Pulmonary Embolism After Knee Arthroscopy

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Abstract

Symptomatic deep venous thrombosis (DVT) after knee arthroscopy is a rare occurrence, especially in the ambulatory patient. In this report, we present an unusual case of pulmonary emboli in a young, active patient after arthroscopic treatment of an osteochondral defect via microfracture technique. We also review the current literature and recommendations for prophylaxis against postarthroscopic DVT.

In our review, we found that DVT prophylaxis appears to effectively decrease nonsymptomatic DVT formation after knee arthroscopy. However, the relatively low rate of symptomatic DVT does not yet seem to warrant the associated risks of pharmaceutical prophylaxis. Further trials may provide more insight.

Symptomatic deep venous thrombosis (DVT) after knee arthroscopy is rare, particularly in the ambulatory patient. In this report, we present an unusual case of bilateral pulmonary emboli after arthroscopic treatment of an osteochondral defect; this treatment included the microfracture technique. We also review the current literature and recommendations for prophylaxis against postarthroscopic DVT.

The authors have obtained the patient's written informed consent for print and electronic publication of the case report.

Case Report

A man in his late 30s on active duty in the Navy presented to our facility with complaints of left knee pain and instability approximately 7 months after a fall down a stairwell hatch on a ship. He described the injury as the knee flexing and twisting when he landed. He experienced immediate pain and swelling in the knee and had difficulty walking. After the injury, he was seen by a physician who prescribed physical therapy. The patient then followed up with an orthopedic surgeon, who continued the therapy for several more weeks. Because of persistent symptoms, the patient underwent arthroscopy of the knee with a medial meniscus repair approximately 3 months after the injury. During the operation, the surgeon documented a partially torn anterior cruciate ligament (ACL). After surgery, the patient was placed in a functional knee brace and prescribed 3-times-a-week physical therapy. He obtained some degree of stability but continued to have pain, particularly with use of the knee.

Previous medical history was significant for a comminuted left distal femur and proximal tibia fracture sustained in a motor vehicle collision when the patient was 11 years old. The injury was treated with traction for 3 months and then casting for 6 months. The outcomes were a healed fracture and a painless knee with a small degree of recurvatum that did not affect physical activities or military duties. Aside from this childhood injury, the patient was a healthy, active man without medical issues.

At presentation to our clinic, he was 7 months out from the injury and 4 months out from the knee arthroscopy. He complained of knee instability when not wearing the brace, anterior knee pain, swelling, and aching knee pain with increased activity or prolonged sitting. He was not satisfied with the knee and was seeking a second opinion. Physical examination revealed noticeable left quadriceps weakness and tight hamstrings. The left knee had grade 1 increased laxity on the valgus stress test at 30° and tenderness to palpation over the medial joint line. The Lachman and anterior drawer tests revealed grade 2 laxity with a soft endpoint. The patient had a stable posterior drawer test with a solid endpoint.

Radiographs showed an irregularity in the anterior cortex of the proximal tibia from the previous fracture, and mild osteoarthritis in the medial and patellar compartments. A diagnosis of patellofemoral pain and lower extremity weakness was made, and the patient began physical therapy, which increased his strength and decreased his symptoms. Given his steady improvement, therapy was continued for a total of 6 months. Despite significant improvements in lower extremity strength and decreased retropatellar pain, he still reported having a deep aching pain toward the end of the day. Magnetic resonance imaging showed an osteochondral defect on the medial femoral condyle. The ACL appeared to be intact, as did the posterior cruciate ligament (PCL) and the medial and lateral collateral ligaments. The menisci did not demonstrate any signal consistent with a tear. After discussion of different treatment options, the patient elected to undergo arthroscopic treatment of the osteochondral lesion; this treatment was planned to include the microfracture technique.

A basic preoperative evaluation, consisting of a complete history and physical examination, revealed no abnormalities in an otherwise healthy man under age 40. As

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Am J Orthop. 2010;39(1):E7-E10. Copyright Quadrant HealthCom Inc. 2010. All rights reserved.

such, we ordered no additional testing, such as electrocardiogram or blood chemistry. The patient presented to an ambulatory surgery center on the day of surgery and received general anesthesia in the operating room. Physical examination under anesthesia revealed a grade 2 varus laxity with a solid endpoint and a grade 2 valgus laxity with a soft endpoint. The knee was stable to ACL and PCL testing, including a negative pivot-shift. The patient had a normal dial-test and full range of motion.

A tourniquet was placed high on the left thigh but was not inflated during the case. The leg was allowed to lie flat on the bed with a post positioned laterally to allow valgus opening of the medial compartment. The notch could be visualized by allowing the knee to flex 90° off the side of the bed, and the lateral compartment could be accessed by the figure-4 position. The uninvolved right leg had a sequential compression device placed over the calf; this device ran throughout the case.

We began by insufflating the knee with sterile saline (30 mL) and creating the lateral and medial portals. Small plica bands were released in the lateral gutter using a 3.5-mm shaver. ACL and PCL were intact visually and by direct palpation. The lateral compartment was found to be normal. The medial compartment had a 1×3-cm cartilage defect on the extension surface of the knee bordering the notch. With use of standard microfracture technique, this area was débrided down to subchondral bone, leaving good cartilage intact around the edges to provide a "shoulder" around the lesion.[1] A microfracture awl system was used to create several holes in the lesion to allow egress of blood and clot formation. Bleeding was verified by dropping pressure within the knee under visualization. No other procedures were performed, and the case took 85 minutes. At no time was the tourniquet inflated.

After surgery, an elastic bandage was lightly applied from foot to thigh, and the patient was placed in a hinged knee brace locked in extension. Recovery in the ambulatory surgery center was uneventful, and he was discharged home approximately 1 hour after completion of surgery. He was given crutches with instructions to gradually increase his weight-bearing as tolerated while wearing the brace at all times until his follow-up. At home, adequate pain control was achieved with use of a cold therapy device, hydrocodone 7.5 mg/acetaminophen 500 mg tablets, and celecoxib 200 mg tablets. As per postoperative instructions, the bandage and sterile dressing were removed by the patient on postoperative day 3, and the Steri-Strips were left in place.

At the first postoperative clinic visit, 7 days later, the patient was bearing slightly more than toe-touch weight straight-legged in the brace with crutches for assistance. He was still taking the pain medications and was using ice for swelling about the knee. He was alert and oriented and reported feeling well overall since the surgery, except for light-headedness and heart racing over the preceding 24 hours. His spouse, an intensive care unit nurse, was taking his blood pressure at home daily and had noticed an increase over the same time. At the visit, the patient's pulse rate was 134 bpm, and his blood pressure was 153/95 mm Hg. He reported some mild chest pain. He had already scheduled to see his primary care physician for these symptoms later in the day. The knee looked fine after surgery, and, as he was leaving our office to go directly to his primary care office, he was discharged from clinic until next follow-up.

That day, the primary care physician drew blood chemistries, treated the patient, and sent him home. Three days later, on postoperative day 10, the patient presented to his local emergency department after his primary physician called to inform him of elevated troponin levels. On admission to the emergency department, the patient reported a 2-day history of acute-onset chest pain and shortness of breath lasting 1 or 2 hours and then subsiding. On admission to the hospital, an echocardiogram showed mild right-ventricular dilation with systolic dysfunction. Cardiology recommended computed tomography (CT) of the chest, and multiple bilateral lower lobe pulmonary emboli were diagnosed with spiral CT. For pharmacologic anticoagulation, the patient was started on heparin, and then coumadin was added.

"Fourth, it was recommended [in the recent AAOS guidelines] that patients be educated with respect to symptoms of DVT and PE, and this seems to be a simple, commonsense approach to increasing patient safety."

With use of ultrasound, the patient was subsequently diagnosed with DVT in the popliteal fossa of the left knee. At no time was the left leg swollen, tender, or erythematous, which might have indicated DVT. The in-depth hospital workup included testing for prothrombic disorders, but the results were normal. The only possible factor identified during the workup was a short commercial airline flight taken 2 days before the surgery.

Symptoms resolved gradually, and the patient was discharged on coumadin 5 days later. He continued to receive coumadin therapy, and at his postoperative follow-ups reported no return of symptoms. The knee responded well to the microfracture technique, and the patient was walking pain-free without a brace and returned to active duty.

Discussion

In our search of the English-language literature, we found no reports of bilateral pulmonary embolism (PE) after knee arthroscopy.

Risk Factors for Development of Pulmonary Embolism

Risk factors for development of pulmonary embolism, as adapted from Geerts and colleagues,[7] include surgery, trauma (major or lower extremity), immobility, paresis, malignancy, cancer therapy (hormonal, chemotherapy, or radiotherapy), previous venous thromboembolism, pregnancy and the postpartum period, estrogen-containing oral contraception or hormone replacement therapy, selective estrogen receptor modulators, acute medical illness, heart or respiratory failure, inflammatory bowel disease, nephrotic syndrome, myeloproliferative disorders, paroxysmal nocturnal hemoglobinuria, obesity, smoking, varicose veins, central venous catheterization, and inherited or acquired thrombophilia.

Increased incidence of DVT was also associated with increases in age, given other risk factors being equal. The age group at lowest risk was younger than 40, the highest risk group was older than 60, and the intermediate-risk group was between 40 and 60.

Delis and colleagues[2] reported on 102 consecutive patients who underwent knee arthroscopy and had color duplex ultrasound performed before and within a week after surgery. Eight patients (7.8%) developed calf DVT in the operated leg; in only 1 of these cases did DVT propagate to the popliteal vein. Risk for developing DVT was higher in patients with previous DVT (relative risk, 8.2) and in patients with more than 1 risk factor for developing DVT (relative risk, 2.9).[2]

Jaureguito and colleagues[3] retrospectively reviewed the charts of 2,050 patients who underwent arthroscopy and had clinically detected DVT confirmed by ultrasonography (resulting incidence, 0.2%). A cost–benefit analysis did not support routine use of preoperative or postoperative duplex ultrasonography.

In a meta-analysis by Ilahi and colleagues,[4] incidence of DVT after knee arthroscopy ranged from 3.1% to 17.9%, depending on detection method. Incidence of proximal DVT ranged from 0% to 4.9%.

In a prospective study, Hoppener and colleagues[5] found that 19 (5.7%) of 335 patients developed DVT within 8 weeks after knee arthroscopy. Ultrasound was performed on both knees, and no DVT was found in any of the nonoperated knees. Complications included 1 case of limb swelling and 1 nonfatal PE with superficial thrombophlebitis and no DVT (0.6%). These statistics appear to agree with previously reported figures.

Pola and colleagues[6] reported on 2 athletes who were positive for lupus anticoagulant and developed DVT and PE after arthroscopic surgery. These patients received low-molecular-weight heparin (LMWH) prophylaxis and had symptomatic presentation of DVT or PE 5 to 7 days after surgery. One of them presented with DVT in the nonoperative leg. Suggestions included evaluating thrombotic risk in athletes who undergo arthroscopy and conducting a workup for a prothrombic disorder after arthroscopy and development of venous thromboembolism.

The American College of Chest Physicians has evaluated risk factors to be considered in the prevention of venous thromboembolism—see the Box.

In 2 prospective randomized trials, LMWH prophylaxis and no DVT prophylaxis were compared.[8,9] DVT rates for control and LMWH groups were 16% and 2%, respectively, in one study[8] (P = .0004), and 4% and 1%, respectively, in the other[9] (P = .2). No major bleeding complications were reported in either trial.

A Cochrane review that included these 2 studies concluded, "No strong evidence was found to conclude thromboprophylaxis is effective in preventing thromboembolic events in people undergoing knee arthroscopy with unknown risk factors for DVT."[10]

Geerts and colleagues[7] suggested not using routine prophylaxis other than early mobilization. LMWH was suggested for patients at higher than usual risk for developing DVT, including patients with preexisting VTE risk factors and patients who underwent a prolonged or complicated procedure.

Recommendations

The American Academy of Orthopaedic Surgeons[11] recently published clinical guidelines on preventing symptomatic PE in patients who undergo total hip or knee arthroplasty. These recommendations are based on systematic reviews identifying the highest quality studies reported in the literature.

Although no such clinical guidelines exist for knee arthroscopy, several interesting points made in these guidelines should be considered.

- First, the guidelines address symptomatic PE prophylaxis, not DVT prophylaxis, as reducing DVT incidence has not been proved to reduce the incidence of fatal PEs.
- Second, the recommendations regarding early mobilization would apply to our population as well, as most knee arthroscopies are performed on an outpatient basis, and patients can be encouraged to increase their mobility on their own after discharge, depending on the actual surgery.
- Third, there is very little disadvantage (except cost) in using mechanical prophylaxis on the contralateral extremity during arthroscopy, and there may be some benefit, though given the low incidence of DVT and PE, many patients would have to be studied to determine its true validity.
- Fourth, it was recommended that patients be educated with respect to symptoms of DVT and PE, and this seems to be a simple, commonsense approach to increasing patient safety.

According to our literature review, prophylaxis for DVT appears to effectively decrease nonsymptomatic DVT formation after knee arthroscopy. However, the relatively low

rate of symptomatic DVT seems not to warrant the risks associated with pharmaceutical prophylaxis. Further trials may provide more insight.

Unless conflicting data arise from subsequent studies, standardized prophylaxis for DVT is not recommended for uncomplicated arthroscopic knee procedures in which immediate postoperative mobility can be achieved in patients younger than 40. Patients with additional DVT risk factors should be considered for LMWH prophylaxis based on individual or institutional recommendations.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.