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Well-Leg Compartment Syndrome Due to Hemilithotomy Positioning after Arthroscopic Reconstruction of the PCL

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Learning Point of the Article:

Acute compartment syndrome is a rare but serious complication of hemilithotomy positioning. Surgeons should be mindful of risk factors that can place a patient at higher risk, including length of the case, body habitus, height of elevation of the leg, and method of leg support.

Abstract

Introduction: Acute compartment syndrome (ACS) occurs due to decreased perfusion of an osseofascial space due to increased compartmental pressure. Due to its potentially devastating sequelae, emphasis is placed on its prompt diagnosis. While fractures continue to be the most common cause of ACS, mechanisms such as crush injuries and even surgical positioning are described etiologies of compartment syndrome. ACS of the well-leg from hemilithotomy positioning has been previously depicted in medical literature; however, there have been no illustrations of this complication after elective arthroscopic-assisted posterior cruciate ligament (PCL) reconstruction.

Case Report: This report discusses a patient undergoing PCL reconstruction who developed an ACS in the non-operative extremity that was positioned in hemilithotomy in a leg positioner.

Conclusion: ACS is an uncommon but serious complication that can occur from hemilithotomy positioning. Surgeons should be mindful of risk factors that can place a patient at higher risk, including length of the case, body habitus, height of elevation of the leg, and method of leg support. The prompt recognition and surgical management of ACS can prevent the devastating long-term complications.

Keywords: Acute compartment syndrome, hemilithotomy, posterior cruciate ligament reconstruction.

Introduction

Acute compartment syndrome (ACS) occurs due to decreased perfusion of an osseofascial space due to increased compartmental pressure [1]. Due to the potentially devastating sequelae of this complication, a high level of emphasis is placed on its early diagnosis. While broken bones are the most common cause of ACS [1], mechanisms such as crush injuries and even surgical positioning are other etiologies of compartment syndrome [2]. ACS of the well-leg from hemilithotomy positioning has been previously depicted in medical literature; however, there have been no illustrations of this complication after elective arthroscopic-assisted posterior cruciate ligament (PCL) reconstruction.

Case Report

This case is of a 15-year-old male who sustained a knee dislocation resulting in a multiligamentous knee injury. At presentation, he had a concomitant popliteal artery injury that was managed by the vascular surgery team and was provisionally stabilized with external fixation by the orthopedic team. His ligamentous injury was later managed by the senior author, who completed a fellowship in orthopedic sports medicine.

This patient underwent staged reconstruction of his

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Author's Photo Gallery


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Figure 1: A patient positioned in the leg holder used in this case report.

multiligamentous knee injury. He underwent an elective all-inside allograft PCL reconstruction with arthroscopic assistance. The patient was positioned in hemilithotomy with a commonly used leg holder (Fig. 1) for 180 min due to positioning, sterile draping, and the duration of the procedure. He was then extubated and taken to recovery in stable condition with good peripheral pulses.

Forty-five minutes after arrival to the post-anesthesia care unit, he reported worsening pain in the non-operative leg. The pain was increasing in severity and requiring narcotic medication. Physical examination at this point revealed firm and non-compressible compartments of the non-operative leg and severe discomfort with passive stretch of the toes and ankle. Sensation was intact to light touch throughout the non-operative extremity and he had a palpable dorsalis pedis pulse. It was determined that the patient had a case of impending ACS.

The patient immediately returned to the operating room, intubated, and placed supine. A 4 compartment fasciotomy of the right lower extremity was performed through two incisions. The muscle protruded through the fasciotomy sites. The anesthesiologist noted a dramatic decrease in heart rate and blood pressure after the releases. All muscle tissue in all compartments was viable; the muscle was entirely contractile with light use of electrocautery. A non-adhering dressing and wound vacuum sponge were applied sterilely, and the patient was extubated and taken to recovery. He had palpable dorsal pedis pulses bilaterally. Five days later, the patient underwent irrigation and debridement and split thickness skin graft.

Discussion

This is a case of a patient who developed ACS in the non-operative leg due to hemilithotomy positioning. This is previously undescribed in the orthopedic arthroscopy literature. This complication occurred despite appropriate use of positioning aids, proper padding with foam, and a sequential compression device. Although the exact pathogenesis of the development of ACS due to positioning remains unclear [3], this complication was likely the result of gentle compression that began the cycle of ischemia and subsequent reperfusion injury necessary to develop ACS. This potential complication during an arthroscopic procedure should bring awareness to an associated risk to a well-leg when positioned in hemilithotomy.

Lithotomy and hemilithotomy positions are known to cause ACS and are described in the obstetrics and gynecology, general surgery, and urology literature [4]. Comparatively, it is uncommon in the orthopedic literature. The orthopedic trauma literature has described nine case reports of ACS due to lithotomy positioning on a fracture table for femoral nailing of femur fractures [3]. It is undescribed in the arthroscopic literature, likely due to the fact that these cases do not often require >2 h of immobilization in this position. A literature review found that the case reports of ACS due to positioning had >2 h of surgical time, with most having >4 h of positioning [5].

Although ACS is undescribed in the arthroscopic literature, complications due to positioning of the well-leg have been described. Development of deep vein thrombosis and rhabdomyolysis in the well-leg of patients undergoing knee arthroscopy has occurred, but this was not associated with ACS [6]. In the operative leg of a patient who underwent knee arthroscopy, ACS developed as a post-operative complication due to irrigation fluid leaking from a popliteal cyst into the deep posterior compartment [7]. In a patient with a medical history of hemophilia A, there is one described case of development of ACS in the operative leg of a patient that underwent arthroscopic synovectomy for chronic hemarthrosis [8].

Compartment pressures in the non-operative leg that has been placed in the lithotomy leg holder have been found to increase over time [2]. The total time our patient was in the lithotomy position was approximately 180 min, placing him at increased risk.

Varek et al. observed a positive correlation with the patient's body mass index (BMI) and development of ACS [2]. This is likely due to the weight of the patient's leg itself contributing to the compression of the osseofascial compartments. This risk

factor was present in our patient, given his BMI of 41.2.

Meyer et al. measured the compartment pressures and diastolic ankle pressures of 80 healthy volunteers in supine positioning, with direct support of the calf and heel placed in lithotomy [9]. Their study found increased compartment pressures in legs with calf-supported lithotomy position when compared to supine positioning or lithotomy position with only ankle support [9]. They concluded that direct support of a patient's calf contributes to an increase in compartment pressure from direct compression by the leg holder itself [9]. Our patient's well-leg was positioned in a calf supported lithotomy position with an interposed foam padding and an intermittent pneumatic compression devices (IPCDs).

IPCDs have previously been linked to ACS in lithotomy position in the setting malfunctioning devices [10] or prolonged operative time [11]. However, this is a very uncommon complication, and in our case, ACS was not associated with a malfunctioning IPCD. In our patient, it is possible that the IPCD was restricted by the overlying straps to maintain the leg in the positioner, which may have increased the compartment pressures above the 40 mmHg typically produced by the IPCD.

The degree to which the well-leg is elevated is an important factor contributing to possible ischemia. The height of elevation exceeding the heart's level is not inconsequential; each centimeter the calves are elevated above the heart results in approximately 0.8 mmHg mean arterial pressure reduction [12]. This can theoretically reduce the variance between overall diastolic pressure and compartment pressure.

Conclusion

There are several identifiable risk factors that can put the well-leg at risk of ACS in the lithotomy position including prolonged time in the position, increased BMI, direct support of the calf, malfunction of the pneumatic compression device, and increased height at which the leg is elevated.

The strength of this clinical case is that despite the uncommon presentation, the diagnosis of ACS was made expeditiously, leading to emergent treatment. As a result, the patient has experienced no long-term consequences of this complication with the exception of needing to return to the operating room for expected surgical management including debridement and skin grafting. This case raises awareness to identifiable risk factors including the position of the well-leg.

Clinical Message

Well-leg ACS in non-trauma patients presenting for elective arthroscopic surgery can occur. It is important to identify possible risk factors for development of ACS when placing a patient in the lithotomy position. If risk factors are present, surgeons should maintain a high degree of suspicion throughout the operative and post-operative course to avoid a rare but devastating complication.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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