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MYONECROSIS: A RARE COMPLICATION OF CRYONEUROLYSIS

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Abstract—Background: Considered a safe and effective procedure, cryoneurolysis has been used to provide pain relief for chronic joint pain for decades. The procedure is similar to common ultrasound-guided percutaneous procedures. Although the literature is limited on the efficacy and safety of cryoneurolysis, there is a consensus that the use of cryoneurolysis is effective, with a risk profile similar to that of other percutaneous procedures. **Case Report:** We are reporting the case of a 74-year-old male who underwent cryoneurolysis for chronic right knee pain. Initially, the patient had complete symptomatic improvement, but subsequently developed rigors and right knee swelling, prompting him to seek emergency medical care. Computed tomography angiography was significant for myonecrosis and phlegmon with early abscess formation. The patient continued to improve symptomatically with i.v. antibiotics. He was discharged home on hospital day 8 with a peripherally inserted central catheter. **Why Should an Emergency Physician Be Aware of This?:** Cryoneurolysis will likely continue to gain popularity as an option for pain management in osteoarthritis and other degenerative joint diseases. It is essential for physicians to be alert to the possibility of severe, albeit rare, complications of a seemingly safe procedure, given the potential to impact a patient's morbidity and quality of life drastically. © 2019 Elsevier Inc. All rights reserved.

Keywords—myonecrosis; cryoneurolysis; necrotic; infection

INTRODUCTION

Considered a safe and effective procedure, cryoneurolysis has been used to provide pain relief for chronic joint

pain for decades. Given the side effects of long-term non-steroidal anti-inflammatory drug and corticosteroid use for joint pain, practitioners have implemented minimally invasive therapies for pain relief. Cryoneurolysis is performed by applying freezing temperatures directly to peripheral sensory nerve fibers; this causes Wallerian degeneration via ice-crystal-mediated injury (1,2). This damage results in termination of axonal transport of the nerve endings distal to the site of application without disrupting the nerve bundle, thereby causing temporary pain relief until the nerve fibers regenerate.

The procedure is similar to common ultrasound-guided percutaneous procedures. The procedure can be performed on an outpatient basis using sterile technique. First, a linear ultrasound transducer within a sterile transducer probe cover is used to visualize the target nerves. Then, an angiocatheter is introduced near the target nerves and positioning confirmed with lidocaine. Finally, the cryoneurolysis probe is inserted via the angiocatheter to deliver nitrous oxide to freeze the nerve endings (1). Although the literature is limited on the efficacy and safety of cryoneurolysis, there is a consensus that the use of cryoneurolysis is effective, with a similar risk profile to that of other percutaneous procedures, including bruising, bleeding, infection, and possible damage to surrounding skin, vasculature, and nerves without serious adverse events reported in the literature to date (3,4). We are reporting the case of a patient with myonecrosis secondary to cryoneurolysis, a complication not widely described in the literature.

CASE REPORT

A 74-year-old man with a history of atrial fibrillation, arthritis, and a meniscal repair 30 years prior presented to the emergency department (ED) with a primary complaint of knee pain noted over the previous 4 days. The pain was exacerbated by ambulation and associated with swelling of the knee. Our patient was seeing pain management specialists for chronic knee pain; after multiple, unsuccessful attempts for pain relief with cortisone and hyaluronic acid injections, the patient underwent cryoneurolysis. The procedure was performed 2 weeks before presentation to the ED. Initially, the patient had complete symptomatic improvement, but 10 days after the procedure he developed increasing pain of the right thigh and knee. The patient was prescribed a course of oral methylprednisolone; however, his symptoms progressed and he developed rigors and right knee swelling, prompting him to seek emergency medical care.

On presentation to the ED, the patient was febrile with a temperature of 38.4°C, blood pressure of 142/78 mm Hg, respiratory rate of 20 breaths/min, oxygen saturation of 98% on room air, and was in atrial fibrillation with a heart rate of 180 beats/min noted on a 12-lead electrocardiogram. The patient appeared uncomfortable secondary to pain. On physical examination, the patient had tenderness to the right thigh without erythema, induration, fluctuance, lymphangitis, or purulence. The knee appeared symmetrical and without gross deformity or crepitus. A suprapatellar effusion with mild tenderness to palpation of the superior aspect of the knee was present. There was some limitation of active extension with full passive range of motion, but the patient was unable to bear weight fully. There was no tenderness to palpation of the calf. The patient had a normal neurovascular examination of the right lower extremity with brisk capillary refill. Laboratory testing was significant for a white blood cell count of 21,000 cells/ μ L without bandemia, hemoglobin of 14.1 g/dL, hematocrit of 41.7%, platelet count of 354,000/ μ L, lactate of 1.9 mmol/L, international normalized ratio of 1.39, prothrombin time of 15.9 s, partial thromboplastin time of 24.7 s. The patient had a sodium of 143 mmol/L, potassium of 5.1 mmol/L, chloride of 99 mmol/L, and calcium of 9.0 mmol/dL; he had a carbon dioxide level of 27 mmol/L, anion gap of 17 mEq/L, blood urea nitrogen of 16 mg/dL, creatinine of 0.8 mg/dL, and albumin of 4 g/dL. Radiographs of the right knee were significant for moderate to severe degenerative changes with joint space narrowing and a moderate-sized suprapatellar effusion. Vascular duplex of the right lower extremity was negative for deep vein thrombosis and superficial thrombophlebitis. CT angiography of the patient's entire right lower extremity revealed an area of hypodensity in the distal vastus

intermedius muscle with interspersed punctate foci of air spanning 10 cm in the craniocaudal dimension signifying myonecrosis and phlegmon with early abscess formation (Figure 1). An arthrocentesis of the right knee performed in the ED demonstrated a white cell count of 223,000 cells/ μ L, 77 lymphocytes, and 23% segmented granulocytes. Cultures from the arthrocentesis were negative for bacteria. However, blood cultures were positive for *Streptococcus* species.

After administering i.v. fluids and diltiazem, as the patient stated he had not taken his medication on the morning of presentation, the patient's heart rate stabilized. After stabilizing him in the ED, the patient was admitted

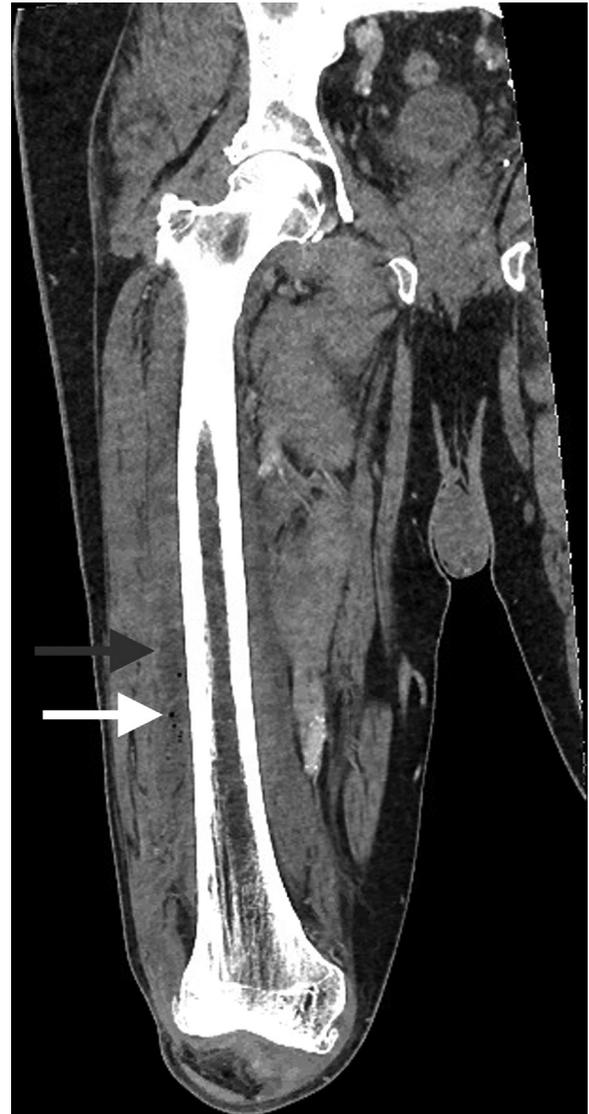


Figure 1. Computed tomography angiography of the right lower extremity (coronal view) showing an area of hypodensity in the distal vastus intermedius muscle with interspersed punctate foci of air spanning 10 centimeters in the craniocaudal dimension signifying myonecrosis and phlegmon with early abscess formation.

to the medical floor with a diagnosis of myonecrosis. Orthopedics and infectious disease were consulted, and the patient was started on i.v. broad-spectrum antibiotics, including vancomycin, ampicillin-sulbactam, and clindamycin. During his inpatient stay, the patient had multiple arthrocenteses for symptomatic relief of the knee pain and further testing of synovial fluid to rule out septic arthritis. All samples of synovial fluid failed to grow bacteria. A diagnosis of septic arthritis was ruled out; the patient's bacteremia was most likely due to the deep tissue infection identified on the CT scan. The patient continued to improve symptomatically with i.v. antibiotics alone, but required physical therapy to regain strength for ambulation. He was discharged home on hospital day 8 with a peripherally inserted central catheter. On a follow-up call 5 months after his discharge, the patient was still receiving antibiotics and was awaiting repeat blood cultures to assess for resolved bacteremia; he also explained that he now relies on a walker for ambulation, whereas he was ambulating independently before the diagnosis.

DISCUSSION

Cryoneurolysis, a relatively simple procedure, has been well accepted as a safe and efficient method of addressing chronic pain. Although there are limited advance studies on the risk profile of this procedure, the literature is overwhelmingly positive, with minimal risk of complication. In a multicenter, randomized, double-blind, sham-controlled trial published in 2017 with up to 6 months of follow-up, cryoneurolysis of the infrapatellar branch of the saphenous nerve showed a statistically significant improvement in pain in study subjects diagnosed with osteoarthritis (2). This study reported mild side effects to the procedure, including local bruising, numbness, redness, tenderness, and swelling, all of which resolved within 30 days of the procedure. The only severe adverse reactions mentioned were 1 patient who experienced a myocardial infarction and another who suffered a pulmonary embolism, but these were deemed unrelated to the procedure (2). While this was the only randomized controlled trial studying cryoneurolysis, multiple case series have reported similar benign side effects. In 2018, the International Anesthesia Research Society published a case series of 3 patients who underwent cryoneurolysis for postsurgical and phantom limb pain after amputation without any reported adverse events in the 3-month follow-up period (5). Further case series of the use of cryoneurolysis beyond that of joint pain, including extremity burns and refractory incisional pain post percutaneous nephrolithotomy, have shown similar positive outcomes without serious complications (6,7). Therefore, we believe this is the first reported case of a severe

complication of a seemingly safe procedure. While our patient did not get confirmatory surgical pathology, the CT scan of his right lower extremity showed evidence of intramuscular infection with gas production strongly suggestive of myonecrosis, a subtype of necrotizing tissue infection.

Myonecrosis is rare, with an incidence of only about 1000 cases per year (8). It is more common in adults who have undergone some traumatic infiltration of the deep tissues with vascular compromise resulting in extensive tissue damage, severe pain, and systemic inflammatory responses; treatment typically requires i.v. broad-spectrum antibiotics in addition to emergent surgical debridement (8,9). Cryoneurolysis involves direct infiltration of deep tissues to administer nitrous oxide and carries the risk of introducing an infectious process, as was the case with our patient. The prognosis of myonecrosis remains poor, with an overall mortality rate of 20–30%, despite aggressive treatment (8). A few cases in the literature discuss the possibility of conservative management of these infections in patients who are relatively stable without significant abnormalities in coagulation studies (10). In fact, a case of streptococcal glossal myonecrosis treated successfully without surgical intervention was published in 2009; in this case, the patient did not have systemic features and improved significantly with antibiotics within 48 h of administration (11). Although prompt surgical intervention is recommended for necrotizing soft tissue infections, it may be rational to approach more stable patients conservatively, as was the case with the patient in this case report. This is the first reported case of a patient undergoing a severe infectious complication, one of which had a direct impact on their morbidity and quality of life after cryoneurolysis.

Why Should an Emergency Physician Be Aware of This? Although cryoneurolysis is a seemingly safe procedure, it is essential for physicians to be alert to the possibility of severe, albeit rare, complications, such as the one discussed in this case report, as the procedure continues to gain popularity for pain management. Whether the low incidence of a complication such as myonecrosis is secondary to low frequencies of cryoneurolysis remains to be seen as the procedure becomes more common. Further investigation of cryoneurolysis may reveal more severe complications than those discussed in the current literature studying the risk profile of this procedure.

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