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CASE REPORT

Compartment Syndrome as a Complication of Routine Knee Arthroscopy: Report of Five Cases and Review of the Literature

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ABSTRACT

Acute compartment syndrome following arthroscopy is rare. Five cases of compartment syndrome resulting from arthroscopic surgery of the knee are presented. All of the cases were associated with the use of a tourniquet and pressure pumps. A capsular injury, either acute or chronic, was seen in most of the cases. Palpation of the thigh or calf during the procedure can allow an early diagnosis. Recommended initial treatment is observation owing to the quick reabsorption of the fluid from the affected compartment(s) and in this series no complications were present afterward. If acute compartment syndrome is diagnosed during the procedure, switching to gravity irrigation to stop the further extravasation of fluid in the affected compartment, releasing the tourniquet, and completing the monitoring of the tension of the compartment(s) are recommended. If the condition is diagnosed after completion of the case, the recommendation is to observe and avoid rushing to do a compartment release.

INTRODUCTION

Compartment syndrome is defined as the progressive condition in which increased compartmental interstitial pressure exceeds capillary pressures resulting in neurovascular ischemia. It is most commonly seen after trauma. It is a very rare complication of routine diagnostic arthroscopy, of which few cases have been reported. Diagnostic arthroscopy of the knee is one of the most common surgical procedures performed in orthopedics. It is generally considered a low-risk procedure with a minimal complication rate. Sherman et al. [1] in 1986 reported a series of 2,640 arthroscopic procedures of the knee, and the incidence of complications was of 8.2 %. The major complications included infection, deep vein thrombosis, pulmonary embolism, vascular injury, nerve injury, reflex sympathetic dystrophy, hematoma, adhesions and intraarticular instrument breakage. The minor complications included superficial wound infection, ecchymosis and wound healing problems.

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They concluded that the highest risk factors were the age of the patient of (older than 50) and the tourniquet time (more than 60 minutes). Surgical experience was not a factor in the incidence of complications. In a five-year review of the American College of Surgeons National Surgical Quality Improvement Program, Martin et al [2] reported in 2013 a 1.6% complication rate in 12,271 knee arthroscopies. In their study the most important risk factors on univarite analysis were black race, surgical time of more than 1.5 hours, higher ASA class, and patients having prior surgery within 30 days of the procedure.

This report presents a series of five cases of compartment syndrome occurring as a complication of routine knee arthroscopic procedures seen in 18 years of medical practice. This complication occurred in 2 female patients and 3 male patients, with ages ranging between 32 and 67 years. It affected the anterior thigh in 2 patients and the lower leg in three patients. The cases are presented in chronological order. Two of the cases occurred at a surgery center and the other three at two different hospitals. All of the arthroscopic surgeries were performed under general anesthesia, using a tourniquet at 350 mmHg in the first two cases and 250 mmHg in the last three cases and using three different arthroscopic water pumps employing the recommended manufacturer pressure. All of the patients and family members were informed of the complication.

CASE REPORTS

Case 1

A 32-year-old Hispanic male with a recent injury that resulted in a posterior horn medial meniscal tear had a diagnostic arthroscopy and partial medial meniscectomy at an outpatient surgery center. The tourniquet time was 35 minutes. At the completion of the procedure and tourniquet release, the patient's lower leg was noted to be very tense on palpation and pale and the patient had no pulses present distally. The patient remained under anesthesia and a decision was made to do a four-compartment fasciotomy, the pulses returning immediately. The patient was transferred to an adjacent hospital, where he had his wounds closed at a later date. His follow-up was uneventful.

Case 2

A 35-year-old Caucasian female sustained an injury to her knee after she fell jumping hurdles. MRI demonstrated the presence of a medial collateral ligament sprain, a partial-thickness quadriceps muscle tear, and an anterior cruciate ligament tear. Owing to the significant edema on presentation the patient was initially treated with bracing, anti-inflammatory medications, and physical therapy to restore the range of motion and decrease her pain. Six weeks later, the patient was taken to the operating room for anterior cruciate ligament reconstruction. After only 3 minutes from the beginning of the arthroscopy, the anterior thigh compartment was extremely tense. The procedure was stopped and the tourniquet deflated. The patient had significantly diminished pulses compared with the contralateral extremity. The procedure was canceled and the patient was taken to the recovery room, where she stayed for 2 hours for close observation. During that time her pulse strength normalized and the tension in the thigh resolved. Her follow-up was uneventful.

Case 3

A 67-year-old Caucasian male with a history of lateral compartment osteoarthritis and a lateral meniscal tear underwent an arthroscopic partial lateral meniscectomy and chondroplasty. The tourniquet time was 30 minutes. At the end of the procedure and release of the tourniquet, the patient's lower leg was noted to be extremely tense in all compartments, pale, and no pulses were palpable. The lower extremity was periodically elevated and compressed with an elastic band until the pulses were detectable by Doppler ultrasound, at this time the patient being taken to the recovery room. In less than hour, the patient's pulses were completely restored and the leg tension clinically normalized. Follow-up was uneventful.

Case 4

A 57-year-old Caucasian female with a history of a chronic lateral meniscal tear associated with a painful lateral meniscal cyst underwent an arthroscopic complete lateral meniscectomy. The tourniquet time was less than 30 minutes. At the end of the procedure and release of the tourniquet, the patient's lower leg was noted to be extremely tense in all compartments, pale, and no pulses were palpable. The patient's lower extremity was periodically elevated and compressed with an elastic band until the pulse could be detected using Doppler, at this time the patient being taken to the recovery room. In less than 2 hours, her pulses were completely restored and the leg tension clinically normalized. Follow-up was uneventful.

Case 5

A 64-year-old Hispanic male was taken to the operating room for an arthroscopic procedure to treat a symptomatic posterior horn medial meniscal tear. At the beginning of the procedure, a thick suprapatellar plica was removed and the synovial capsule was accidentally perforated by the shaver. In less than 5 minutes the anterior thigh became significantly tense in the anterior compartment. In this case, the pressure pump was stopped and the tourniquet was deflated and no pulses were felt distally. The procedure used was gravity irrigation and was completed in less than 25 minutes. By the time of completion, the thigh was softer and the pulse was weakly palpable. The patient was taken to the recovery room for observation and in less than 1 hour, the thigh had normal tension and the pulses were normal. Follow-up was uneventful.

DISCUSSION

In 1982, Noyes & Spievack [3] reported four cases of compartment syndrome in the thigh due to rupture of the suprapatellar pouch. They reported complete arterial occlusion in one case, the pulses returning in one hour. They concluded that the thigh injury occurred due to a suprapatellar pouch rupture and from their experimental studies that the lower leg injuries were due to a rupture of the semimembranosus bursa. In the present series, the two cases involving the anterior compartment of the thigh presented the same type of injury, one that the patient sustained initially even though there was a 6-week delay in the surgery. In the second case the capsule was perforated accidentally. Seiler et al. [4] in 1996 reported a series of four cases of postoperative compartment syndrome, one after a knee arthroscopy that was performed 9 months after the initial injury. Mendel et al. [5] reported

one case that occurred while treating a medial meniscal tear in a patient that also had a popliteal cyst. This patient had involvement of the superficial posterior compartment and was treated with an urgent compartment release. Dinakar & Kumar [6] reported in 2005 a case in which the patient was treated for a meniscal tear and an anterior cruciate ligament tear in which the patient also developed a compartment syndrome. The compartment syndrome was diagnosed at the end of the procedure and involved all of the compartments. Owing to the lack of pulses distally, the patient was treated with a single-incision, four-compartment release. In the first case described in the present series, we also treated the patient with a compartment release and all the compartments were involved. After the second case, in which owing to the presence of barely palpable pulses that resolved and thigh tension that became normal within 2 hours, it was concluded that this complication can be treated initially with observation to allow the water in the compartment to be reabsorbed. The muscle survival time in compartment syndrome is in the range of 4 to 6 hours, providing plenty of time to observe the extremity before deciding to surgically decompress the extremity. In the present series, all of the lower leg cases were diagnosed at the completion of the surgery. We cover the lower leg with a stockinet and we normally do not manipulate the calf to be able to note the consistency of it. Kaper et al. [7] in 1997 reported two cases that were treated nonoperatively. Delayed compartment syndrome was reported by Shands & Jansson [8] in 1999. The compartment syndrome was diagnosed 8 days after surgery and affected the thigh. They used gravity irrigation during the procedure and their conclusion was that the tourniquet and the leg holder caused a crushing injury to the quadriceps muscle that slowly and progressively caused the symptoms of compartment syndrome. Their patient was treated with fasciotomy.

All of our cases were associated with the use of a pressure pump and in at least three cases a capsular injury was evident. The extravasation of fluid into the compartments decreases the pressure in the joint, which automatically makes the pump push more fluid to increase it to the expected pressure, creating a vicious cycle. The experience of the first four cases helped in the last-described and most recent case 5, in which compartment syndrome affected the thigh. Even though the diagnosis was made during surgery, the case was completed with the use of gravity irrigation without any problem. Since then, we have used this type of irrigation routinely. In the series reported by Seiler et al. [4], a patient had a temporary nerve deficit that resolved in 2 weeks; it was the only neurological deficit in our literature review. None of our patients had a neurological deficit.

CONCLUSIONS

Acute compartment syndrome is a rare occurrence in arthroscopic knee surgery, and few cases have been reported. All of the cases we present here were associated with the use of pressure pumps and the presence of a capsular injury, either acute or chronic, was an association in the majority of cases. Palpation of the thigh or calf during the procedure can allow an early diagnosis. Recommended treatment is observation owing to the quick reabsorption of the fluid from the affected compartment(s) and in our series no complications were present afterward.

If compartment syndrome is diagnosed during the procedure, it is recommended to switch to gravity irrigation (to stop the further extravasation of fluid in the affected compartment), release the tourniquet, and continue to monitor the tension of the compartment(s). If the condition is diagnosed after completion of the case, the recommendation is to observe and avoid rushing to do a compartment release.

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