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Abstract

Multiple trauma usually results from RTAs or falls, affecting several systems. Treatment should be properly designated according to the type of injury, patient's assessment and health-care-serving status. Damage-control orthopaedics aims at improving the patient's physiological status as to delay any orthopaedic surgery that may worsen the patient's condition, meanwhile achieving provisional stability of the fractures. In this work, a patient with multiple fractures at once was managed using this approach. Advanced trauma life support (ATLS) was firstly applied, followed by reduction and fixation. The patient administered long-term prophylactic antibiotics and possessed physiotherapy sessions from the first week. On 3 and 6 months postoperatively, the patient showed progress and regained his ability to work and live normally.

Keywords: Multiple Fractures; Polytrauma; Emergency Medicine; Damage Control System.

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Introduction

Road traffic accidents are the first cause of death for <45-yearold people whereas victims are usually young and in their most productive age. In USA, trauma accounts for 145.000 deaths per year (disabilities of three-folds this number), and in developing countries, trauma is the first cause of death for all ages. In Egypt, there is about 7000 death toll per year caused by trauma which is more than the casualties caused by wars [1].

Car accidents usually cause multiple injuries with vast inflammation and severe bleeding that affect several organs, limbs or visceral tissues. This requires physicians and surgeons from different specialties to cooperate in managing such cases.

Polytrauma is known as multiple injuries at the same onset that usually affect multiple organs. This type of injury is usually severe and associate with systemic inflammation and a state of immunity suppression extending for certain period during which extensive surgical intervention should be avoided. It needs special management and prolonged immobilization to prevent subsequent com-

plications such as suffocation, prolonged healing and high rate of infection [2]. Damage-control orthopaedics is warranted for patients with multiple fractures as it helps in stabilizing patient's condition and provides better control on the postoperative outcome [2].

Early total-care principle was more commonly used in management of polytraumatic patients, aiming to fix many fractures as possible in a single session and to allow patients to undergo tests and therapies within shorter period [3].

Damage-control theory aims to correcting body fluids, electrolytes, acid-base and nutritional imbalances, fixing multiple fractures in divided sessions, stabilizing the patients again during the breaks between sessions and not fixing more than two bones in each session [4].

In this paper, we present the applicability of damage-control theory in a patient with multiple fractures in one extremity, reporting the treatment method and postoperative results.

Patient and Method

A 24-year-old male driver was evolved in a car accident and presented with 10 fractures in his left leg with other minor injuries. The fractures involved ipsilateral intracapsular neck femur, shaft femur, upper tibia, bimalleolar fracture ankle as well as dislocation in the 1st MTP and open fractures in the heads of 2nd, 3rd, 4th and 5th metatarsals (Figure 1).

The patient had some adverse factors for bone healing as he was a heavy smoker and used to receive strong NSAIDs; but he had no head injury.

Advanced trauma life support (ATLS) was applied. We considered the following issues: timing of surgery, order of operations, type of techniques and funding the cost of the implants, as the patient was not insured.

Figure 1. Preoperative radiograph.



On admission, we prepared the patient for immediate debridement, reduction of the open fractures and reconstruction nailing to fix the fractures of the shaft and neck of femur. Although the wound of the left foot was 10 cm in length, it was not possible to reduce the dislocation because the head of the 1st metatarsal was button-holed from the capsule. The cartilage was partially damaged from the long exposure of the head to the open atmosphere. Reduction was achieved after capsulotomy and fixed by k-wires. The patient was stabilized again, and two days later, he was taken to the OR for a second look and debridement of the open wound and for the fixation of other fractures by plating of upper tibia, lateral malleolus, tension band and k-wiring of medial malleolus and plaster cast for other metatarsal fractures (Figure 2). The patient had prophylactic antibiotic and DVT measures and he started physiotherapy in the first week of treatment.

Results

By three months, the patient was fully weight bearing and showed signs of healing of the fractured neck and shaft of femur, upper tibia and other fractures (Figure 3). However, he was complaining

of mild ache of his first MTP joint and a discharge from the surgical wound of his upper tibia which was found later on to be sterile. At 6-month follow-up, the progress was satisfactory and the patient was trying to go back to his work.

Discussion

Management of multiple fractures has been questioned over years, and debates over the total-care principle versus damage-control system took decades of work and review across the globe [4]. Damage-control theory has been a broad term as variations might happen depending on the type of fracture, timing of fixation, patient comorbidities together with other factors that may alter the treatment approach [5].

Management of multiple-fracture trauma (polytrauma) is a topic of interest for most orthopaedic researchers. Early intervention, while the patient is still under an immune-suppressive state, may cause excessive inflammation and dysfunction of any remote organ. However, time and pattern of intervention should be decided up on the patient's overall physiologic status and complexity of

Figure 2. Postoperative radiograph.



Figure 3. Clinical photos for the patient 3 months postoperatively.



injuries [2]. Damage-control orthopaedics is demanding for patients with polytrauma as it provides ideal initial treatment based on balancing body measurements (e.g, respiratory rate and blood pressure) before proceeding in any surgical intervention. Meanwhile, the patient achieves provisional stabilization of fractures to closely watch potential concerns such as vascularity of the bony structure and its proximity to other vital organs as well as osteoporosis. Open-wound reduction and infection control are done later on to stabilize the affected bones and restore the function [4].

Concerns over potential hemorrhage, fat embolism, infection and metabolic derangement may necessitate the surgeon to refer the patient to the critical care unit until primary stabilization is achieved, following the guidelines of damage control theory [7]. Assessing the patient's parameters and the appropriate treatment options requires a multidisciplinary approach between orthopaedic surgeon, critical-care physician, anesthesiologists and nursing staff [8]. The major role that prophylactic antibiotics play to stop soft tissue infection following traumatic injury was investigated by Lane et al. [9].

On managing the case presented, the surgeons decided to work on two stages: first stage mainly provided fixation of the femoral fractures (including neck of femur) and second stage (after 2 days) for fixation of the tibial and metatarsal fractures; on each stage, proper and thorough debridement of the wounds was done. The two-day interval offered reasonable delay, thus the patient could benefit from further damage-control measures before applying the definitive fixation. We could further reduce hemorrhage, manage soft-tissue laceration and prevent prolonged concussion. This is in accordance with D'Alleyr and O'Toole review which

summarized the evolution of damage-control orthopaedics with an emphasis on femoral fractures [6].

From the authors' view, total care may prolong the treatment period and may associate with early definitive treatment's complications unless safe measures were taken. Damage-control theory seems more advantageous in managing patients with multiple fractures over the early total-care principle.

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