

Case Report

Aggressive Fasciotomy for Critical Influenza Rhabdomyositis in Children

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Abstract

Influenza occasionally causes critical conditions in children, such as encephalitis, myocarditis or rhabdomyositis, resulting in severe multiple organ complications while symptoms like fever, headache, cough and sore throat are usually common. Rhabdomyositis, a rare complication of influenza, hardly presents compartment syndrome in the lower extremities requiring urgent fasciotomy to prevent further necrosis by muscular ischemia and paralysis of the nerves in children. A 12-year-old girl was suffering from pain in her right foot joint followed by progressive pain in both lower extremities on the fifth day. Her Creatine Kinase (CK) was remarkably elevated at 117,900 U/L and urine showed dark, and extremely high levels of myoglobin at 3,900,000ng/ml suggesting post-influenza infection rhabdomyolysis. The following day, we measured compartment pressures which were at 35 torr at the front of her right calf, and 24 torr at the back of her right calf because of progressive swelling followed by emergency fasciotomies in both thighs and calves. After fasciotomy, aggressive hydration was continued under intubation to maintain urine output, and respiratory management to restore circulation volume. Her serum CK decreased after peaking at 297,600U/L the day following fasciotomy, while pulsation in both lower extremities was well-palpable. Plastic surgeons carefully treated the open wound to prevent permanent sequelae and she was extubated on the fourth day after fasciotomy, followed by open-wound closure on the ninth day and discharge on foot on the seventy-first day after hospitalization. Aggressive fasciotomy based on quick and precise diagnosis is significant for preventing the progression of compartment syndrome by rhabdomyolysis in children, resulting in improved prognosis post-critical influenza infection.

Keywords: Influenza, Rhabdomyositis, Compartment syndrome, Fasciotomy, Children

Background

Influenza occasionally causes critical conditions in children, such as encephalitis, myocarditis or rhabdomyositis, resulting in severe multiple organ complications while symptoms like fever, headache, cough and sore throat are usually common. Rhabdomyositis, a rare complication of influenza, often presents in the lower extremities, causing pain or muscle weakness in children. These early symptoms sometimes progress rapidly, becoming critical with systemic inflammatory response syndrome or sepsis. Thus, complications from influenza infection require prompt and precise diagnosis, enabling speedy treatment.

Treatment of rhabdomyositis remains challenging. Rhabdomyolysis, destroying muscle cells, often causes severe complications such as acute renal failure or compartment syndrome, requiring hemodialysis or urgent surgery. Compartment syndrome, resulting from excessive swelling of the extremities, requires urgent fasciotomy to prevent further necrosis by muscular ischemia and paralysis of the nerves in adults, while surgical intervention is only available in a tertiary center in children. Surgical intervention for compartment syndrome needs to be undertaken before deterioration, because myositis and paralysis cause severe sequelae including the delay of motor development in children.

In this report, we present a case with a severe rhabdomyositis from influenza infection in a child where urgent fasciotomy for compartment syndrome and rhabdomyositis was performed.

Case Report

A 12-year-old girl was suffering from pain in her right foot joint, at the fourth day of influenza B infection, with a high fever. Progressive pain and swelling in both lower extremities on the fifth day. Her Creatine Kinase (CK) was remarkably elevated (at 84,840 U/L the next day) whereupon she was urgently transferred to the pediatric intensive care unit in our tertiary center.

Initial clinical examination revealed intolerable pain in both legs, with severe swelling. Both lower limbs were pale and the dorsal artery in either foot was impalpable. Laboratory data demonstrated a significantly high level of creatine kinase at 117,900 U/L, aspartate aminotransferase at 1,360U/L and lactate dehydrogenase at 3,890U/L, respectively. Urine showed dark, and extremely high levels of myoglobin at 3,900,000ng/ml. Post-influenza infection rhabdomyolysis was diagnosed. Aggressive intensive care with respiratory control, hydration with extracellular fluid and pain control with intravenous fentanyl was delivered. The following day, the patient's lower extremities demonstrated further swelling with

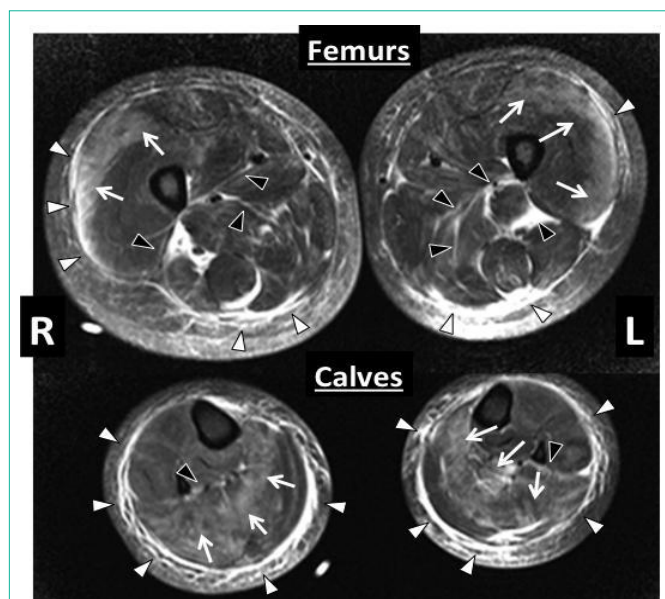


Figure 1: Magnetic resonance imaging of femurs and calves (Fat suppression mode taken by T2 with short tau inversion recovery mode). White areas demonstrated histological edema in the skeletal muscles (arrows) and fascia (black arrowheads) and subcutaneous tissues (white arrowheads) resulting from inflammation.

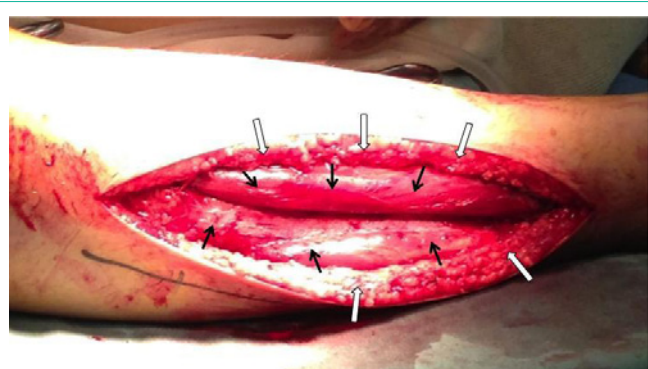


Figure 2: Fasciotomy (right calf). Skeletal muscles (black arrows) and subcutaneous tissues (white arrows) were remarkably swelling.

loss of sensory sensitivity. Creatine kinase increased to 273,300U/L, and Magnetic Resonance Imaging (MRI) revealed inflammation in her leg muscles, fascia and subcutaneous fat tissues (Figure 1). We measured compartment pressures which were at 35 torr at the front of her right calf, and 24 torr at the back of her right calf before conducting emergency fasciotomies in both thighs and calves (Figure 2).

After fasciotomy, aggressive hydration was continued under intubation to maintain urine output, and respiratory management to restore circulation volume. Her serum CK decreased after peaking at 297,600U/L the day following fasciotomy, while pulsation in both lower extremities was well-palpable. During critical treatment, plastic surgeons carefully treated the open wound to prevent permanent sequelae. Histopathologic examination of the muscle tissue demonstrated diffuse striated muscle degeneration and necrosis, with little inflammatory infiltration (Figure 3).

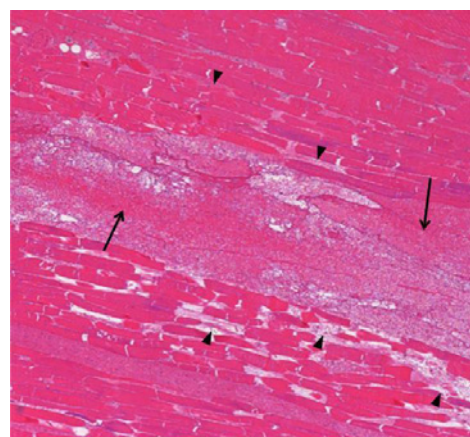


Figure 3: Histological findings of skeletal muscle. Diffuse muscular necrosis (arrows) and intra-muscular edema (arrowheads) are recognized with little inflammatory infiltration.

She was extubated on the fourth day after fasciotomy, followed by open-wound closure on the ninth day. Consequently, her exercise rehabilitation was initiated, allowing her to be discharged, on foot, on the seventy-first day after hospitalization.

Discussion

Although influenza infection is common in children, severe complications, like pneumonia, encephalitis, myocarditis or rhabdomyositis, sometimes result in life-threatening sequelae. Although Wong et al reported that pneumonia is the most frequent complication causing death in children, Agyeman et al reported that ten of 311 patients with influenza myositis (3%) developed severe rhabdomyolysis and two patients (0.6%) suffered from compartment syndrome requiring fasciotomy [1,2] on the fourth day of his illness as a result of Skellett et al reported that a healthy boy died multi-organ failure secondary to disseminated influenza [3]. He had extensive myositis, rhabdomyolysis, renal failure and compartment syndrome, which were resistant to supportive medical management. In our case, the girl suddenly suffered from myalgia and muscle weakness two days prior to her emergency admission, suggesting possible severe complications by influenza infection. Therefore, immediate transfer to a tertiary center and preparation of critical care are vital for the treatment of possible complications in children.

Rhabdomyolysis, a rare complication occurring in three to nine percent of influenza myositis cases, includes considerable risk of multi-organ failure, whereas most influenza myositis cases generally improve without specific interventions [1,2,4,5]. Acute renal failure is a serious complication secondary to rhabdomyolysis, causing such possible life-threatening sequela as compartment syndrome or multi-organ failure. Watanabe reported that risk of acute renal failure secondary to rhabdomyolysis was fifty percent, while Mannix et al reported only five percent [6,7]. As dehydration, massive muscular necrosis, metabolic acidosis and aciduria were all contributing factors leading to acute renal failure, the early introduction of critical care including fluid therapy is crucial for severe rhabdomyolysis [6]. Rhabdomyolysis requires aggressive medical intervention to prevent acute renal failure.

Early detection of rhabdomyositis is significant, because the classic symptoms of severe muscle pain, weakness and urinary discoloration are not always present in children, resulting in difficulty of diagnosis [3]. Rominger et al reported the usefulness of MRI for diagnosis and the therapy of compartment syndrome of the lower legs [8]. Measuring compartment pressure is a good index for the introduction of invasive therapy, because elevated pressure in a closed fascial space causes decompression of muscle, vessels and nerves, resulting in further histological damage and critical condition. Although normal compartment pressure is around 15 mmHg, viral-induced myositis increases rapidly and needs to be assessed frequently [9,10]. We performed MRI, followed by measuring compartment pressure to confirm compartment syndrome, before pursuing fasciotomy and the resulting good clinical course. Early recognition of rhabdomyolysis and prompt management of complications are crucial to outcome.

Fasciotomy is vital, and frequently performed, for the treatment of trauma in adults where acute compartment syndrome follows fracture, crush injuries or vascular problems. We show it is also vital to combat infection in children, [11,12] Douvoyiannis et al reported fasciotomy with rhabdomyolysis associated with parainfluenza virus, and Ramos et al performed fasciotomy in cases with cellulitis in children [13,14]. The outcome after fasciotomy is excellent in most pediatric patients, and complications such as muscle necrosis and nerve damage are avoided by immediate decompression [15,16]. Aggressive fasciotomy under optimal assessment will prevent further complications in compartment syndrome in children.

Pathogenesis of influenza myositis and rhabdomyolysis remain unclear. Direct viral invasion into skeletal muscle is a possible cause in myositis, such as influenza pneumonia, while immune-mediated interaction is another possible cause in myositis in influenza demonstrating primary muscle cells leading to cytolysis. Desdouts et al studied the susceptibility of cultured-primary human skeletal muscle cells to influenza virus, and the levels of inflammatory cytokines were not elevated in the supernatants of cultured cells [17]. Cheng et al suggested that the pathogenesis of influenza encephalitis might not be simply due to immune activation or cytokine storm, but could also be caused by direct viral invasion [18]. In our case, diffuse striated muscle degeneration and necrosis with little inflammatory infiltration were noticed in histopathologic examination of skeletal muscle. Ishiwada et al reported rhabdomyolysis associated with influenza, describing that influenza RNA was negative and that no viral positive-antigen cells were detected in the muscle tissues [19]. Therefore, the mechanism of influenza rhabdomyositis is still under discussion.

In conclusion, aggressive fasciotomy based on quick and precise diagnosis is significant for preventing the progression of compartment syndrome by rhabdomyolysis in children, resulting in improved prognosis post-critical influenza infection.

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