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Case Report

Fatal Thigh Compartment Syndrome: A Case Report and Review of Literature

Tie-Ling Zhao[1], Ye Xue[2], Xiao-Hui Tan[2], Dong-Fang Qiao[2], Xiao-Li Xie[3*],Qi Wang[2*]

[1]*Public Security Bureau of Shunde District, Foshan, China*

[2]*Department of Forensic Medicine, School of Basic Medical Science, Southern Medical University, Guangzhou, China*

[3]*Department of Toxicology, School of Public Health and Tropical Medicine, Southern Medical University, Guangzhou, China*

**Corresponding author: Dr. Xiao-Li Xie, Department of Toxicology, School of Public Health and Tropical Medicine, Southern Medical University, No. 1838, Guangzhou 510515, Guangdong Province, PR China,Tel:+862062789132; Fax:+862061648324; E-mail: xiexiaoli1999@126.com*

Dr. Qi Wang,Department of Forensic Medicine, School of Basic Medical Science, Southern Medical University, No. 1838, Guangzhou 510515, Guangdong Province, PR China; Tel:+862062789101;Fax:+862061648359; E-mail:wangqi_legmed@126.com

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Abstract

Compartment syndrome of the thigh is a rare surgical emergency, which is commonly caused by blunt trauma. It is a condition where pressure within an osseofascial compartment of the thigh rises, leading to cellular anoxia, muscle ischemia, and death. The diagnosis of compartment syndromes of the thigh is usually clinical. Since the thigh compartments are larger than those of the forearm and calf, it can accommodate a large volume prior to the manifestation of pathological changes. Compartment syndrome of the thigh has been mostly reported by clinicians. However, there is a lack of knowledge of the histopathological and postmortem biochemical features of thigh compartment syndrome. In this report, we described a 59-year-old man who pulled his right thigh muscles during manual labour, with an acute compartment syndrome occured at the fourth day after the injury, and died on the following day. At autopsy, diffused necrosis and edema of skeletal muscles were found in his right thigh. Histopathological examination revealed hemorrhage and infiltration of neutrophils in his skeletal muscles and connective tissue. Positive immunoreactivity of myoglobin in the granular casts in distal convoluted tubules by immunostaining and marked elevation of serum urea nitrogen, uric acid and creatinine levels were observed.

Keywords: Autopsy case; Thigh compartment syndrome; Immunostaining; Postmortem biochemistry

Abbreviations

TCS: Thigh Compartment Syndrome

DVT: Deep Venous Thrombosis

MCT: Mast Cell Tryptase

BUN: Blood Urea Nitrogen

Scr: Serum Creatinine

Introduction

Compartment syndrome is a surgical emergency that occurs when compartment pressure elevates higher than perfusion pressure [1]. Based on the characteristic of thigh compartment structures, thigh compartment syndrome (TCS) occurs less frequently than in the forearm and calf, but associated with high morbidity and mortality. The etiology of TCS is diverse. Cases of TCS have been reported as a result of fracture, vascular lesion, extrinsic compression, contusion after blunt trauma, tumor infiltration, drug-induced and prolonged muscular effort [2-4]. Most cases in literature were published by clinical practitioners, but rarely reported by forensic medical examiners [5]. Therefore, there is a lack of knowledge of the histopathological and postmortem biochemical features of thigh compartment syndrome.

Case Report

A59-year-old manual worker pulled the muscles of his right thigh during work. He suffered from persistent pain and went to hospital for treatment immediately, but went home without symptomatic remission on the same day. Four days later he was admitted to the orthopedic ward. The obvious presentation was a hematoma of the right thigh, following progressive skin tenderness in his right iliac region and popliteal fossa. He was kept in bed and treated with improving microcirculation therapy and other supportive treatments.

On the following day, the patient suddenly lapsed into unconsciousness without responses. After all rescue measures proved ineffectually, the patient was declared clinical death.

A standard legal autopsy was required in order to give a clear conclusion of the cause of death. Several suspects were raised, including acute pulmonary embolism and deep venous thrombosis (DVT) of his right lower limb.

Figure 1. Diffuse skeletal muscles necrosis and edema were found in the right thigh.

At autopsy, highly swollen right knee and thigh, as well as diffused necrosis and edema of skeletal muscles were detected in his right thigh (Figure 1). Most of the organs were congestive and edematous, where the lungs and kidneys were most pronounced. The victim also had a history of coronary arteriosclerosis with II degree luminal stenosis.

The tissue histopathological test of right thigh muscles showed massive connective tissue necrosis, skeletal muscle fiber swollen and rhabdomyolysis with neutrophilic granulocyte infiltrated (Figure 2).

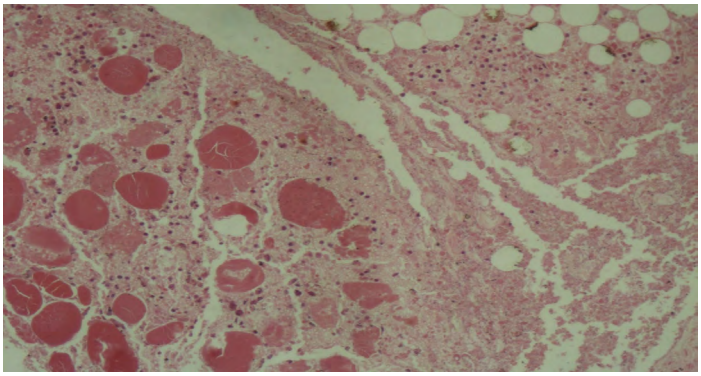

Figure 2. Massive connective tissue necrosis, skeletal muscle fiber swollen and rhabdomyolysis with neutrophilic granulocyte infiltratedintheright thigh (HE ×100).

Allergy related test of right heart blood sample showed a slight increase of total blood IgE, but not MCT. Blood urea nitrogen (BUN) and serum creatinine (Scr) elevated significantly (Table 1). Intensive positive immunoreactivity of myoglobin was detected in distal convoluted tubules by immunostaining (Figure 3).

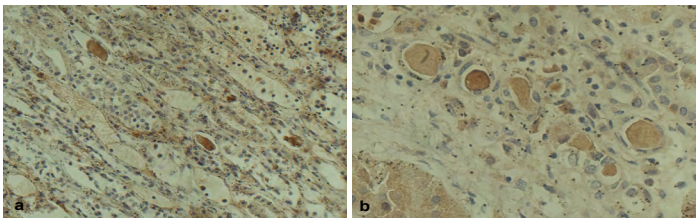

Figure 3. Intensive positive immunoreactivity of myoglobin was detected in granular casts in distal convoluted tubules by immunostaining.

Test	Test result	Reference
Total blood IgE	146IU/ml	≤100 IU/ml
MCT	2.693 ng/ml	≤13.5ng/ml
BUN	17.10mmol/L	2.90-8.20mmol/L
Scr	366.78umol/L	59.00-104.00umol/L

Table 1. Postmortem biochemistry results.

Discussion

On the basis of autopsy findings, especially the muscle necro-

sis and hematoma in the right thigh by histological results, he was diagnosed as fatal compartment syndrome. Furthermore, intensive positive immunoreactivity of myoglobin in his distal convoluted tubules and elevated BUN and Scr levels were detected, indicating massive skeletal muscle damage and renal failure. The cause of death was renal failure.

Two cases of fatal acute compartment syndrome were reported by Zhu et al., demonstrating that both victims died due to myoglobinuric renal failure on the basis of pathological findings and postmortem biochemical measurements [6].

Uzel et al. reported a case of TCS resulted from muscle contusion, which bring sports-related injuries into the etiology of TCS. They mentioned that muscle injuries can increase cell membrane permeability leading to extravasation of intravascular protein and increased colloid pressure in the interstitial space which promotes a vicious cycle [4]. Increased pressure may aggravate muscle ischemia and edema, accompany with muscle infarction, leading to acidosis, hyperkalemia, myoglobinuria, high level of blood urea nitrogen and serum creatinine, and ultimately develop into renal failure, shock, and cardiac dysrhythmias.

As a rare condition, thigh compartment syndrome generally occurs within hours to days. Wardi et al. described a particular case of delayed compartment syndrome which the time between injury and symptomatic presentation could be the longest in literature. As the thigh consists of three compartments, which are much larger in size than the forearm and calf, the required degree of pressure elevation to cause thigh compartment syndrome is much higher. Etiologically, muscular hematomas result a slower pressure increase than vascular injuries, which could be the mechanism of the delay compartment syndrome [7]. How et al. also reported a delayed TCS case after blunt trauma and vascular injury occurred in a soccer athlete which highlighted the response of thigh musculature to blunt trauma and vascular injury and the role of vascular study in evaluating thigh hematoma [8].

TCS is more difficult to diagnose due to the atypical five major traditional signs: pain out of proportion, paraesthesia, paralysis, pallor, and pulselessness [9]. According to Knab et al.'s research data, only 50% of the patients were diagnosed within less than 24 hours, and only 40% of the patients were diagnosed based on compartment pressure measurement [1].

Conclusion

TCS is a rare complication of multiple etiologies, which is difficult to diagnose. Practitioners should highly alert to the case of disproportionate painful muscular contusion. Timely compartment pressure measurements and fasciotomy could be the only way to prevent a fatal consequence.

Acknowledgments

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