outcome was 28 times greater for patients with a delay in surgery greater than 6 months in comparison with those undergoing surgery within 3 months. All but one of the chronic cases, however, was treated with primary repair.

Klingele and Sallay reported a series of 11 patients who underwent proximal hamstring repair. Seven cases were acute repairs and in 4 chronic cases a distal fractional lengthening was performed before direct primary repair. Excellent outcomes were reported for both groups, and isokinetic strength was reported to be 83% and 89% of the contralateral side for acute and chronic ruptures, respectively. We reported our results in 26 patients who underwent surgical treatment of proximal hamstring ruptures. Twenty-one patients underwent acute primary repair and 5 chronic cases underwent either a direct primary repair, Achilles allograft reconstruction with suture anchors, or Achilles allograft reconstruction with interference screw fixation. At a mean follow-up of 20 months, outcomes were improved with a specific functional questionnaire in all but 1 patient. The mean isokinetic strength was 92% vs 79% at 60° per second and 88% vs 98% at 180° per second compared with the contralateral leg for the acute vs chronic groups, respectively. We have now performed 36 acute repairs and 8 chronic surgeries (6 Achilles allograft reconstructions). We believe that the use of an Achilles allograft reconstruction for chronic tears has the advantage of secure fixation, ease of tensioning the repair, avoids excessive tension or tethering of the sciatic nerve, and allows for postoperative mobilization of the leg similar to that for acute proximal hamstring repairs.

Conclusions

Untreated complete proximal hamstring ruptures can lead to significant disability in active patients. A detailed history and physical examination can make the diagnosis in most cases. Although primary repair and tenodesis for chronic injuries have resulted in suboptimal outcomes, both fractional lengthening in addition to primary repair and allograft reconstruction have lead to improved outcomes approaching those seen after acute repair. Allograft reconstruction may simplify the procedure in comparison with distal fractional lengthening, and with the small numbers available the outcomes have been rewarding.

References