Meniscal Repair: Intra- and Postoperative Complications

6.2

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Introduction

Arthroscopic meniscal procedures have a relatively low complication rate. In a large retrospective study sponsored by the Arthroscopy Association of North America (AANA) in 1985, De Lee [15] reported an overall complication rate of 0.6%. In this survey, focusing on diagnostic arthroscopy and first-generation arthroscopic surgical procedures, some serious neurological and vascular complications were identified. This rate was believed to be underestimated, and specific complications of meniscal repair procedures were not considered. Variability in the reported overall complication rate of arthroscopic meniscal surgery depends on the criteria used to define a surgical complication. In a prospective study conducted together with the French Arthroscopy Society (SFA), reporting an overall complication rate of 16%, Coudane and Buisson [14] defined a complication as every phenomenon considered abnormal by the patient or the surgeon during and after an arthroscopic procedure. In a prospective survey of 8,741 knee joint procedures, the AANA evaluated complications in arthroscopic surgery [46]: the overall complication rate was 1.8%, and the incidence of complications was not higher for meniscal repair (1.2%) than for partial meniscectomy (1.7%). An analysis of large surveys of meniscal repair procedures performed by the AANA [45–47] and SFA [28] showed that serious injury involving neurovascular structures was rarely encountered in the most recent studies (Table 6.2.1).

The focus of treatment on preservation and repair of the meniscus whenever possible has led to the development of new approaches to arthroscopic and minimally invasive meniscal repair techniques. In meniscal repair, iatrogenic damage to neurovascular structures including the peroneal and saphenous nerve and popliteal artery, are of utmost concern to both the orthopedic surgeon and the patient. To minimize the neurovascular risks, a number of all-inside devices (arrow, dart, staples, and screws) and repair techniques have been developed, but each has its own specific complications such as cartilage damage or meniscal implant failure. When performing a meniscal repair, the surgeon must keep in mind that each step in this surgery can carry a potential pitfall and be a source of complications: posterolateral or posteromedial approaches, extraarticular knotting, meniscal needles, and all-inside repair devices. Every anatomic structure around or inside the joint can be injured (Fig. 6.2.1a).

Neurovascular and Soft-Tissue Complications

All meniscal repair techniques of the posterior and posterolateral horn of both the medial and lateral meniscus are fraught with the risk of damaging neurovascular structures. Because of their anatomic location (Fig. 6.2.1b, c), the popliteal artery and the common peroneal nerve may be injured when the posterior horn of the lateral meniscus is repaired. Repairing the posterior horn of the medial meniscus carries the risk of saphenous nerve injury (mainly the infrapatellar branch of the nerve). Injuries of the tibial nerve or popliteal vein have not been reported in recent studies of meniscal repair.

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Table 6.2.1 Major complications reported after meniscal repair procedures

	AANA 1986 [45] retrospective $N=3034$	AANA 1990 [46,47] prospective $N=257$	SFA 2003 [28] retrospective $N=203$	SFA 2003 [28] prospective $N=75$
Saphenous nerve injury	30	1	4	0
Peroneal nerve injury	6	0	0	1
Vascular injury	3	0	0	0
Cartilage damage	–	–	3	0
Meniscal damage	–	–	1	0
Synovitis	–	–	1	0

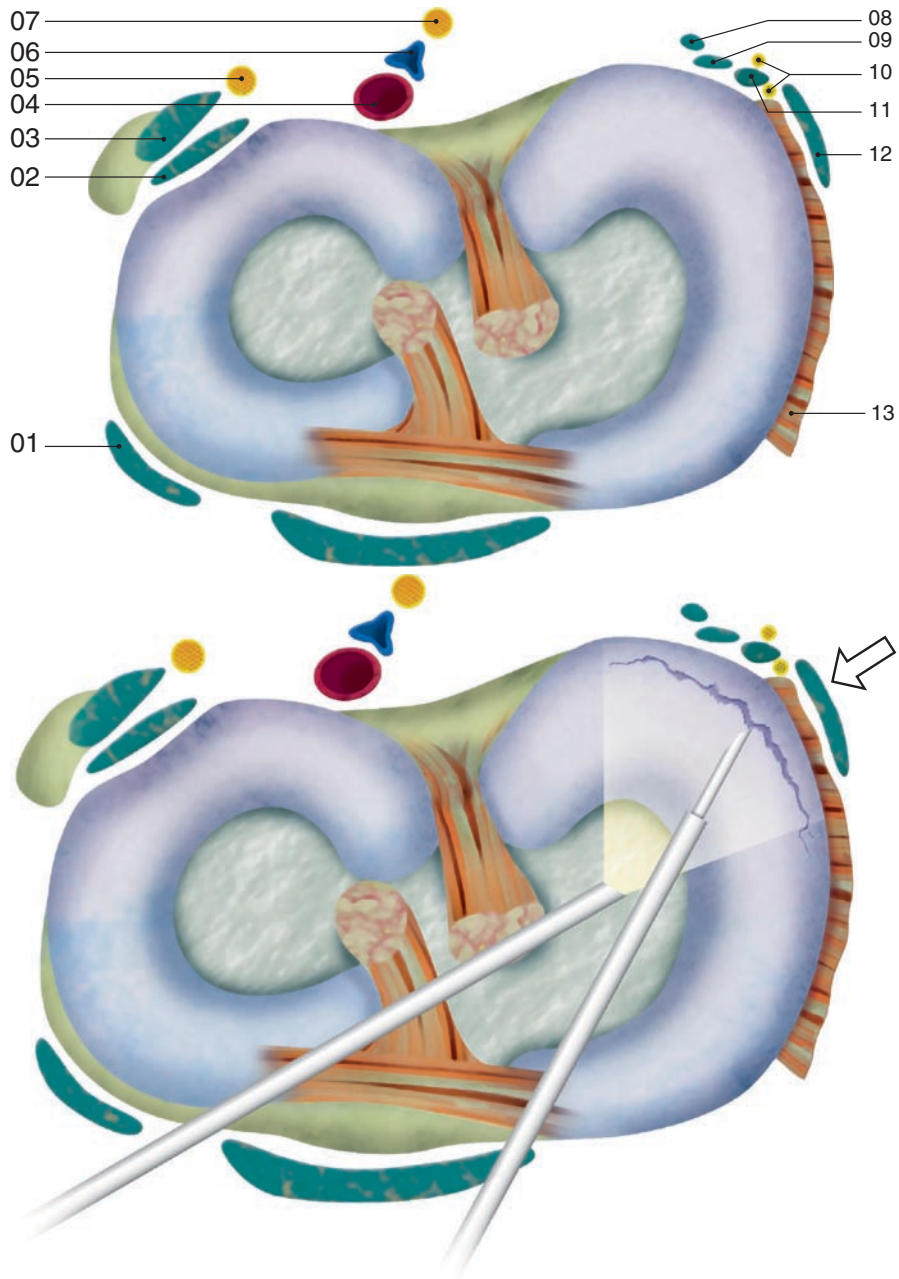
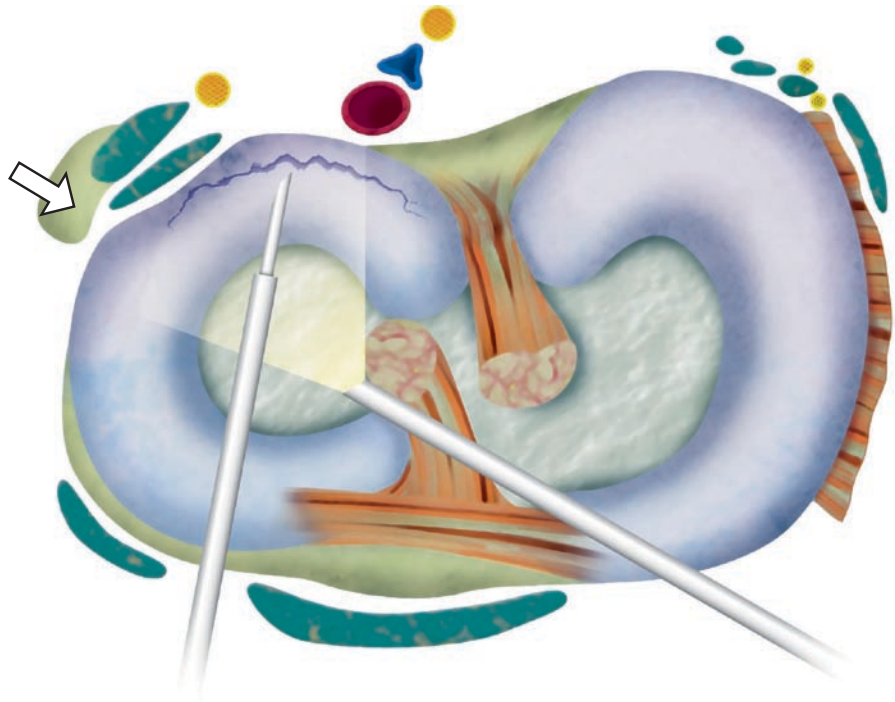


Fig. 6.2.1 (**a**) *1* Iliotibial band, *2* popliteus tendon, *3* biceps tendon, *4* popliteal artery, *5* peroneal nerve, *6* popliteal vein, *7* tibial nerve, *8* semitendinosus tendon, *9* semimembranosus tendon, *10* saphenous nerve, *11* gracilis tendon, *12* sartorius tendon, and *13* medial collateral ligament. (**b**) Structures at risk when repairing the medial meniscus. The *arrow* shows the posteromedial approach. (**c**) Structures at risk when repairing the lateral meniscus. The *arrow* shows the posterolateral approach

Fig. 6.2.1 (continued)



Popliteal artery injury, including pseudoaneurysms and arteriovenous fistulas resulting from laceration or penetration during meniscal surgery, is extremely rare. Several such complications have been reported during arthroscopic meniscectomy [9,11,47], the injury usually being caused by a basket forceps or the use of a shaver without adequate direct visualization. Henning et al. [24] reported a popliteal artery laceration after lateral meniscal repair using a posterior approach. At the proximal aspect of the popliteal fossa, the popliteal artery is located slightly medial to the midline, in front of the popliteal vein and medial to the tibial nerve. At the level of the knee joint, it lies slightly lateral to the midline, in close proximity to the posterior region of the lateral meniscus (Fig. 6.2.2). Because of its anatomic location, the popliteal artery is at risk during lateral meniscal surgery and may be injured during posterolateral surgical dissection or by the posterior exit of a needle or an all-inside device. In a cadaveric study, Cohen et al. [13] referred to the proximity of the popliteal artery with two all-inside repair devices inserted in the posterior horn of the lateral meniscus. Using a penetration limiter and an appropriate needle or meniscal implant of proper length and introducing the device through the contralateral portal (when possible) allows a safer all-inside repair. With an inside-out repair technique, the use of a posterolateral approach is recommended to control the posterior exit of the needles and to safely tighten the knots. Early diagnosis of vascular injury is essential to avoid catastrophic consequences: the surgeon must take care of early and unusual pain after a meniscal procedure. If the clinical examination suggests a popliteal artery injury, the

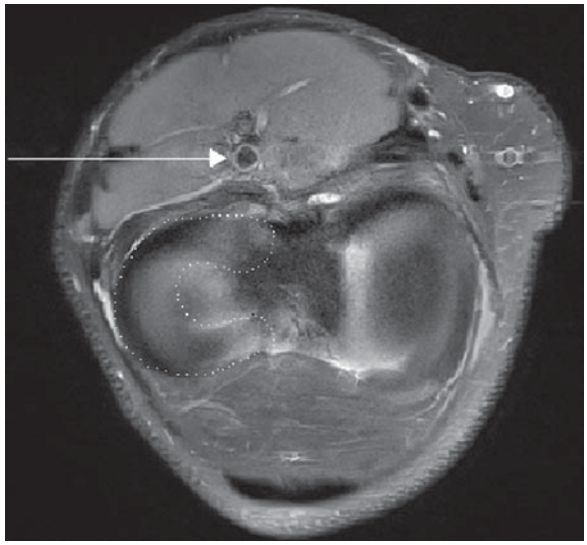


Fig. 6.2.2 Axial MRI view at the knee joint level showing the proximity of the popliteal artery (*arrow*) to the posterior horn of the lateral meniscus (*dotted line*)

diagnosis must be confirmed by ultrasonography or angiography (computed tomographic or catheter-based angiography) prior to surgery.

The peroneal nerve is at risk when the lateral meniscus is repaired near or posterior to the popliteal recess. In an anatomic cadaveric study, Jurist et al. [27] showed that inside-out needles placed into the posterior horn of the lateral meniscus are very close to the peroneal nerve. The nerve runs posterior to the posterior border of the biceps tendon at the joint line level; it then crosses the lateral gastrocnemius and turns around the head and neck of the fibula before entering the anterolateral compartment of the lower leg. Anatomic variability in the course of the peroneal nerve is common and could also be a cause of iatrogenic injury. Deutsch et al. [19] performed a cadaver study of the anatomy of the common peroneal nerve around the joint and described one to five separate peroneal nerve branches at the level of the joint line. The common peroneal nerve divides into its deep and superficial branches at or distal to the fibular neck in only 80% of cases. Krivic et al. [30] reported a case of complete lesion of the common peroneal nerve during inside-out lateral meniscus repair. They found an unusually located common peroneal nerve during revision surgery. Injury to the peroneal nerve is rare during meniscal repair. In a retrospective study of the AANA [45], Small reported six cases in 3,034 meniscal sutures. Boyd and Myers [8] described one neuropraxia of the peroneal nerve in 288 meniscal repairs which resolved after 6 weeks, and Jurist et al. [27] reported one case of complete peroneal nerve palsy after inside-out meniscal repair combined with a posterolateral approach. The nerve injury usually occurs when a posterolateral approach is used to repair the meniscus (directly or by an inside-out or outside-in technique). Peroneal nerve injury can be caused by needle puncture, sutures tied over the nerve, technical error in surgical approach or excessive tension on nerve during posterolateral exposure. The type of injury conditions the quality of neural healing and functional recovery. An all-inside repair technique appears to be safer with regard to peroneal nerve injury as long as the depth of penetration of the meniscal device and implant is being controlled. When a posterolateral incision is used, the peroneal nerve must be protected by a retractor placed anterior to the biceps tendon and the knee must be held in 60–90° of flexion, bearing in mind the anatomic variability in the course of the nerve. Anterior deflection of the needle tip and inserting the needle or suture holder through a contralateral portal, when possible, will avoid posterior exit of the needle towards the peroneal nerve.

Neurapraxia of the saphenous nerve and its infrapatellar branches is the most common neural injury. Barber [4] reported 22% of transient saphenous neurapraxia after meniscal inside-out repair in 24 patients. Stone and Miller [51] reported 43%, of which 8% were symptomatic at follow-up. In a retrospective multicentre study of 203 meniscal repairs using various techniques [28], the SFA reported four cases of saphenous neurapraxia, all associated with the use of a posteromedial approach. The saphenous nerve usually exits the Hunter canal between the sartorius and gracilis tendons along the medial aspect of the knee, and frequently shows anatomic variability in its course and in the number of infrapatellar branches at the knee joint level. The nerve location varies with the degree of knee flexion or extension [36]. When the knee is fully extended, the nerve lies approximately 2 cm anterior to the posteromedial corner; when the knee is in 70–90° of flexion, the nerve lies near the joint, in the posteromedial corner. In order to prevent saphenous nerve injury, Morgan and Casscells [36] described a posteromedial approach located 2 cm behind the posteromedial corner with the knee in only 10–15° of flexion. Conversely, Espejo-Baena et al. [20] recommended a medial incision located more anteriorly and distally, with the knee in 70–90° of flexion. They described a "safety zone" between the surface of the fascia cruris and the medial collateral ligament, where knotting is performed using an inside-out meniscus repair technique. Arthroscopic transillumination at the posteromedial corner can also help locate the nerve [29]. Careful dissection and knotting the sutures directly over the capsule will avoid injury or entrapment of soft tissues and small nerve branches. Saphenous neurapraxia has become a very rare complication since the development of all-inside meniscal repair techniques. Spindler et al. [50] reported a 13% nerve injury rate when repairing the medial meniscus with an inside-out technique, vs. 0% when using arrows with an entirely arthroscopic technique. When an all-inside meniscal repair is performed, saphenous nerve irritation can be caused by implant failure and migration [42] or by a prominent meniscal arrow tip [1]. In a cadaveric study of medial meniscus repair using an inside-out suturing device, Espejo-Baena et al. [20] showed that no vascular or nervous structures were pierced by needles. However, on posterior knot tightening, many structures became

trapped. In case of persistent saphenous nerve irritation, steroids, or long-acting anesthetic drugs can be locally injected and usually lead to good functional recovery.

Other soft-tissue injuries during meniscal repair could be responsible for residual pain after surgery (Fig. 6.2.1b, c). Anatomic cadaveric studies, in which different meniscal repair techniques (inside-out and all-inside) and meniscal repair devices were used, showed a high incidence of soft-tissue injuries. Entrapment of the popliteal tendon and iliotibial band has been reported during lateral meniscus repair [20,35], Entrapment of the saphenous vein and the different layers of the medial collateral ligament, and tenodesis of the sartorius, gracilis, and semimembranosus tendons have been observed during medial meniscus repair [12,20].

Complications Related to Meniscal Devices and Implants

The objective of all-inside meniscal repair techniques is to minimize surgical incisions and neurovascular risks and to decrease the operating time while ensuring that the biomechanical properties of the repaired meniscus are as close as possible to those obtained with vertical sutures. With the growing development of meniscal devices and implants, new complications of meniscal repair surgery have emerged.

The absorption profile of meniscal implants affects their biomechanical properties and leads to possible fragmentation, which can be a source of some specific complications. A number of meniscal repair implants are made of polylactic acid (Mitek RapidLoc) or its derivatives: poly-L,D-lactic acid (Arthrex Meniscal Dart), poly-L-lactic acid (Linvatec BioStinger, Clearfix Meniscal Screw), and self-reinforced poly-L-lactic acid (Meniscus Arrow). The tensile strength of poly-L-lactic acid decreases significantly after 6–12 weeks. The structural integrity of these polymers declines with time, leading to a decrease of the molecular weight and eventual fragmentation of the implant [21]. A nonspecific foreign-body reaction is induced by lower-molecular weight polymer. When using biodegradable implants, a foreign-body reaction induced by the degradation of the implant can cause aseptic synovitis [2,48]. The mechanism of synovitis is not well understood; the shape and the crystallinity of the implant as well as some other mechanical factors seem to influence the degradation rate of the material and cause synovitis. If this is the case, removal of the meniscal implant and all implant fragments is indicated. Arthroscopic synovectomy is associated in case of severe inflammation with hypertrophy of synovial membranes. Removing all small articular implant fragments can help achieve full functional recovery.

Because the Bionx Meniscus Arrow was the first implant to become popular, its complications have been reported in several studies. Chondral injury is of particular concern and occurs when the head of the arrow is not inserted sufficiently deep in the meniscal tissue. Chondral damage is located in the posterior area of the femoral condyle overlying the arrow; the depth of the chondral groove created by the head of the arrow can vary from partial to full thickness (Fig. 6.2.3). Several cases of chondral grooving have been reported [31,34,39,41,43,44], and have also been observed with other meniscal implants such as Mitek RapidLoc [5], Mitek Meniscus Staple [32], Biostinger bioabsorbable device [2], and bioabsorbable screw. At a second-look arthroscopy, Sarimo et al. found some degree of chondral irritation at the repair site in 7 out of 13 patients [41]. These results are in contrast with the nearly 0% rate of chondral injury with meniscal repairs using traditional vertical sutures or all-inside Fast-Fix suturing devices [22].

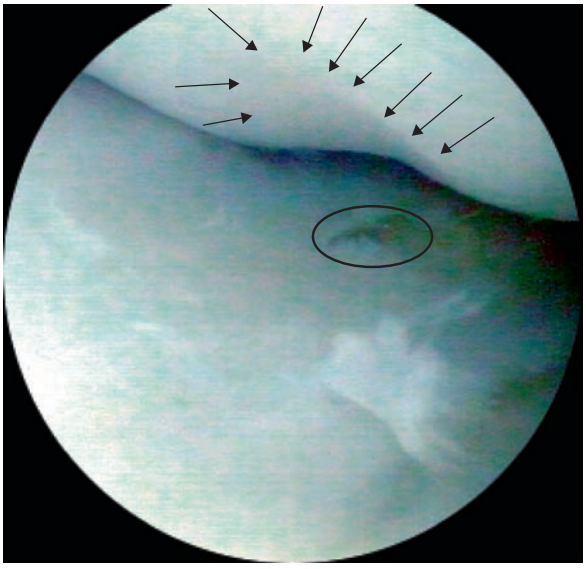


Fig. 6.2.3 Chondral grooving of the femoral condyle caused by the head of a meniscal arrow (courtesy R Seil, J Menetrey)

Other mechanical complications related to the use of bioabsorbable meniscal implants are local irritation at the site of repair usually resolving within 3–12 months [26,31,40,41,52,53], implant breakage [10,31,39], subcutaneous migration [7,32,38], articular migration [52], foreign-body reaction [33,39], cystic haematoma formation [23], and synovial cyst formation [3]. Because all-inside meniscal repair techniques remain technically demanding procedures, some complications are particularly encountered during the learning curve period: intraarticular loosening of the implant, articular deployment of the implant, failure, or section of suture during tensioning (with Fast-Fix and RapidLoc repair systems), and intraoperative meniscal and chondral damage.

Nonspecific Complications

Nonspecific complications are equally prevalent after any type of arthroscopic meniscal surgery. Some of them, e.g., septic arthritis and pulmonary embolism, cause significant morbidity, sometimes leading to serious sequelae, and should not be overlooked.

Infection following arthroscopic knee surgery is relatively rare, with Small [46] reporting a 0.21% rate in 8,791 arthroscopic knee procedures. The most commonly identified germs in septic arthritis after arthroscopic knee surgery are Staphylococcus and Streptococcus species. Long operating times, intraarticular steroid injections, and inadequate sterilization of arthroscopic instruments, especially cannulas, increase the risk of septic arthritis, as was reported by Blevins et al. [6]. Early diagnosis, immediate arthroscopic lavage, and intravenous antibiotics are crucial to achieve full recovery.

Deep venous thrombosis (DVT) following knee arthroscopy is a consistent finding in studies of unprophylaxed patients when routine screening using venography or ultrasonography is performed. Demers et al. [18] found that 17.9% of 184 patients presented DVT, documented by venography following knee arthroscopy; 4.9% of them had proximal DVT. There was no clinically suspected pulmonary embolism; 39.4% of patients with DVT were clinically asymptomatic. Delis et al. [17] and Hoppener et al. [25] reported a 7.8 and 5.7% incidence of DVT, respectively, using an ultrasonographic detection device. Hoppener et al. [25] did not identify risk factors for DVT, while Demers et al. [18] found the risk to be significantly higher with tourniquet times of more than 60 min. Delis et al. [17] demonstrated a higher incidence of DVT among patients with two or more risk factors for thromboembolism. Prophylaxis with low-molecular weight heparin significantly reduced the rate of DVT [54] but had some side effects: minor bleeding and transient variations in platelet count in a minority of patients, rarely major bleeding. Pharmacological thromboprophylaxis seems justified after both knee arthroscopy and meniscal repair but a clearly identified high-risk group and a consensus on the duration of treatment are lacking.

Arthrofibrosis sometimes seems to be associated with meniscal repair [29] and can be observed when posterior capsular tissues have been overtightened, limiting the extension of the knee. Morgan and Casscells [36] recommend tying the sutures with the knee in full extension in order to prevent excessive posterior capsular tensioning.

Reflex sympathetic dystrophy (RSD), also known as type 1 complex regional pain syndrome, is a multisymptom syndrome usually affecting one extremity. Symptoms include unusually prolonged pain, vasomotor disturbances, and trophic changes in soft tissues. According to O'Brien et al. [37], arthroscopic procedures were the most common event precipitating RSD of the knee. Because RSD remains poorly understood and often difficult to treat, neural blockade is helpful to obtain resolution of symptoms. Complete functional recovery is usually obtained after a period of 6–24 months. The prognosis seems to be closely related to the presence or absence of a remaining anatomic lesion or a persistent painful stimulus [37]. In the postoperative period, pain can be relieved by intraarticular injection of long-acting anesthetic drugs or morphine, but the effect on reducing the incidence of RSD is not proven. Patellar tendon contracture and loss of patellar height are more uncommon in RSD [49], but can be involved in the mechanical limitation of knee flexion. If patella infera persists after the resolution of all RSD symptoms, surgical lengthening of the patellar tendon can be proposed, as described by Dejour et al. [16].

Medial collateral ligament rupture has been reported during medial meniscal procedures [46] when excessive valgus forces are applied to a tight medial compartment. When visualization of the posterior horn of the medial meniscus is difficult, it is however possible to relax the tight medial ligament by means of several needle punctures. Healing is usually achieved with no residual laxity or local pain.

Several other complications have been reported after arthroscopic knee surgery, such as hemarthrosis, instrument failure, compartment syndrome, and knee fracture.

Conclusion

Meniscal repair surgeries have become minimally invasive procedures with relatively low morbidity, comparable to arthroscopic meniscectomy. Complications are very rare, among which neurovascular damage is the most serious and could lead to definite sequelae. Complications related to the surgical approach and repair technique can largely be avoided with a thorough understanding of neurovascular anatomy and proper surgical planning of posterolateral or posteromedial incisions, when needed. The orthopedic surgeon must be familiar with the method of repair, and with the specific pitfalls and complications of all-inside meniscal devices.

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