Endoscopic Resection of Avulsed Fragment of Tibial Tuberosity and Endoscopic-Assisted Repair of Patellar Tendon


Abstract: An avulsion fracture of part of the tibial tuberosity can occur as a result of a tophaceous tuberosity or Osgood-Schlatter disease. We describe an endoscopic technique of debridement, bone fragment resection, and tendon repair. This technique has the potential advantage of fewer wound complications. It is performed through proximal and distal portals on the sides of the patellar tendon. The working space is deep to the tendon. After debridement of the tendon and resection of the bone fragment, the tendon gap is assessed. Endoscopic-assisted side-by-side repair is performed to close the gap if the gap is less than 30% of the width of the tendon. If the gap is more than 30% of the width of the tendon, the proximal stump of the avulsed tendon can be retrieved through the proximal portal. Krackow suture with stay stitches is applied to the proximal stump. The stump is put back and sutured to the tibial insertion through a bone tunnel or suture anchor. This is augmented by side-by-side suturing of the avulsed tendon with the adjacent normal tendon.

A tophaceous deposition of the patellar tendon and the tibial tuberosity is very rare. Monosodium urate crystals can directly interact with tenocytes to reduce cell viability and function. This may result in spontaneous ruptures of involved tendons. An avulsion fracture of part of the tibial tuberosity can also occur. The avulsed fragment and the surrounding synovitis can cause anterior knee pain and swelling (Fig 1). We report an endoscopic technique of debridement, bone fragment resection, and tendon repair.

Technique

A 4.0-mm 30° arthrooscope (Dyonics; Smith & Nephew, Andover, MA) is used for this procedure. The patient is in the supine position, and a thigh tourniquet is applied. The knee is flexed with support at the popliteal fossa. The patella, patellar tendon, and tibial tuberosity are outlined. The proximal-lateral portal is located at the proximal-lateral corner of the patellar tendon. The distal-medial portal is located at the intersection of the medial border of the tendon and the medial joint line. The investing fascia surrounding the patellar tendon is incised open. The portals are coaxial portals, and the working space is deep to the deep surface of the tendon. The deep surface of the tendon is examined from the patellar insertion to the tibial insertion. Knee extension can facilitate the reach of the tibial insertion. The proximal-lateral portal is the viewing portal. The scar tissue, inflamed synovium, and tophaceous deposit at the retrotendinous space and the surface of the tendon are debrided with an arthroscopic shaver through the distal-medial portal (Fig 2). The avulsed bone fragment is identified and is partially detached from the tendon by an arthroscopic shaver (Smith & Nephew) through the distal-medial portal (Fig 2). The avulsed bone fragment is identified and is partially detached from the tendon by an arthroscopic shaver. Shaving is performed at the bone-tendon interface, with the shaver opening facing the bone fragment. This is followed by resection of the detached portion of the fragment with an arthroscopic acromionizer (Smith & Nephew) (Fig 3). This step of detachment from the tendon, followed by bone resection, starts from the proximal end of the bone fragment downward and is repeated until the whole fragment is resected. The fragment can be stabilized during the resection either by hyperflexion of the knee or by holding of the fragment by the assistant. After complete resection of the fragment and the surrounding scar tissue, a gap in the tendon can be seen. The tophaceous deposit at the tibial tuberosity is located at the proximal-lateral corner of the patellar tendon. The distal-medial portal is located at the intersection of the medial border of the tendon and the medial joint line. The investing fascia surrounding the patellar tendon is incised open. The portals are coaxial portals, and the working space is deep to the deep surface of the tendon. The deep surface of the tendon is examined from the patellar insertion to the tibial insertion. Knee extension can facilitate the reach of the tibial insertion. The proximal-lateral portal is the viewing portal. The scar tissue, inflamed synovium, and tophaceous deposit at the retrotendinous space and the surface of the tendon are debrided with an arthroscopic shaver through the distal-medial portal (Fig 2). The avulsed bone fragment is identified and is partially detached from the tendon by an arthroscopic shaver. Shaving is performed at the bone-tendon interface, with the shaver opening facing the bone fragment. This is followed by resection of the detached portion of the fragment with an arthroscopic acromionizer (Smith & Nephew) (Fig 3). This step of detachment from the tendon, followed by bone resection, starts from the proximal end of the bone fragment downward and is repeated until the whole fragment is resected. The fragment can be stabilized during the resection either by hyperflexion of the knee or by holding of the fragment by the assistant.
debrided. After completion of debridement, the gap in the tendon is assessed (Fig 4). Endoscopic-assisted side-by-side repair to close the gap is performed if the gap is less than 30% of the width of the tendon. The distal sutures are applied through the distal-medial portal, and the proximal sutures are applied through the proximal-lateral portal. A No. 2 Ethibond suture (Ethicon, Somerville, NJ) is passed through the medial half of the tendon from inside out by means of an eyed needle through the distal-medial portal. The movement of the needle is from the deep surface of the patellar tendon toward the skin. A No. 1 PDS suture loop (Ethicon) is passed through the lateral half of the tendon at the same level as the Ethibond suture. The Ethibond suture and the PDS suture loop are retrieved from the superficial surface of the patellar tendon through the distal-medial portal. The suture loop serves as a suture retriever and brings the Ethibond suture limb through the lateral half of the tendon from the superficial surface of the tendon inward. A surgical knot is applied at the deep surface of the tendon by means of a knot pusher (ConMed, Largo, FL) (Video 1). Another suture is applied through the distal-medial portal (Fig 5). If the tendon gap extends proximally,
arthroscopic-assisted suturing can be repeated through the proximal-lateral portal (Table 1). Range of motion, quadriceps control, and weight bearing as tolerated are initiated on the day of surgery.

If the gap is more than 30% of the width of the tendon, the proximal stump of the avulsed tendon can be retrieved through the proximal portal. Krackow suture with stay stitches is applied to the proximal stump. A small incision is made at the tibial tuberosity. The stump is put back by retrieval of the stay stitches to the incision. The avulsed tendon is then sutured to the tibial insertion through a bone tunnel or suture anchor. Side-by-side suturing of the avulsed tendon with the adjacent normal tendon is performed.

**Table 1.** Pearls for Endoscopic Resection of Avulsed Fragment of Tibial Tuberosity and Endoscopic-Assisted Repair of Patellar Tendon

| Preoperative magnetic resonance imaging is essential for surgical planning. |
| The working space is in the retrotendinous space. |
| Thorough examination of the tendon and debridement of the inflamed synovium and scar tissue are essential for symptom control. |
| The adjacent normal tendinous tissue should be respected during resection of the avulsed bone fragment. |
| Applying the sutures through the proximal and distal portals allows the sutures to be spaced out over the tendon rupture site. |

**Discussion**

Patellar tendoscopy has been used to treat chronic patellar tendinitis and tendinosis,12,13 recalcitrant bursitis around the tendon,14 Osgood-Schlatter disease,15 jumper’s knee,16,17 gouty tophus,18 and synovial lipoma of the tendon.19 Our endoscopic technique follows the same surgical principles of debridement, bone resection, and tendon repair as in an open procedure. It is indicated in the case of an avulsion fracture of the tibial tuberosity or partial rupture of the patellar tendon with involvement of less than one-third of the tendon. Preoperative magnetic resonance imaging is useful for determining the location and dimension of the tendon tear and proportion of tendon involvement. This is important information for preoperative planning.

The major advantage of our endoscopic technique is smaller portal incisions away from the patellar tendon, which can minimize the formation of painful scars or unhealed wounds. Open debridement of the lesion requires a long incision directly over the tophus. This can result in symptomatic scar adhesion of the patellar tendon or an unhealed wound with persistent tophaceous discharge. In severe cases, skin necrosis and tendon or joint exposure can occur after debridement.20,21 The use of small portal incisions that are not directly over the patellar tendon can avoid these complications.17,18 Moreover, the use of endoscopy can allow examination of the whole tendon, similar to open exploration of the tendon. Precise debridement under arthroscopic guidance hopefully can reduce the surgical trauma to the tendon. The use of the proximal and distal portals can allow an even distribution of the sutures.

The main contraindication to the described technique is involvement of more than two-thirds of the patellar tendon, for which tendon reconstruction may be indicated. Debridement of the tophaceous deposition at the tibial tuberosity should be performed with caution because debridement of the adjacent tendon may weaken the tendon insertion and result in tendon rupture.19 However, in the case of an avulsion fracture of the tibial tuberosity with gouty deposition, debridement of the tophus is considered essential to reduce the risk of invasion of the adjacent bone and tendon leading to a further avulsion fracture or tendon rupture. The major limitation of our technique is that it is technically demanding and should be reserved for the experienced
arthroscopist. In conclusion, endoscopic resection of an avulsed fragment of the tibial tuberosity and endoscopic-assisted repair of the patellar tendon comprise a viable alternative to the open procedure.

References