

A case report of compartment syndrome of the lower leg during arthroscopic knee surgery

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Abstract

Serious complications following arthroscopic knee surgery are unusual. In the present case, the patient had no predictive factors for complications of compartment syndrome other than age. Compartment syndrome might have developed due to the invasiveness of the varicose vein surgery. Delayed diagnosis of compartment syndrome is associated with irreversible neurological dysfunction. Careful observation of the lower leg is necessary during the perioperative period.

Keywords: Complication, Compartment syndrome, Arthroscopic surgery, Varicose vein surgery, Fasciotomy

Introduction

Arthroscopic knee surgery for treatment of meniscal injury is commonly performed. The operation is a safe and minimally invasive procedure, and serious complications such as compartment syndrome in the lower leg are unusual. We herein present a case of compartment syndrome following arthroscopic knee meniscectomy in a patient with a history of varicose vein surgery and discuss the clinical mechanism of this complication.

Case report

A 55-year-old woman presented with a 6-month history of right knee pain. She had undergone varicose vein surgery by vein stripping and endoscopic ligation in her right lower leg about 1 year previously. Physical examination of the right knee showed no effusion and full range of motion. Tenderness was present in the medial joint space, and the McMurray test was positive; however, the anterior and posterior drawer test was negative and no obvious muscle atrophy was present. Radiography of the right knee showed slight narrowing of the medial joint space with no obvious osteophyte formation (Figure 1). Magnetic resonance imaging showed a horizontal tear at the posterior horn of the medial meniscus, but a Baker's cyst was not observed (Figure 2).

The patient's pain did not improve with conservative treatment; therefore, arthroscopic surgery to repair the posterior tear of the medial meniscus was performed. After establishment of lumbar spinal anesthesia in combination with intravenous anesthesia, the surgery was performed using a femoral tourniquet inflated to 350 mmHg. For approximately 30 minutes, irrigation fluid (Ringer's lactate) was introduced using a gravity flow system. The standard medial and lateral infrapatellar portals were used, and partial resection of the posterior horn of the medial meniscus was performed using a

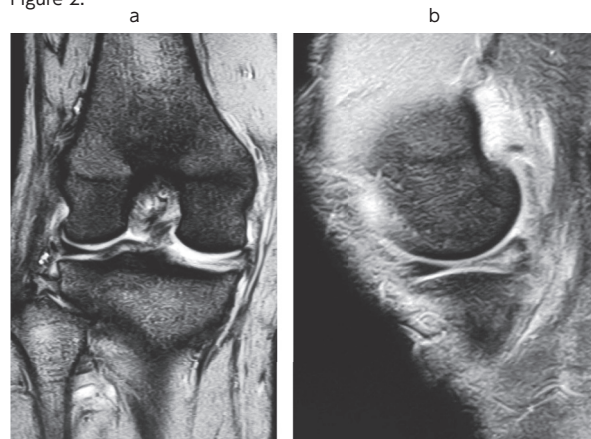
shaver and arthroscopic scissors. No abnormal findings were encountered other than the meniscal injury. Intra-articular decompression such as joint capsule rupture was not observed during the surgery.

Figure 1.



Preoperative radiography of the right knee joint in the anteroposterior plane shows medial joint space narrowing with no obvious osteophyte.

Figure 2.



Preoperative T2-weighted magnetic resonance image of the right knee joint in the (a) coronal plane and (b) sagittal plane shows a horizontal tear at the posterior horn of the medial meniscus with no Baker's cyst.

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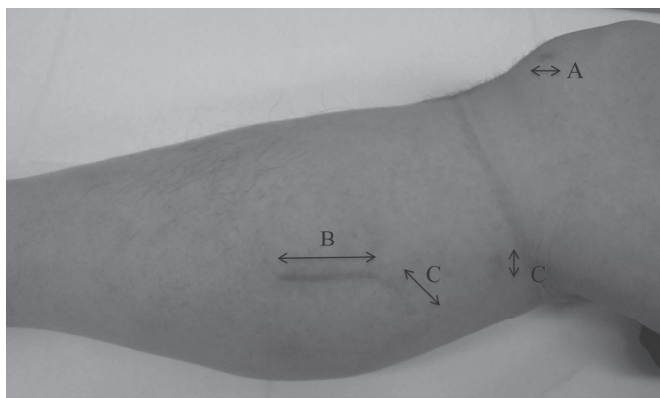
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Remarkable tension in the lower leg developed after deflation of the tourniquet. We diagnosed acute lower leg compartment syndrome based on the presence of cold, pale skin of the lower leg and a pulseless dorsalis pedis artery and posterior tibial artery. It appeared likely that the inner pressure of the posterior compartment was too high because the pulse pressure of the dorsalis pedis artery was weakly perceivable using Doppler. The pulselessness of the arteries was persistent 30 minutes after the surgery, and the tension was particularly high around the inside to posterior aspect of the lower leg; therefore, a limited skin incision for decompression was made around the inside scar of the varicose vein surgery (Figure 3). The muscle was distended and edematous, but its color was within normal limits. Subcutaneous release was performed with the intermuscular septum between the gastrocnemius and pes anserinus, and irrigation fluid with a small amount of a viscous, joint fluid-like liquid was discharged. Insertion of a probe into the skin incision confirmed the presence of an open route to the joint-line articular cavity. Measurement of the irrigation fluid showed that approximately 700 ml had leaked into the surrounding soft tissues in the lower extremity.

A pulse was perceivable in the bilateral arteries immediately after the subcutaneous release, and self-movement of the toes was possible 6 hours postoperatively. No postoperative sequelae, including neurovascular dysfunction, were observed. Delayed skin suturing was performed 2 days postoperatively, and the patient was discharged from the hospital 5 days postoperatively. Ten months after the surgery, recovery of the meniscal injury was confirmed based on the Japanese Orthopaedic Association score. Of a possible total of 100 points for 7 items (pain on walking, pain on going up and down stairs, pain on extending the knee, landing on the diseased leg, McMurray test result, diameter of the femur, and tenderness of the joint space), the patient scored 90 points postoperatively (20, 20, 20, 5, 10, 5, and 5 points, respectively) compared with 35 points immediately before surgery (10, 5, 10, 0, 5, 5, and 0 points, respectively).

We informed the patient that the data would be submitted for publication and obtained her consent.

Figure 3.



Skin incision scars show (A) the medial infrapatellar portal and (B) decompression of the compartment syndrome during the arthroscopic surgery and (C) the varicose vein surgery in the right lower extremity.

Discussion

The incidence of complications following arthroscopic surgery reportedly ranges from 0.56% to 8.20%.¹⁻⁴ The predictive factors for complications in high-risk patients include an age of >50 years and a tourniquet time of >60 minutes. More specifically, the complication rate of fluid extravasation into the surrounding soft tissues was approximately 1%,^{5,6} and the risk factors of which were the use of a pressure delivery irrigation system, a partial tourniquet effect on venous return, and rupture of the suprapatellar pouch or semimembranosus bursa.⁶

The development of compartment syndrome after use of irrigation fluid in arthroscopic surgery is unusual. To date, seven such cases have been reported in the English-language literature. In these cases, fasciotomy was performed for the treatment of compartment syndrome of lower leg that developed after arthroscopic knee surgery^{5,7-11} (Table 1). In these cases, compartment syndrome developed due to excessive perfusion pressure, which caused an increased in the intra-articular pressure,^{5,7,8,10} perioperative damage to the capsule,^{7,11} blockage of the draining canuula,⁷ traumatic capsular and fascial injury,⁹ and an increased length of surgery.¹⁰ None of these factors were associated with the present case; the only risk factor present in our patient was an age of 55 years.

A committee of the Japan Arthroscopy Association reported that 18,499 arthroscopic knee surgeries were performed among 205 institutions in the year 2003. The incidence of complications was 0.83%, and these complications did not include compartment syndrome due to fluid extravasation.¹³

Notably, our patient had undergone varicose vein surgery in the same lower extremity about 1 year before the arthroscopic knee surgery. During the varicose vein surgery, the greater saphenous vein was stripped and an incompetent communicating vein was ligated endoscopically. The endoscope was inserted under the fascia and released between the gastrocnemius and pes anserinus at a point about 15 cm distal to the knee joint. No complications occurred during the varicose vein surgery in the present case, and such surgeries are generally accompanied by few serious complications.¹⁴

Arthroscopic knee surgery and varicose vein surgery have been performed more frequently in Japan¹² and are generally recognized as less invasive and safe procedures.

The pressure of the posterior compartment is reportedly higher than that of the anterior and lateral compartments after arthroscopic knee surgery.¹⁵

In the present case, we suspect that the extravasated fluid leaked into the posterior compartment beneath the pes anserinus tendons to the lower extremity because the inserted probe reached the articular cavity. This pathway resembled the mechanism described in a case of irrigation fluid leakage into the posterior compartment secondary to synovial pouch rupture between the gastrocnemius and semimembranosus.⁶ This area corresponded to the region in which the endoscope was inserted during the varicose vein surgery in our case.

The elevated compartment pressure due to the leaked irrigation fluid remains for a longer period of time in patients with than without fascial injury, and when the volume of extravasated fluid exceeds a fixed quantity, the compartment pressure increases remarkably.⁹

Based on these findings, we considered that the compartment syndrome in our case might have developed due to the

Table 1. Patient characteristics

Authors	Year	Age (years)	Mechanism	Disease	Fasciotomy	Journal
Peek and Haynes ⁹	1984	25	Capsular and fascial injury	Proximal fibula fracture	Four compartment	<i>Am J Sports Med</i>
Fruensgaard and Holm ⁷	1988	43	Capsular tear, failure of irrigation pressure or draining cannula	Medial meniscus tear	Medial and lateral compartment	<i>J Bone Joint Surg Br</i>
Bomberg et al. ⁵	1992	21	Excessive perfusion pressure	Posterior cruciate ligament tear	Four compartment	<i>Arthroscopy</i>
Bamford et al. ¹⁰	1993	19	Excessive perfusion pressure	Medial meniscus tear	Posterior compartment	<i>J R Coll Surg Edinb</i>
Bamford et al. ¹⁰	1993	32	Length of surgery	Degenerate lateral meniscus	Four compartment	<i>J R Coll Surg Edinb</i>
Amendola et al. ¹¹	1999	32	Capsular defect	Arthrolysis after ligament reconstruction	Four compartment	<i>Arthroscopy</i>
Tommaso et al. ⁸	2004	30	Excessive perfusion pressure	Diagnostic arthroscopy	Posterior compartment	<i>Anaesthesia</i>

surgical invasiveness involved in stripping of the greater saphenous vein and ligation of the incompetent communicating vein. The leakage of the irrigation fluid might have been further accelerated due to the increased intra-articular pressure caused by the flexed position of the knee during the surgery,⁶ which readily contributes to compartment syndrome. Therefore, the pulse pressure of the arteries was recovered only after subcutaneous release around the pes anserinus by the limited skin incision.

The extravasated fluid causing compartment syndrome during arthroscopic knee surgery may also be removed without a fasciotomy incision.^{10,11} Such cases can be recognized earlier by the presence of a tense lower leg and avoidance of the ischemic state was acquired in order that the operative procedure was stopped immediately. However, neurological dysfunction may remain in cases of delayed diagnosis of compartment syndrome, even if a fasciotomy procedure is performed postoperatively.¹⁶

Careful observation of the lower leg is necessary during the perioperative period because a delayed diagnosis of compartment syndrome could result in serious ischemic dysfunction.

In summary, we experienced a case of compartment syndrome in a lower leg after arthroscopic knee meniscectomy. A possible cause of the complication in this case was the patient's history of varicose vein surgery.

Conflict of interest

None of the authors have any actual or perceived conflicts of interest of a financial nature regarding the work in the manuscript.

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