Volume 7, Number 1, April 2024

THE JOURNAL OF INDONESIAN ORTHOPAEDIC & TRAUMATOLOGY

journal homepage: http://journal.indonesia-orthopaedic.org

Case Report

Crush Injury of Upper Extremity Leading to Bywater's Syndrome: A Case Report

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Article Info :

Article History :
Submission: January 5, 2024
Revision: July 28, 2024
Accepted: July 28, 2024

Keywords :
Crush injury
Bywater's Syndrome
Case Report
Mess Score
Surgery
Necrotic Tissue

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Abstract

Introduction:
A male came to the ER with wounds on his left arm after a vehicle incident. He was run over by the truck's wheels on his left upper extremity until his whole arms were crushed. He had a massive crush injury on his whole left arm, no movement or pulse was detected. MESS Scoring resulted in a score of 11, thus an indication for amputation. Blood examination showed an increase of ureum and creatinine without previous kidney disease history. The patient was diagnosed with a crush injury of the upper extremity and Bywater's Syndrome based on kidney involvement. He was consulted by the orthopedic department and was given fluid resuscitation, injections of analgesics, antibiotics, and Human Tetanus Immunoglobulin (HTIG). Proximal humerus amputation was performed. A second surgery later was performed to debride the wound due to contaminated necrotic tissues.

Introduction

Crush injury can lead to many complications, one such uncommon consequence is known as Bywater's Syndrome.[1] It is characterized by the sudden and excessive destruction of red blood cells (hemolysis) due to mechanical trauma.[2] It is a relatively rare condition, Mangled Extremity Severity Score (MESS) should be performed on patients with crush injuries as diagnostic tools and to determine if the patient needs amputation.[3]

Case Report

A 57-year-old male came to the ER with a massive wound on his left arm after a motor vehicle incident on the street. The patient was riding his bike and then collided with a truck. The patient got run over by the truck's wheels on his left upper extremity until his whole arms were crushed.

Vital signs showed blood pressure of 85/51mmHg, body temperature of 36.5°C, heart rate of 128 bpm, respiratory rate of 24 times per minute. Physical examination showed a massive crush injury on his whole left arm, no movement or pulse were detected. MESS Scoring was performed and the patient's score is 11, thus an indication for amputation. The left humerus



Figure 1. Crushed left arm after injury

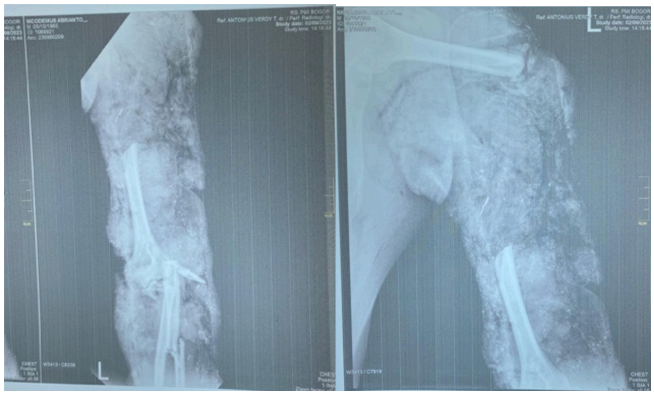


Figure 2. Upper left arm x-ray

x-ray was performed even though the crush injury was already visible. The x-ray showed a one-third mid-left humeral fracture with poor alignment. Blood examination showed lowered hemoglobin of 10.4 g/dl, elevated leukocytes of 34.720/uL, urea and creatinine of 59 mg/dL, and 2.12 mg/dL without previous kidney disease history. The patient was diagnosed with a crush injury of the upper extremity and Bywater's Syndrome due to kidney involvement. The patient was consulted to the orthopedic department and was given 2 liters of ringer lactate fluid, ketorolac injection, ceftriaxone injection, and Human Tetanus Immunoglobulin (HTIG), and proximal humerus amputation was performed. Three days later, he complained about darkened skin around his amputated arm, followed by slight blood and pus. A second surgery was performed to debride the wound due to contaminated necrotic tissues. Five days after the second surgery, the patient showed improvement and there were no signs of infection. The patient was discharged from the hospital and continued the treatment to evaluate post-amputation condition and systemic symptoms.

Discussion

A crush injury is characterized by the extensive damage of a large muscle mass. Bywater's syndrome or crush syndrome is a crush injury with systemic manifestations.[4] Systemic symptoms arise from traumatic rhabdomyolysis, which occurs when there is muscle reperfusion injury following the release of compressive forces on the tissues.[5] The patient showed kidney dysfunction as in elevated creatinine and urea levels upon trauma without prior kidney failure history. Upon arrival, vital signs showed hypotension, tachycardia, and tachypnea, which might be early signs of hypovolemic shock due to massive blood loss. Early resuscitation and treatment were done to prevent further complications. According to literature, early untreated Bywater's syndrome death is caused by hypovolemic shock and hyperkalemia due to kidney dysfunction, and late untreated death is caused by prolonged renal failure, coagulopathy, hemorrhage, and sepsis.[6] Further treatment is determined by using a MESS score to decide whether the patient needs an amputation. MESS score includes skeletal/soft tissue injury, limb ischemia, shock, and age as variables.[7] Score of 7 or above is highly predictive of amputations. As this patient scored 11, amputation surgery was performed. According to the literature, it is reported that 13-40% of infections happen in major limb amputation. The risk factors vary from ischemia, pre-existing limb ulcers, patient co-morbidities, and



Figure 3. Necrotizing tissue after amputation surgery



Figure 4. Debridement surgery



Figure 5. Post debridement surgery

contamination of the wound.[8] In this patient, contamination of the wound is verdict to become the source of infection. The second surgery was performed to debride the contaminated wound. After a total of six days of treatment and two surgeries, the patient showed improvement after the second surgery. Further treatment was still needed to evaluate the wound and systemic signs of kidney involvement. Post-operative pain and psychological factors also need to be issued. We would recommend psychological assessment, kidney function evaluation, and wound hygiene for the next treatment. It is an important case to be reported as early recognition and treatment might result in a notable outcome for the patient.

Conclusion

Urgent and effective medical care is required to reduce the risk of cardiac arrhythmia, kidney damage and death. Decisions may need to be made quickly as postponed therapy might result in worse prognosis. Patients with crush injury present some of the greatest challenges in field medicine, and may need a physician's attention on the site of their injury. Appropriate physiological preparation of the injured is mandatory.

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