

Received: 2022.05.12

Accepted: 2022.07.14

Available online: 2022.09.02

Published: 2022.10.07

# Peripherally Inserted Central Catheter-Related Infectious Myositis: A Case Report

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Study Design A  
Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
Literature Search F  
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**Financial support:** None declared

**Conflict of interest:** None declared

**Patient:** Male, 43-year-old  
**Final Diagnosis:** Infectious myositis  
**Symptoms:** Fever • swelling  
**Medication:** —  
**Clinical Procedure:** —  
**Specialty:** Infectious Diseases

**Objective:** Rare disease

**Background:** Peripherally inserted central catheters (PICCs) are commonly used by clinicians in daily practice as a safe and reliable alternative to central venous catheters. While there are advantages to the use of PICCs, such as a low insertion-related complication rate and cost-effectiveness, using PICCs may expose patients to life-threatening severe complications such as a central line-associated bloodstream infection and deep venous thrombosis (DVT). There have been no reports of infectious myositis associated with PICC insertion.

**Case Report:** We report a case of infectious myositis related to PICC insertion complicated by brachial DVT in a 43-year-old immunocompromised patient with myelodysplastic syndrome. Despite the administration of broad-spectrum antibiotics, the patient's condition did not improve. He developed septic shock and required emergency excision of the infected and necrotic muscles. Although the pathogen responsible for the infection was unknown, infectious myositis and myonecrosis were observed intraoperatively. Furthermore, histopathological examination revealed evidence of infectious myositis in the biceps brachii and brachial muscles. The septic shock resolved with treatment and the patient survived with residual elbow joint dysfunction.

**Conclusions:** We present a case of infectious myositis related to PICC insertion. We believe that urgent resection of infected and necrotic tissues, rather than broad-spectrum antimicrobial therapy alone, was essential to save the patient's life.

**Keywords:** Myositis • Pyomyositis • Catheterization, Peripheral • Venous Thrombosis

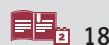
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## Background

As a safe and reliable alternative to central venous catheters (CVCs), peripherally inserted central catheters (PICCs) are commonly used by clinicians in daily practice [1-4].

PICCs are associated with fewer insertion-related serious complications compared to CVCs, such as inadvertent cervical arterial puncture and pneumothorax [1,5,6]. Furthermore, since PICCs have low insertion-related complication rates and can be inserted by specially trained nurses outside of the operating room, the use of PICCs is cost-effective and decreases any delay in treatment because of busy operating rooms or intensive care units [1,4,7].

In contrast to these benefits, using PICCs may expose patients to life-threatening complications, such as central line-associated bloodstream infection (CLABSI) and deep venous thrombosis (DVT) [1,3,4]. The risk of CLABSI with PICCs may be equal to or higher than that with CVCs [8-10]. Additionally, when compared to that of CVCs, PICCs are associated with an increased incidence of DVT [11,12].

Although CLABSI has been assessed in many reports [3-6,8-10], there are no reports of infectious myositis being associated with PICC insertion in the clinical setting.

Here, we describe a case of infectious myositis and septic shock related to PICC insertion complicated by brachial DVT in a patient with myelodysplastic syndrome.

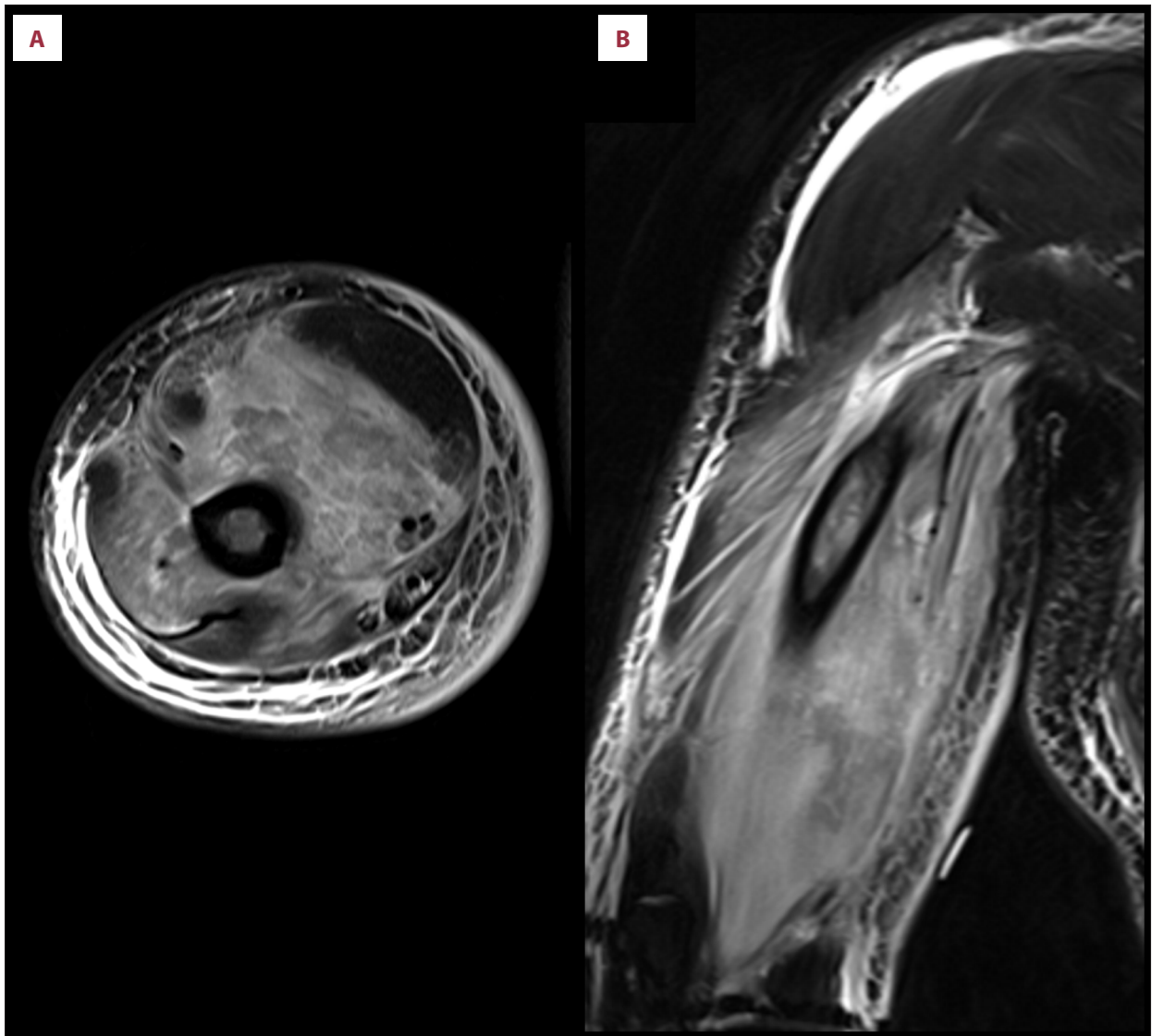
## Case Report

A 43-year-old-man with myelodysplastic syndrome with excess blasts-1 was scheduled for bone marrow transplantation. The

patient had received 6 courses of treatment with azacytidine. His medical history included Kawasaki disease, hypertension, hyperuricemia, and angina pectoris. He underwent surgery for coronary artery lesions caused by Kawasaki disease 11 years previously. Postoperatively, no functional cardiac abnormalities were observed, and he received no treatment for inactive Kawasaki disease. The patient was 175 cm tall and weighed 90 kg. He did not smoke and denied the use of alcohol or illicit drugs. A COVID-19 IgG/IgM combined antibody test was performed; it was negative. On day 0, the PICC was inserted into the right upper arm for the treatment of myelodysplastic syndrome by a hematologist who had previously performed 30 PICC procedures. Venous access was achieved without difficulty using ultrasound-guided puncture and fluoroscopic wire/catheter guidance; the hematologist wore a surgical cap, surgical mask, sterile gown, and sterile gloves in a clean working space. On day 4, local redness was observed at the insertion site and the hematologist removed the catheter and initiated broad-spectrum antimicrobial therapy with piperacillin/tazobactam (18.0 g/day) and teicoplanin (600 mg/day). On day 6, the patient had a fever of up to 39.6°C. The hematologist changed the antimicrobials to meropenem (3.0 g/day), teicoplanin (600 mg/day), and clindamycin (2400 mg/day). The patient's right upper arm swelled gradually and he had difficulty bending his elbow. On day 8, the patient had a fever of 40.2°C and the hematologist consulted an orthopedic surgeon because the antibacterial therapy had had no effect: the fever did not decrease, and the swelling worsened. The orthopedic surgeon decided that further antimicrobial therapy would be advisable as the patient seemed to be doing well and there was less redness around the insertion site. He decided to continue conservative treatment for the next 2 days. On the afternoon of day 10, the patient's vital signs were as follows: Glasgow Coma Scale, E4V5M6; temperature, 39.1°C; blood pressure, 79/43 mmHg; heart rate, 90 beats/min; respiratory rate, 16 breaths/min; and 100% oxygen saturation



**Figure 1.** Photograph of the patient's right arm showing swelling and redness of the right upper arm without blistering.

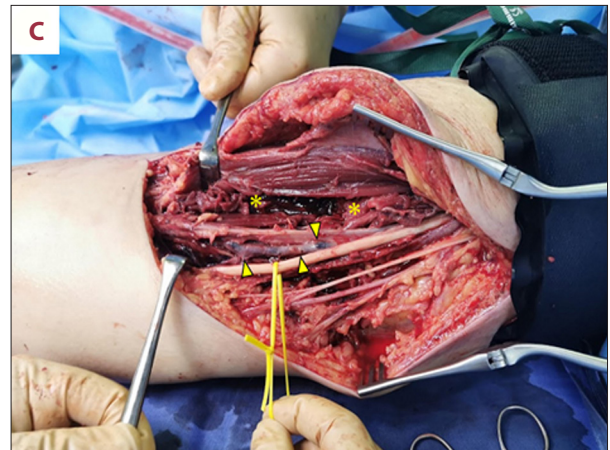
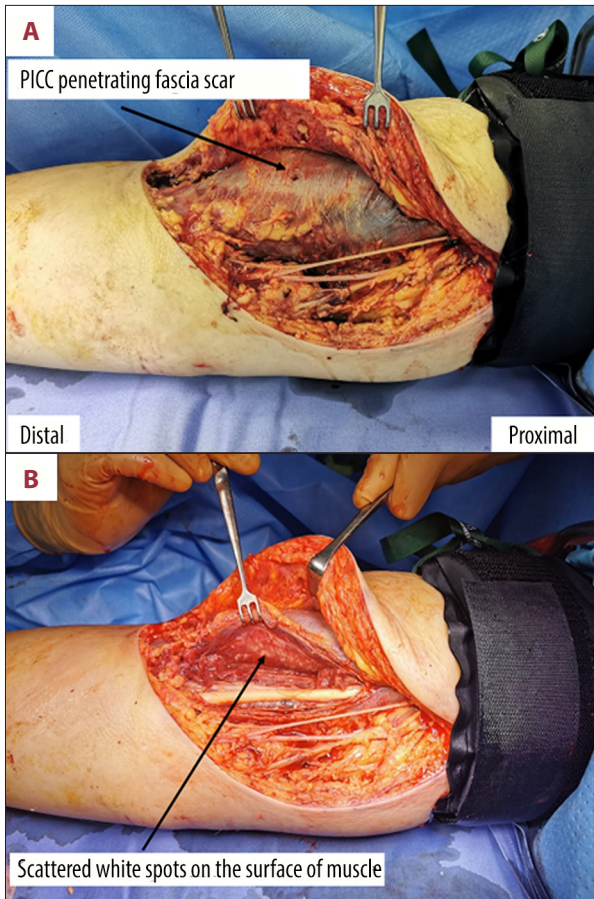


**Figure 2.** Fat-suppressed T2-weighted magnetic resonance imaging showed diffuse heterogeneous high signal intensity in the biceps brachii, brachialis, and triceps brachii muscles. Axial (A) and coronal (B) images of the right upper arm.

on a 100% non-rebreather reservoir mask at 10 L/min of oxygen. On physical examination, there was exacerbation of swelling and redness in his right upper arm without blistering (Figure 1). There was muscle pain and tenderness to palpation along the right biceps brachii muscle. Blood investigations revealed a white blood cell count of  $10.4 \times 10^3/\mu\text{L}$  with 94.0% neutrophils; hemoglobin, 7.0 g/dL; platelet,  $18.8 \times 10^4/\mu\text{L}$ ; C-reactive protein (CRP), 24.6 mg/dL; total protein, 5.1 g/dL; albumin, 2.6 g/dL; aspartate aminotransferase, 18 U/L; alanine aminotransferase, 15 U/L; total bilirubin, 1.7 mg/dL; creatine kinase, 281 U/L; blood urea nitrogen, 39 mg/dL; creatinine, 2.53 mg/dL; prothrombin time/international normalized ratio, 1.61; fibrinogen, 699 mg/dL; fibrin and fibrinogen degradation products, 15.1  $\mu\text{g/mL}$ ; D-dimer, 9.6  $\mu\text{g/mL}$ ; procalcitonin, 46.2 ng/mL; and presepsin, 1420 pg/mL.

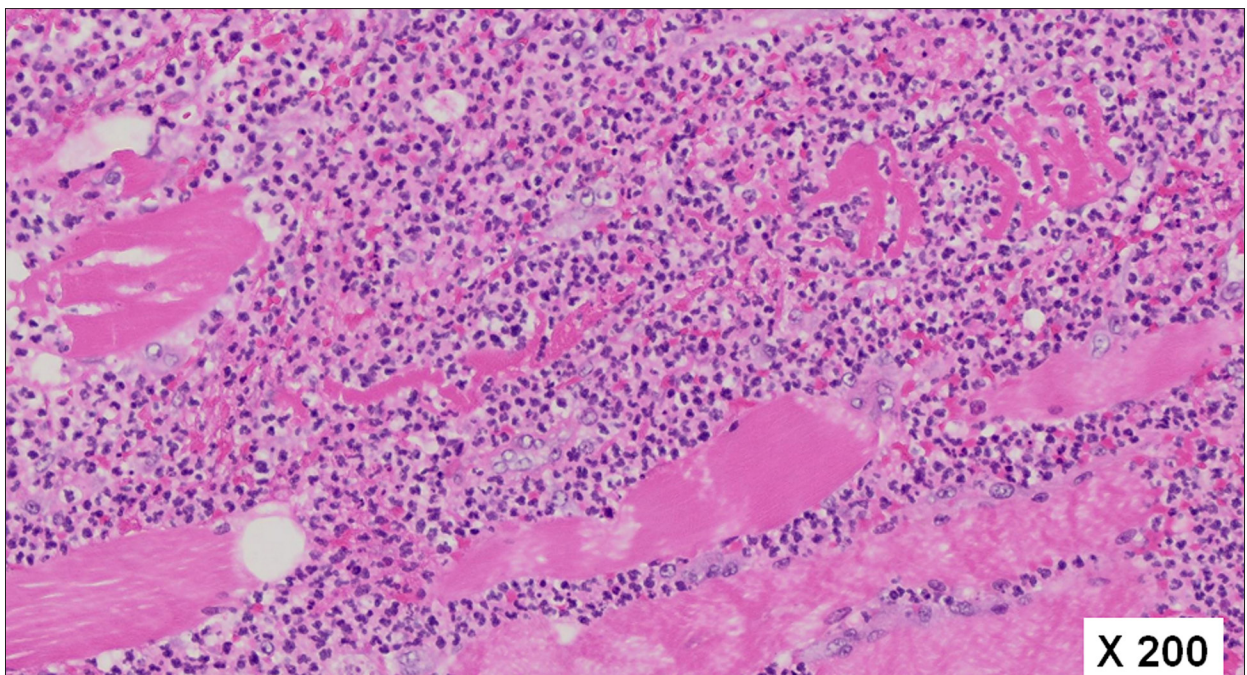
A plain radiograph of the upper arm did not show gas in the soft tissue. Fat-suppressed T2-weighted magnetic resonance imaging (MRI) showed diffuse heterogeneous high signal intensity in the biceps brachii, brachialis, and triceps brachii muscles (Figure 2). We suspected an emergency necrotizing soft tissue infection with progression to septic shock. The patient underwent urgent debridement surgery on the same (day 10) as administration of a large fluid infusion, noradrenaline infusion, and broad-spectrum antimicrobial agents with meropenem (3.0 g/day), daptomycin (350 mg/day), clindamycin (2400 mg/day), and posaconazole (300 mg/day). There were no infectious findings between the skin and the subcutaneous tissue, and the brachial fascia was severely swollen with evidence of internal pressure (Figure 3A). After incising the brachial fascia, no obvious exudation of pus was observed. More





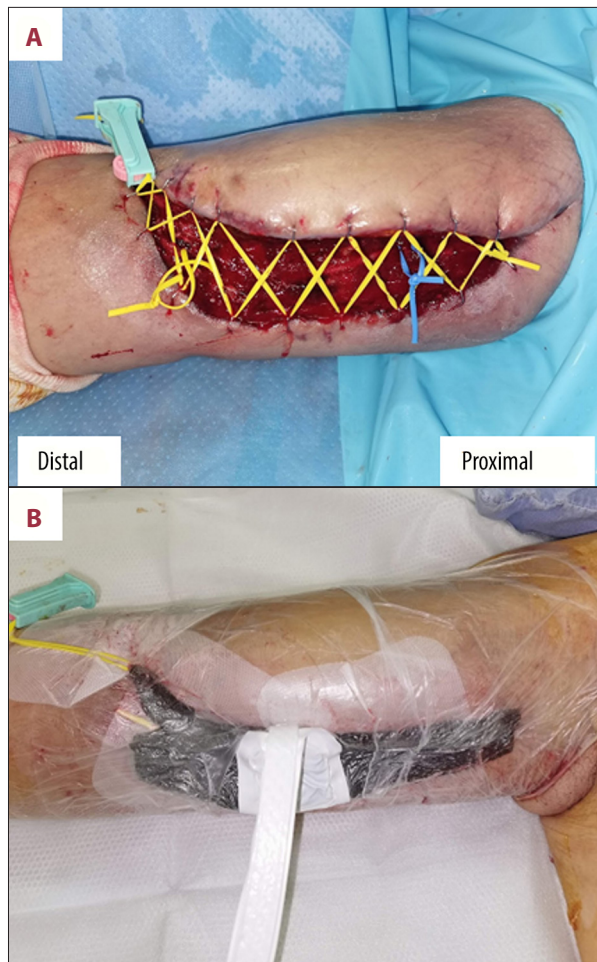
**Figure 3.** Intraoperative photographs. (A) There were no infectious findings between the skin and subcutaneous tissue, and the brachial fascia was severely swollen with evidence of internal pressure. (B) There were scattered white spots on the surface of muscles. (C) Muscle torn by a finger (yellow asterisk). There is a deep venous thrombosis (DVT) of the brachial vein (yellow arrowhead).

than half of the biceps brachii and brachialis muscles were poorly colored, and there were scattered white spots on the surface of the muscles (**Figure 3B**). These muscles were easily torn with the finger, suggesting infectious myositis and myonecrosis (**Figure 3C**). In addition, DVT of the brachial vein was observed and the catheter insertion site was confirmed. We



**Figure 4.** Histological examination of the affected muscles revealed marked infiltration of polymorphonuclear leukocytes (hematoxylin and eosin stain).





**Figure 5.** (A) The shoe-lace technique with vessel tape was used for rapid wound closure, combined with negative-pressure wound therapy by using RENASYS TOUCH™ (Smith & Nephew, Hull, UK) for decreasing edema and granulation (B) (day 28). (C) The appearance of the wound on day 41 (day 0 was the day the peripherally inserted central catheter was inserted).

submitted the muscle tissues and surrounding exudate for tissue culture and the muscle tissues for histopathological examination. We excised any muscle that appeared to be infected or necrotic and cleaned the wound thoroughly. The wound was left open postoperatively. On day 11, we evaluated the extent of the upper-extremity DVT with echo and enhanced computed tomography and found no thrombosis in the infraclavicular and axillary veins. The patient received intravenous heparin at a dose of 10 000 units per day for 14 days. The patient was admitted to the Intensive Care Unit (ICU) postoperatively, and his vital signs were stable on day 13. The culture tests were negative and histopathological examination showed evidence of infectious myositis in the biceps brachii and brachialis muscles (Figure 4). On day 14, rehabilitation of the right upper extremity was initiated. The patient was treated in the ICU until day 16. We performed regular wound cleaning and debridement in the ward and operation room, respectively. After the signs of infection disappeared (on day 20), we aimed to improve edema and granulation with negative-pressure wound therapy using RENASYS TOUCH™ (Smith & Nephew, Hull, UK) (Figure 5B) for 3 weeks, in addition to the shoe-lace technique using vessel tape for rapid wound

closure (Figure 5A, 5C). On day 25, we changed the antimicrobials and antifungals to oral tosufloxacin (450 mg/day) and oral posaconazole (300 mg), which were continued until day 40. On day 35, the CRP levels were negative. On day 52, the wound closed spontaneously. Six months after PICC insertion, the range of motion of the right elbow was 100 degrees of flexion and -30 degrees of extension.

## Discussion

Here, we report a case of infectious myositis and septic shock related to PICC insertion complicated by brachial DVT in an immunocompromised patient with myelodysplastic syndrome. Despite the administration of broad-spectrum antibiotics, our patient's condition was life-threatening and required emergency surgical debridement. To the best of our knowledge, our case is considered an unreported complication of PICC insertion.

Patients with hematological malignant disorders, such as myelodysplastic syndrome, are known to have a higher risk for CLABSI and DVT than patients with other disorders in the clinical setting of PICC insertion [4]. Additionally, they are at risk of infection and septic shock, which is the most severe complication [13]. In general, infection of the skeletal muscle is uncommon because of the resistance of the musculature to infection. Infectious myositis can occur due to a variety of pathogens, including bacteria, fungi, viruses, and parasites. Bacterial myositis usually presents as a focal muscle infection without an intramuscular abscess; however, viruses and parasites are often

more diffuse, causing generalized myalgia or multifocal myositis [14,15]. Infectious myositis can result from contiguous sites of infection, penetrating trauma, vascular insufficiency, or hematogenous dissemination. Immunocompromised hosts have a heightened risk of bacterial and fungal myositis [14,15]. It is likely that the infectious myositis in this case was due to procedural invasion during the insertion of the PICC, as evidenced by the physical examination findings of the right upper extremity, the intraoperative finding (penetration of the fascia surrounding the biceps brachii and brachialis muscles by the PICC), and the pathological findings of the focal infection in these muscles. Though the hematologist who inserted the PICC did so while wearing protective equipment and in a clean working space, there is still a possibility of accidental bacterial contamination. We assumed that the bacteria migrated into the muscle from the catheter. Furthermore, the presence of DVT may have reduced the circulation in the muscle tissue, contributing to worsening of the infection. Similar to pyomyositis (defined as an acute intramuscular infection that is secondary to the hematogenous spread of the microorganism into the skeletal muscle), a wide range of bacteria can cause myositis, with gram-positive bacteria being particularly predominant [14,15]. The reason for the negative blood and tissue culture results in our case may be due to the administration of broad-spectrum empirical antibiotics or antifungal drugs prior to the collection of specimens for evaluation.

Prompt imaging is essential for evaluating patients with focal soft tissue pain and fever because it is necessary to perform urgent surgical exploration. In such cases, MRI images would

show hyperabsorbed areas corresponding to swelling, intramuscular necrosis, or collections in the affected muscle [16]. In our case, MRI was useful for early surgical decision making.

We confirmed the brachial DVT intraoperatively and administered intravenous heparin for 14 days. The incidence of pulmonary embolism attributable to upper extremity DVT is 2%, regardless of anticoagulation treatment [17]. Additionally, considering the risk of mortality associated with anticoagulation, such as intracranial hemorrhage and the tendency to bleed easily from open wounds, anticoagulation therapy was discontinued [17]. We judged that the risk of fatal pulmonary embolism due to upper-extremity DVT was very low and the patient started rehabilitation of the right upper extremity 4 days after surgery [17,18].

## Conclusions

We encountered a rare case of infectious myositis and septic shock related to PICC insertion, complicated by brachial DVT, in a 43-year-old man with myelodysplastic syndrome. We believe that urgent resection of the infected and necrotic tissues, rather than broad-spectrum antimicrobial therapy alone, was essential to save the patient's life.

## Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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