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Management of Acute Compartment Syndrome During the Al Haouz Earthquake - Department of Reconstructive and Aesthetic Plastic Surgery, CHU Mohammed VI, Marrakech

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Abstract **Original Research Article**

On September 8, 2023, a devastating earthquake struck the Al Haouz region of Morocco, causing significant injuries, including cases of acute compartment syndrome (ACS), a surgical emergency. This report presents a case of a patient from the earthquake, treated for ACS at Mohammed VI University Hospital in Marrakech. The patient, who suffered limb trauma from debris crushing, presented with rhabdomyolysis and signs of ACS in the left upper and lower limbs. Clinical findings included functional impairment, "Coca-Cola" urine, and high creatine kinase levels (60,000), accompanied by renal failure. Decompression surgery (aponevrotomies) was performed to relieve intracompartmental pressure, followed by a directed healing protocol using the "shoe-lace" technique for wound closure. Post-operative management included antibiotics, hemodialysis for acute renal failure, nutritional support, and motor rehabilitation. Complications, such as surgical site infection and hematoma, were addressed with revision surgery and adjusted antibiotic therapy. Despite these challenges, the patient showed significant clinical improvement and resumed normal activity within three months post-operatively. This case highlights the critical importance of timely surgical intervention in ACS, particularly in disaster settings. Early diagnosis, prompt fasciotomy, effective wound management, and multidisciplinary care are essential to prevent severe complications, such as septic wounds or amputation, and ensure successful recovery.

Keywords: Acute Compartment Syndrome, Rhabdomyolysis, Crush Injuries, Fasciotomy, Earthquake, Renal Failure, Acute, Debridement, Wound Healing, Disaster Medicine, Postoperative Complications.

1. INTRODUCTION

On September 8, 2023, one of the most devastating earthquakes in Morocco was recorded in the Al Haouz region, causing significant damage and affecting thousands of people, who were left under the rubble before being reached by rescuers. This led to a variety of injuries and complex traumas requiring specialized surgical management, particularly for patients suffering from acute compartment syndrome. It is an absolute surgical emergency characterized by an increase in pressure within the muscle compartments surrounded by an inextensible aponeurotic membrane, which can lead to vascular, nerve, and muscle ischemia with potentially fatal consequences.

2. PATIENTS AND METHODS

A case report on a patient who was a victim of the Al Haouz earthquake in Morocco in September 2023, treated for acute compartment syndrome following the crushing of her limbs by debris. She was cared for by the Department of Plastic, Reconstructive, and Aesthetic Surgery at Mohammed VI University Hospital in Marrakech.

Figure 1: Overview of the surgical management of an aponeurotomy and its delayed closure following trauma

3. RESULTS

The patient was initially admitted to the surgical intensive care unit at H-10.

She presented with trauma affecting the left upper limb as well as the left lower limb, with a clinical picture of rhabdomyolysis:

- Functional impairment and pain upon mobilization affecting both limbs, with a claw-like appearance and signs of tension in the left hand.
- Dark brown urine, referred to as "Coca-Cola" urine.

A complete biological assessment was conducted, showing: a CPK level elevated to 60,000, elevated LDH, hyperkalemia at 5.8, as well as acute renal failure with a urea level of 1.7 and creatinine at 36. The patient underwent decompression surgery (aponevrotomies) at H-2 using cold blades, allowing for total decompression of the muscle compartments.

At the end of the procedure, the incisions were left open to allow for complete evacuation of the edema.

The patient was placed on directed healing using a well-defined care protocol, followed by gradual closure using the so-called "shoe-lace" technique at the onset of granulation, with a steel wire facilitating good approximation of the edges.

The initially loose stitches were gradually tightened starting from post-operative day 10 in our case. Antibiotic prophylaxis was initiated with amoxicillin-clavulanate.

Clinical and biological improvement was noted as early as H-12 post-operatively, with clearer urine and regression of CPK and LDH levels.

However, persistent electrolyte imbalances and renal failure were observed. Consequently, the patient underwent 4 sessions of hemodialysis post-operatively to manage acute renal failure.

Post-operative complications included:

- An infection at the surgical site that occurred on day 12 of hospitalization, requiring a change in antibiotic therapy to ciprofloxacin + tazobactam.
- A hematoma of the vastus lateralis muscle requiring surgical revision in the emergency operating room (day 22 of hospitalization).
- Paresthesias and pain in the left upper limb.

The patient benefited from multidisciplinary care:

In general terms, she required several transfusions of packed red blood cells with the aim of achieving a hemoglobin level of at least 11 g/dL, along with iron supplementation.

She also received albumin transfusions with the goal of achieving a serum albumin level of at least 30 g/L.

Nutritionally, she was placed on a hypercaloric hyperproteic diet (35 kcal/kg/day) and received supplementation with vitamins and trace elements (Selenium, Zinc, Vitamin B, C) essential for healing.

Functionally, she underwent motor and functional rehabilitation by the physiotherapy team with early mobilization. The duration of hospitalization was

47 days, with satisfactory results both locally and generally.

Following her hospitalization, the patient was continued on directed healing in outpatient consultations until complete healing of the incisions and return to normal regular activity at 3 months post-operative.

4. DISCUSSION

Once the diagnosis of acute compartment syndrome is established, immediate measures must be taken to prevent further increases in intracompartmental pressure.

A fasciotomy is an emergency procedure used to treat acute compartment syndrome. Compartment syndrome is when the pressure builds up in a non-compliant osseofascial compartment and causes ischemia leading to muscle and nerve necrosis. It occurs most commonly in the volar compartment of the forearm, deep posterior, or anterior leg compartment [1]. The primary objective of performing an fasciotomy is to quickly and effectively decompress the affected area, thereby restoring optimal tissue perfusion.

It is crucial for the plastic surgeon to have the ability to identify healthy, viable tissues from necrotic tissues, as debridement combined with decompression incisions plays a key role in minimizing the risk of infection and improving the prospects for successful tissue recovery.

Delaying the performance of a decompressive fasciotomy is the only factor leading to unfavorable outcomes in acute compartment syndrome, simultaneously increasing the likelihood of complications such as septic wounds and mortality rates.

Well-executed surgical interventions reduce amputation rates, thus offering clinically satisfactory results. General postoperative management is also important: directed healing remains a technique of choice and yields excellent results if performed correctly.

Transfusion of blood and macromolecules (Albumin) may be necessary to successfully implement this therapeutic project. Rehabilitation and hypercaloric, hyperprotein nutrition are complementary aspects that are equally important.

Adjunctive techniques such as hyperbaric oxygen therapy or the use of VAC can be useful, thereby accelerating detersion and promoting granulation.

Figure 2: Overview of wounds during the healing phases

5. CONCLUSION

The Acute Compartment Syndrome is a potentially serious condition that can result from various causes, including crush injuries to the limbs, as seen in our case due to an earthquake. Diagnosing and treating this pathology poses a challenge for surgeons. However, despite conditions such as natural disasters (the earthquake in our case), they must provide the most optimal medical care to ensure the best outcomes for the victims. Hence, there is a need for a sound surgical strategy, a follow-up plan, and good collaboration between different specialties to ensure complete healing.

Conflict of Interest: The authors declare having no conflict of interest

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