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Hematogenous Seeding of Traumatized Muscle by Fusobacterium necrophorum: Delayed Compartment Syndrome Following a Sports Injury

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Abstract

Thigh compartment syndrome after blunt athletic trauma can be difficult to recognize when symptoms evolve in a delayed fashion. We present the case of a previously healthy 20-year-old male football player who developed progressive right thigh pain and swelling after blunt trauma sustained during play. Initial radiographs and venous duplex ultrasonography showed no acute osseous abnormality or deep venous thrombosis, and he was discharged with a presumed soft tissue injury. He returned nine days later with worsening thigh and knee pain, progressive swelling, inability to ambulate, paresthesia, tachycardia, hypotension, leukocytosis, elevated creatine kinase, and elevated lactate. Compartment pressure measurements and clinical examination were concerning for thigh compartment syndrome, and he underwent emergent decompressive fasciotomy. Intraoperatively, purulent material was encountered within the muscle compartment, prompting further evaluation for an infectious process. Subsequent imaging and operative exploration demonstrated a large intramuscular abscess involving the thigh and septic arthritis of the knee. Blood and synovial anaerobic cultures grew *Fusobacterium necrophorum*. Further history revealed recent pharyngitis, supporting a presumed but unproven mechanism of transient bacteremia with hematogenous seeding of traumatically injured thigh musculature and secondary involvement of the knee joint. Dental disease identified on imaging represented an alternative potential portal of entry that could not be excluded. The patient required serial operative debridement, arthrotomy with irrigation and debridement, targeted antimicrobial therapy, and delayed primary closure. He was discharged in stable condition with close outpatient follow-up and demonstrated clinical improvement. This case emphasizes that delayed progression after blunt extremity trauma should prompt consideration of occult infection, particularly when pain, systemic findings, or operative findings are disproportionate to the presumed injury.

Categories: General Surgery, Emergency Medicine, Trauma
Keywords: fusobacterium necrophorum, hematogenous seeding, intramuscular abscess, septic arthritis, thigh compartment syndrome

Introduction

Acute compartment syndrome of the thigh is less common than compartment syndrome involving the leg or forearm [1]. The thigh has larger fascial compartments and more compliant soft tissue, allowing it to accommodate greater swelling or hematoma expansion before critical pressures are reached [2]. This relative compliance can make the diagnosis more challenging and may contribute to delayed recognition. Delays in diagnosis and treatment can result in irreversible muscle and nerve injury, limb loss, permanent sensory deficits, and, in severe cases, death [1]. Although thigh compartment syndrome is well described, there remains no clear consensus on the optimal diagnostic approach. The diagnosis is primarily clinical, but practice patterns vary. Some surgeons use compartment pressure measurements to support the diagnosis and guide operative decision-making, whereas others proceed with fasciotomy based on clinical suspicion alone. In a large single-center series of 69 cases collected over nearly two decades, thigh compartment syndrome remained uncommon even at a level I trauma center and occurred predominantly in men, often after high-energy trauma and with a high rate of complications [3]. Mortality associated with thigh compartment syndrome has been reported to be as high as 47%, although most deaths are attributed to associated injuries rather than the syndrome itself [1].

Fusobacterium necrophorum is an anaerobic gram-negative rod best known for causing Lemierre's syndrome, a rare but life-threatening complication of oropharyngeal infection [4]. This condition typically develops when infection spreads to the lateral pharyngeal spaces of the neck, causing septic thrombophlebitis of the internal jugular vein with subsequent septic embolization to distant sites, including the lungs, joints, bones, muscles, and other organs [4]. Although *F. necrophorum* is classically associated with head and neck infections, the clinical spectrum of invasive disease is broader than previously appreciated. Nygren and Holm reviewed 300 cases of invasive *F. necrophorum* infection in Sweden over an eight-year period and found that 31% occurred outside the head and neck region, with the annual incidence increasing from 2.9 to 5.0 cases per million [5]. Musculoskeletal manifestations remain particularly rare. In a 2025 literature review,

Franceschi et al. identified only 42 previously reported cases of *F. necrophorum* septic arthritis [6]. Its occurrence as a musculoskeletal pathogen, particularly after recent trauma, is exceedingly rare and may delay diagnosis because of its atypical clinical presentation.

We report a case of delayed thigh compartment syndrome after blunt football trauma in a previously healthy 20-year-old male patient who developed *F. necrophorum* bacteremia complicated by intramuscular abscess and septic arthritis of the knee. This case involved three overlapping but distinct diagnostic entities: traumatic thigh compartment syndrome, infectious myositis with intramuscular abscess formation, and septic arthritis of the knee. The proposed mechanism is antecedent pharyngitis with transient bacteremia, resulting in hematogenous seeding of traumatically injured muscle. To our knowledge, this mechanism has not been well characterized for this pathogen and has implications for understanding how concurrent infection may transform a seemingly isolated sports injury into a life-threatening musculoskeletal infection.

Case Presentation

A 20-year-old male patient with a past medical history of asthma presented to a community emergency department with right thigh pain and swelling after blunt trauma sustained while playing football. At the initial evaluation, femur radiographs showed no acute osseous abnormality, and venous duplex ultrasonography demonstrated no evidence of deep venous thrombosis (Figure *1*). He was discharged with a presumed diagnosis of soft tissue injury or hematoma.

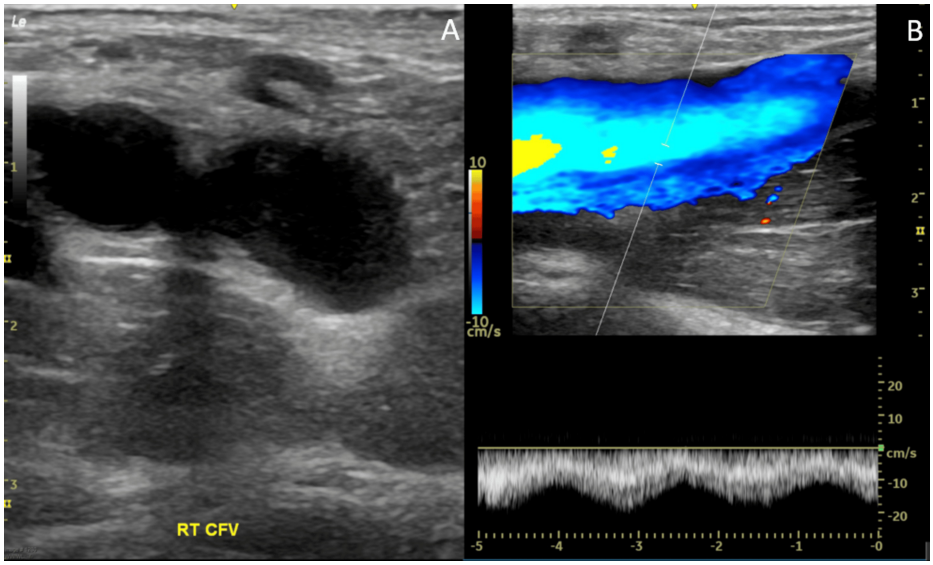


FIGURE 1: Venous Duplex Ultrasonography of the Right Lower Extremity

(A, B) Representative venous duplex ultrasound image of the right common femoral vein obtained during the initial evaluation. Grayscale and color Doppler imaging demonstrated venous flow, and the complete venous duplex examination showed no evidence of deep venous thrombosis.

He re-presented approximately nine days later to urgent care with escalating right thigh and knee pain, progressive swelling, inability to ambulate, and paresthesia. On examination, he had a tense, firm anterior thigh, severe pain, diminished right-sided pulse quality compared with the left side, and limited movement secondary to pain. He was tachycardic, with a heart rate of 125 beats per minute, and hypotensive, with a blood pressure of 99/72 mmHg. Laboratory evaluation demonstrated leukocytosis, elevated creatine kinase, and elevated serum lactate, concerning for systemic inflammatory response and muscle injury (Table *1*).

Laboratory test	Patient value	Reference range	Interpretation
White blood cell count	18.2 × 10^3/μL	4.0-11.0 × 10^3/μL	Elevated
Creatine kinase	1,003 U/L	30-200 U/L	Elevated
Serum lactate	4 mmol/L	0.5-2.2 mmol/L	Elevated

TABLE 1: Laboratory Findings on Re-presentation

μL: microliter; U/L: units per liter; mmol/L: millimoles per liter

Compartment pressure measurements obtained using a Stryker intracompartmental pressure monitor (Stryker Corporation, Kalamazoo, MI, USA) demonstrated anterior thigh pressures up to 37 mmHg. With a diastolic blood pressure of 72 mmHg, the calculated delta pressure was 35 mmHg, which did not meet the commonly cited delta pressure threshold of less than 30 mmHg for fasciotomy [1]. However, the patient's overall clinical presentation remained highly concerning for evolving acute compartment syndrome, including a tense anterior thigh compartment, pain out of proportion to examination, paresthesia, limited movement secondary to pain, and systemic compromise. Therefore, the decision to proceed emergently to decompressive fasciotomy was based on clinical concern rather than pressure measurements alone.

A lateral incision extending from the greater trochanter to the distal thigh was performed. Upon release of the anterior compartment, there was immediate bulging of muscle, followed by unexpected return of purulent material tracking from within the muscle compartment. The wound was copiously irrigated, and intraoperative cultures were obtained. Final wound dimensions measured approximately 28 × 9 × 0.5 cm. These findings suggested that the compartment syndrome was not solely traumatic in origin but was associated with a deep intramuscular infectious process.

Postoperatively, the patient remained tachycardic, with heart rates reaching 169 beats per minute. He developed worsening lactic acidosis, with lactate increasing to 7.3 mmol/L, and progressive leukocytosis, with a white blood cell count rising to 40 × 10^3/μL. Given ongoing sepsis despite broad-spectrum intravenous antibiotics with vancomycin and piperacillin-tazobactam, he returned to the operating room on hospital day two for repeat exploration. A large deep abscess involving the knee joint was identified. Orthopedic surgery was consulted intraoperatively, and an arthrotomy was performed with irrigation and debridement of the right knee. Tissue cultures were obtained from both the thigh and knee, and the diagnosis was revised to right thigh abscess with associated septic arthritis. Subsequent CT imaging demonstrated a large multilobulated, peripherally enhancing fluid collection along the mid-to-distal thigh, preferentially involving the vastus intermedius muscle and measuring approximately 6.5 × 9.2 × 16.7 cm, suspicious for a large intramuscular abscess (Figure *2*). The patient required multiple subsequent operative interventions to achieve definitive source control. By hospital day nine, following resolution of gross purulence and marked improvement in wound viability, he underwent final washout and delayed primary closure.

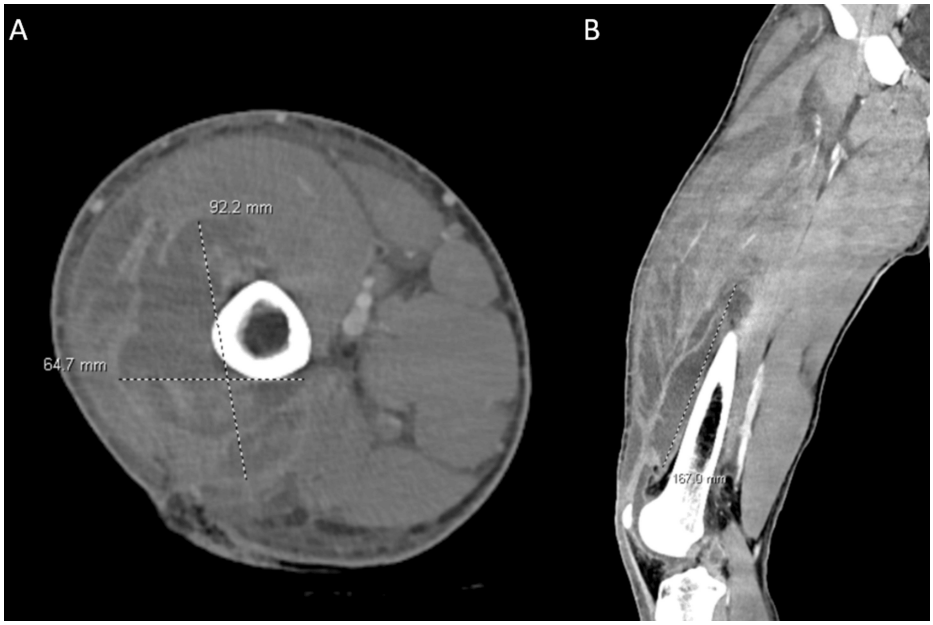


FIGURE 2: Contrast-Enhanced CT of the Right Thigh Demonstrating a Large Intramuscular Abscess

(A, B) Axial and longitudinal CT images of the right thigh demonstrate a large multilobulated, peripherally enhancing fluid collection centered in the mid-to-distal thigh, preferentially involving the vastus intermedius muscle within the anterior thigh compartment. The collection measures approximately 6.5 × 9.2 × 16.7 cm.

Intraoperative cultures from the thigh abscess initially demonstrated mixed anaerobic flora. Subsequent anaerobic blood cultures and synovial fluid cultures from the right knee grew *F. necrophorum*, which was beta-lactamase-negative; aerobic cultures remained negative. Repeat blood cultures obtained two days after initiation of antibiotics were negative. Infectious disease was consulted and guided antimicrobial management. The patient initially received broad-spectrum intravenous antibiotics with vancomycin and piperacillin-tazobactam, which were later narrowed based on culture data and infectious disease recommendations.

Given the association of *F. necrophorum* with oropharyngeal infection, evaluation for a head and neck source was pursued. CT of the neck with contrast showed no evidence of internal jugular vein thrombosis, deep neck space infection, or Lemierre's syndrome but demonstrated mildly prominent cervical lymph nodes, including a left level IIa lymph node measuring approximately 27 × 13 mm, interpreted as likely reactive (Figure *3*). Dental caries of the left maxillary medial incisor with buccal cortex defect were noted incidentally, representing an alternative potential portal of entry that could not be excluded. However, further history revealed a recent episode of sore throat with tonsillar swelling approximately one week before clinical deterioration. Taken together, these findings supported a presumed but unproven mechanism of antecedent pharyngitis with transient bacteremia, resulting in hematogenous seeding of traumatically injured thigh musculature with secondary involvement of the knee joint.



FIGURE 3: Contrast-Enhanced CT of the Neck Demonstrating Reactive Cervical Lymphadenopathy

Coronal contrast-enhanced CT image of the neck demonstrates mildly prominent cervical lymph nodes, including a left level IIa lymph node measuring approximately 27 × 13 mm, interpreted as likely reactive. CT evaluation demonstrated no internal jugular vein thrombosis, no deep neck space infection, and no imaging evidence of Lemierre's syndrome.

He was discharged on hospital day 12 in stable condition on a planned two-week course of oral metronidazole, with close outpatient follow-up arranged with trauma surgery and infectious disease. At follow-up, he demonstrated marked clinical improvement, with well-healed incisions, resolution of infectious symptoms, and progressive return toward baseline function.

The patient's clinical course is summarized in Table *2*.

Time point	Clinical event
Day 0	Blunt right thigh trauma sustained while playing football; initial emergency department evaluation showed no fracture or deep venous thrombosis, and the patient was discharged with presumed soft tissue injury or hematoma
Day 9	Re-presented with worsening right thigh and knee pain, progressive swelling, inability to ambulate, paresthesia, tachycardia, hypotension, leukocytosis, elevated creatine kinase, and elevated lactate. Compartment pressure measurements and clinical examination raised concern for thigh compartment syndrome, and emergent decompressive fasciotomy was performed, revealing purulence within the muscle compartment
Hospital day 2	Returned to the operating room for repeat exploration due to persistent sepsis; a large deep abscess and septic arthritis of the right knee were identified, and orthopedic surgery was performed, including arthrotomy with irrigation and debridement
Hospital days 2-9	Underwent serial operative debridements and continued targeted antimicrobial therapy for source control
Hospital day 9	Underwent final washout and delayed primary closure after resolution of gross purulence and improvement in wound viability
Hospital day 12	Discharged in stable condition on oral metronidazole with outpatient follow-up arranged with trauma surgery and infectious disease
Follow-up	Demonstrated clinical improvement with healed incisions, resolution of infectious symptoms, and progressive return toward baseline function

TABLE 2: Clinical Timeline

Discussion

This case highlights several important clinical points. First, it underscores the diagnostic challenge of delayed thigh compartment syndrome after blunt trauma. Although the patient's initial evaluation was negative for fracture and deep venous thrombosis, he developed progressive symptoms culminating in compartment syndrome requiring emergent fasciotomy. Prior series have shown that thigh compartment syndrome may evolve over several days in the setting of quadriceps injury and hematoma formation, and that early imaging may underestimate the extent of deep tissue injury [2,3,7].

Second, this case demonstrates that an apparently traumatic compartment syndrome may have an underlying infectious etiology. The patient's clinical progression, characterized by worsening pain, elevated creatine kinase, and increasing compartment pressures, was initially consistent with delayed traumatic compartment syndrome. However, the intraoperative discovery of purulence prompted a critical shift in diagnosis toward a deep infectious process. Subsequent imaging and serial operative interventions confirmed a large intramuscular abscess extending into the knee joint. Definitive management required repeated operative debridement for infection control rather than a single decompressive fasciotomy. This case demonstrates that the patient's clinical deterioration was driven not only by elevated compartment pressures but also by a progressive deep infection.

A plausible mechanism is supported by evidence that injured skeletal muscle is more susceptible to infection. Muscle injury has been shown to upregulate vimentin, which facilitates bacterial adherence, and experimental models demonstrate preferential localization of circulating bacteria to injured muscle compared with uninjured tissue [8,9]. Disruption of endothelial integrity in traumatized tissue may further promote bacterial extravasation [10]. Although these findings have been described primarily with *Streptococcus pyogenes*, they are likely not organism-specific and may extend to *F. necrophorum*. In addition, trauma-related impairment in host defenses, including reduced neutrophil function, may further increase susceptibility to infection [10]. In this case, blunt trauma likely created a vulnerable intramuscular environment that permitted hematogenous seeding of the thigh musculature during transient bacteremia, with secondary involvement of the knee joint.

The microbiology in this case is unusual. The identification of *F. necrophorum* in cultures is highly unusual outside the context of head and neck infection and Lemierre's syndrome. In the Swedish nationwide study by Nygren and Holm, 35% of invasive *F. necrophorum* infections presented as Lemierre's syndrome, 34% as invasive head and neck infection without Lemierre's syndrome, and 31% as non-head-and-neck infection [5]. The non-head-and-neck group tended to affect older patients, with a median age of 64 years, making our patient's young age and athletic presentation even more unusual within this category [5]. Franceschi et al. identified only 42 prior cases of *F. necrophorum* septic arthritis in the literature, further reinforcing the rarity

of this presentation [6].

Several limitations should be acknowledged. The presumed source and sequence of infection are based on the patient's clinical history, imaging findings, culture results, and operative course, but they cannot be confirmed definitively. The patient's recent sore throat and tonsillar swelling support a possible antecedent oropharyngeal infection; however, this history was obtained retrospectively and was not microbiologically confirmed. Dental caries with a buccal cortex defect were also identified on CT and represent an alternative potential portal of entry that cannot be excluded. Therefore, an oropharyngeal source remains plausible but unproven. In addition, the proposed mechanism of hematogenous seeding of injured muscle is extrapolated from literature on *S. pyogenes* and has not been directly demonstrated for *Fusobacterium* species.

Conclusions

We present an atypical case of *F. necrophorum* bacteremia associated with delayed thigh compartment syndrome, intramuscular abscess, and septic arthritis of the knee after blunt sports-related trauma. The clinical course supports a plausible but unproven mechanism in which antecedent pharyngitis led to transient bacteremia, with presumed hematogenous seeding of traumatically injured thigh musculature and secondary involvement of the knee joint. This case suggests that local tissue injury may create a vulnerable environment for deep musculoskeletal infection, although the exact source and sequence of infection cannot be confirmed definitively.

Delayed or disproportionate progression after blunt extremity trauma should prompt evaluation for occult infection in addition to compartment syndrome. Early recognition of systemic findings, identification of anaerobic pathogens, aggressive surgical source control, and multidisciplinary management are central to successful treatment. Awareness of this potential overlap between traumatic compartment syndrome and deep infection may help prevent delays in diagnosis and improve outcomes in similarly complex presentations.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mohamad Ballan, Alanna Stefano, Richard Marino, Jaime Giraldo

Acquisition, analysis, or interpretation of data: Mohamad Ballan, Alanna Stefano, Richard Marino, Jaime Giraldo

Drafting of the manuscript: Mohamad Ballan, Alanna Stefano, Richard Marino, Jaime Giraldo

Critical review of the manuscript for important intellectual content: Mohamad Ballan, Alanna Stefano, Richard Marino, Jaime Giraldo

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. von Keudell AG, Weaver MJ, Appleton PT, et al.: Diagnosis and treatment of acute extremity compartment syndrome. Lancet. 2015, 386:1299-310. 10.1016/S0140-6736(15)00277-9
2. Colosimo AJ, Ireland ML: Thigh compartment syndrome in a football athlete: a case report and review of the literature. Med Sci Sports Exerc. 1992, 24:958-63. 10.1249/00005768-199209000-00002
3. Rameder P, Schmidt R, Machold W, Tiefenboeck TM, Bukaty A, Huf W, Boesmueller S: Epidemiology, treatment and outcome after compartment syndrome of the thigh in 69 cases-experiences from a level I trauma centre. Injury. 2019, 50:1242-6. 10.1016/j.injury.2019.04.001
4. Allen BW, Anjum F, Bentley TP: Lemierre syndrome. StatPearls [Internet]. StatPearls Publishing, Treasure Island (FL); 2026.
5. Nygren D, Holm K: Invasive infections with Fusobacterium necrophorum including Lemierre's syndrome: an 8-year Swedish nationwide retrospective study. Clin Microbiol Infect. 2020, 26:1089.e7-12. 10.1016/j.cmi.2019.12.002

6. Franceschi G, Marchi M, Zambianchi F, Meschiari M, Mussini C, Bedini A: Fusobacterium necrophorum septic arthritis of the hip: a case-report and literature review. Anaerobe. 2025, 91:102934. 10.1016/j.anaerobe.2024.102934
7. Solasz S, Ganta A, Robitsek RJ, Egol KA, Konda S: Thigh compartment syndrome: outcomes in an urban level 1 trauma center. Injury. 2024, 55:111331. 10.1016/j.injury.2024.111331
8. Hamilton SM, Bayer CR, Stevens DL, Lieber RL, Bryant AE: Muscle injury, vimentin expression, and nonsteroidal anti-inflammatory drugs predispose to cryptic group A streptococcal necrotizing infection. J Infect Dis. 2008, 198:1692-8. 10.1086/593016
9. Bryant AE, Bayer CR, Huntington JD, Stevens DL: Group A streptococcal myonecrosis: increased vimentin expression after skeletal-muscle injury mediates the binding of Streptococcus pyogenes. J Infect Dis. 2006, 193:1685-92. 10.1086/504261
10. Lee GR, Gallo D, Alves de Souza RW, et al.: Trauma-induced heme release increases susceptibility to bacterial infection. JCI Insight. 2021, 6:e150813. 10.1172/jci.insight.150813