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Case Report

Management of Polytrauma Patient in a Limited Setting: A Case Report

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Abstract

Polytrauma patients with multiple fractures present a significant challenge in limited resources settings. The application of damage control orthopedics (DCO) principles, including temporary stabilization, staged definitive fixation, and multidisciplinary collaboration, resulted in favorable outcomes for the patient. This case report describes the successful management of a polytrauma patient who sustained multiple injuries, including unstable pelvic fracture and fractures of the femur, radius, shoulder dislocation, and distal radio-ulnar joint dislocation. This report emphasizes the importance of timely intervention and resource optimization in limited settings.

Introduction

Polytrauma is often defined as having a high Injury Severity Score (ISS) and is frequently used interchangeably with terms like “severely injured” or “multiple injuries”. An ISS above 16 is considered to predict a mortality risk over 10%.[1-3] Polytraumatic conditions are critical and require a unique approach. Patients with multiple injuries, including head, chest, abdominal or pelvic injuries with significant blood loss, benefit from fracture management principles. However, the term “polytrauma” may also refer to a severe single-system injury (monotrauma) with a high ISS.

The "Damage Control Orthopedic" (DCO) strategy is widely accepted for treating unstable severely injured patients. Polytrauma patients have a higher mortality rate. They require more extensive and costly treatments, intensive resuscitation resources, and longer stays in the Intensive Care Unit (ICU)[1,2] Fundamental principles of DCO involve stabilizing life-threatening conditions by using minimally invasive external frames to fix long bone fractures, followed by definitive fracture fixation after metabolic and respiratory recovery, typically after a few days.[1]

Case Presentation

Mechanism of Injury

A 17-year-old male arrived at the Emergency Department following a high-speed motorcycle collision with a utility pole.

Patient Care

The initial assessment revealed signs of hemorrhagic shock and multiple fractures. Examination of several areas such as the wrist showed swelling with obvious deformity upon inspection. Vascular, neurological, and motor function distal did not show a deficit, but the range of motion of the left forearm and left thigh were limited by pain. Pelvic was tender to palpation. The left thigh showed deformity upon inspection. (Figure 1a).

The patient’s condition was stabilized following Advance Trauma Life Support protocols, including resuscitation of 2000 cc crystalloid fluids, blood products were not administered due to limited. Adjunct diagnostic procedures such X-Rays and Abdominal CT Scan were performed. Splints and Pelvic Binder was applied. (Figure 1a)

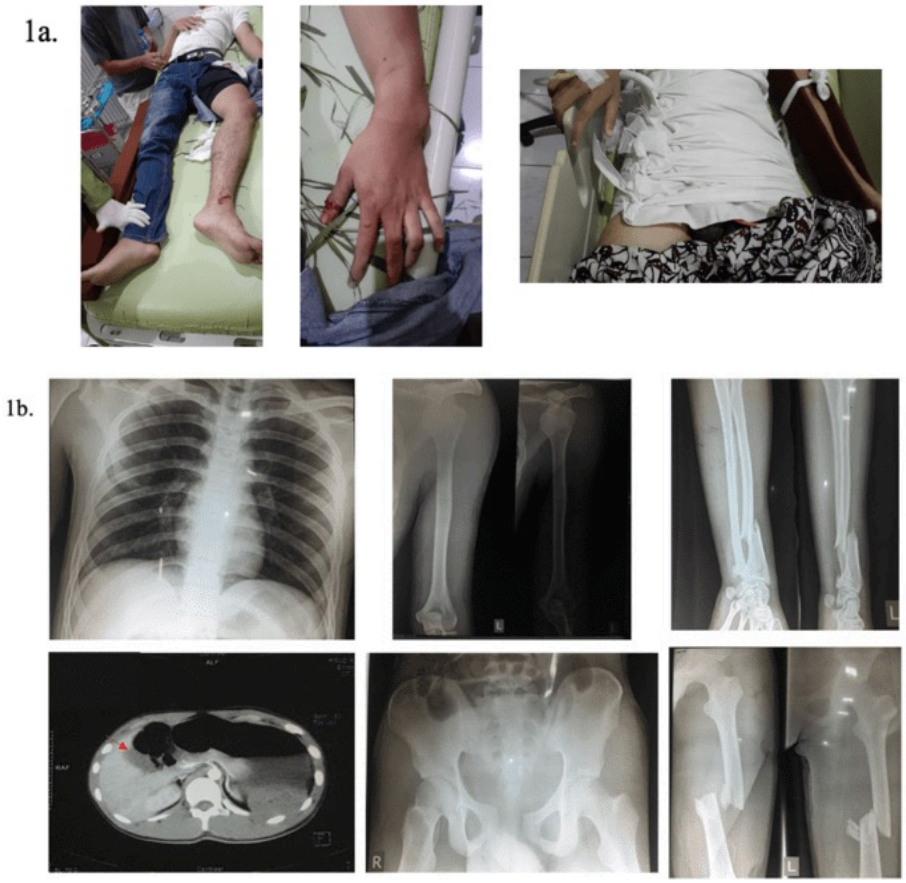

Figure 1. 1a) Clinical Photos of the patient upon arriving at the emergency department. **2b)** Plain X-ray films showing dislocation of left shoulder, multiple fractures on left wrist, pelvic, and left thigh. Abdominal CT-Scan showed minimal hemoperitoneum on the red arrow.

The patient presented with hemorrhagic shock (Grade IV) and multiple fractures. Adjunct diagnostic evaluation revealed an unstable pelvic fracture and blunt abdominal trauma and fractures of the left radius, left femur, shoulder dislocation, and distal radio-ulnar joint. (Figure 1b).

Surgical Exploration

Surgical resuscitation was performed, including laparotomy exploration to assess the abdominal trauma which revealed a minimal hemoperitoneum. Orthopedic intervention following damage control orthopedics (DCO) principles. Due the to limited availability of external fixation C-clamps Clamps at the hospital, open reduction and internal fixation (ORIF) of the symphysis pubis were performed as a temporary stabilization. (Figure 2a).

The patient's vital sign gradually improved in response to surgical resuscitation, definitive treatment was performed on a later day. This included ORIF of the radius and femur fractures and closed reduction of the shoulder and distal radio-ulnar joint. (Figure 2b).

Postoperative Care

The movement of other joints was maintained, and the patient was only irritablewhen required to move his left wrist and left thigh. The vascular and neurological function was retained and the wound was properly closed. Following the remarkable progress, we involved the medical rehabilitation specialist for rehabilitation. The patient was followed up daily after the second stage surgery. After 14 days length of stay at the hospital, the patients was discharged. There were no abnormalities found after damage control orthopedic performed on this patient shown in Figure 3a. Figure 3b shows The Lower Extremity Functional Scale with a of score suggest a minimal or no disability in performing daily activities.

Discussion

The Primary and Secondary evaluations are conducted regularly to detect any changes in the patient's condition that may require further intervention. Triage involves the sorting of patients based on the resources required for treatment and the resources that are available. Treatment is based on the ABC priorities.[1-4] Airway was clear, thoraco-abdominal breathing with respiratory rate 26 times per minutes. But there was hemorrhagic shock. Upon arrival patient was urgent resuscitation with 2000 cc of crystalloids. Splints and Pelvic Binder was assembled. After the

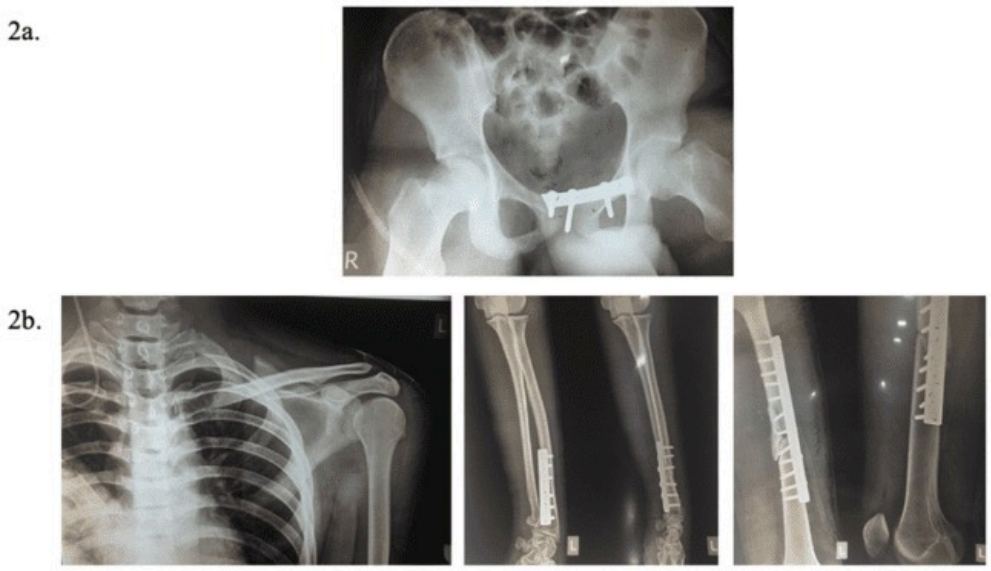

Figure 2. 2a) Plain X-Ray film after the first surgery showing a plate and screw was placed on the superior of pubic ramus. **2b)** After Damage Control Orthopedic Shoulder dislocation was reduced, plate and screw were placed on the distal of the radial bone and left shaft femur.

patient is stable, an X-ray and CT are performed. In mass-casualty events, patients have greatest chance of survival.[1-4]

Multiple trauma refers to the presence of severe injuries that pose a life-threatening risk to the patient. The location of these injuries particularly in the thorax and long bones, affects the clinical progression. Manifestations such as hemorrhagic shock, coagulopathy, hypothermia and soft tissue injuries may occur. An Injury Severity Score (ISS) above 16 indicates a mortality risk exceeding 10% hemorrhagicic shock is defined by a systolic blood pressure equal to or less than 90 mmHg in patients with trauma-related blood loss.[1-3] Upon the arrival at the ER, the patient's blood pressure showed 90/80 mmHg, heart rate was 144 beats per minute. The ATLS guidelines provide a classification system for hemorrhagic shock as shown in Figure 4a. It is the leading cause of preventable early mortality among polytrauma patients.[4]

The presence of high-energy trauma accompanied by bruising, swelling, and specific signs such as scrotal or labial edema, bleeding from the external meatus, vaginal bleeding, and rectal bleeding strongly indicates the likelihood of a pelvic fracture.[3] In cases of an open book type pelvic fracture with diastasis of the pubis symphysis as illustrated in Figure 1b.[4] Prompt use of a pelvic binder can be life-saving. The mortality rate for pelvic fractures ranges from 5% to 10%, but it increases to 60% with hemodynamic instability.[4-9] Bleeding is the primary cause of death following severe pelvic fractures, it can originate from arteries, veins or the bone itself. Patients with isolated pelvic fractures, without other urgent injuries are managed according to the pelvic fracture management algorithm as illustrated in Figure 4b.

The patient had to transient response after volume resuscitation with 2000 cc of crystalloids. A pelvic binder was applied due to the unavailability of external fixator C-clamp. Damage control orthopedics (DCO) is a specialized approach for treating fractures in patients with severe or multiple injuries.[6,7] Its primary objective is to postpone the definitive fixation of fractures until the patient's overall condition is stabilized. Orthopedic traumatologists prioritize the

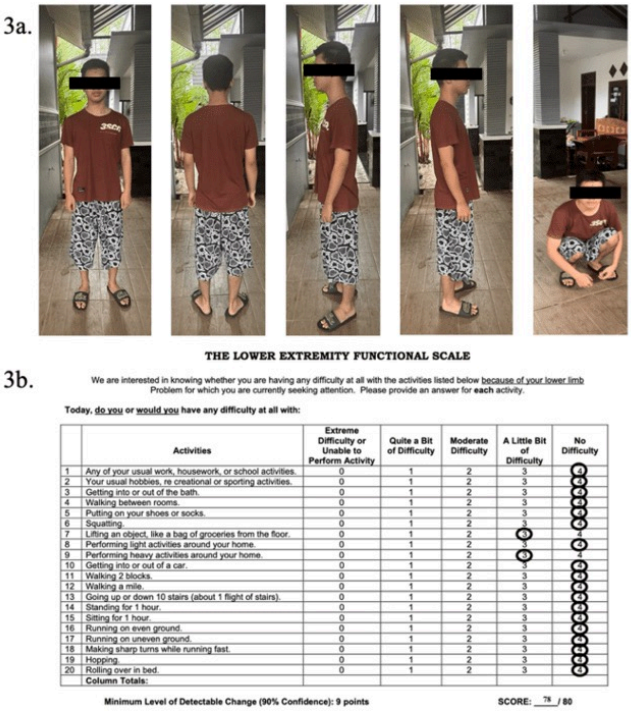

Figure 3. 3a) Clinical photos after a year follow-up, showing no abnormalities. **3b)** The Lower Extremity Functional Scale serves as positive indicator[12]

resuscitation process, focusing on promptly stopping bleeding and preventing hypovolemic shock and the "lethal triad." Once these immediate concerns are addressed, DCO measures are initiated to effectively manage the fractures.[7]

The injury Severity Score on this patient was 34, categorized as Extreme. Patients was transferred to the ICU as followed the algorithm treatment for major fractures, based on patient clinical categories as shown in Figure 5a.

The introduction of Early Total Care (ETC) highlighted the significance of stabilizing long-bone fractures as an initial step in managing multiple traumas. Previously, patients with these injuries were considered too medically unstable for surgery, and there was reluctance to manipulate the fracture sites due to concerns about potential *fat embolism syndrome* or second hit phenomenon as shown in Figure 5b.[10,11]

Conclusion

In limited resource settings, timely emergency response, appropriate timing of interventions, and the availability of adequate resources and skilled healthcare professionals are vital to minimize the risks of morbidity and mortality. The implementation of Damage Control Orthopedic principles proved to be an effective approach in managing this polytrauma patient, highlighting the significance of resource optimization and multidisciplinary teamwork.

4a.

Grading of Hemorrhagic Shock

PARAMETER	CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
Approximate blood loss	<15%	15–30%	31–40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓	↓
Base deficit	0 to –2 mEq/L	–2 to –6 mEq/L	–6 to –10 mEq/L	–10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion Protocol

4b.

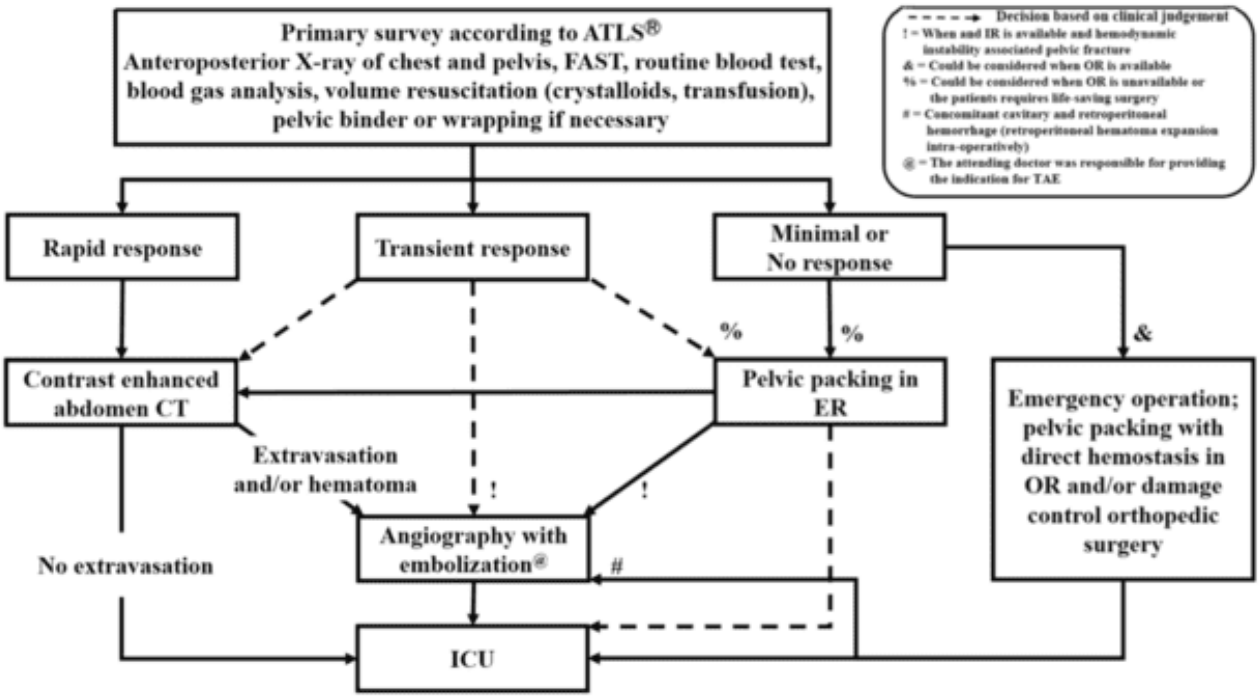

Figure 4. 4a) Grading for Hemorrhagic Shock based on ATLS.[4] **4b)** Algorithm for Unstable Pelvic Fractures based on ATLS.[9]

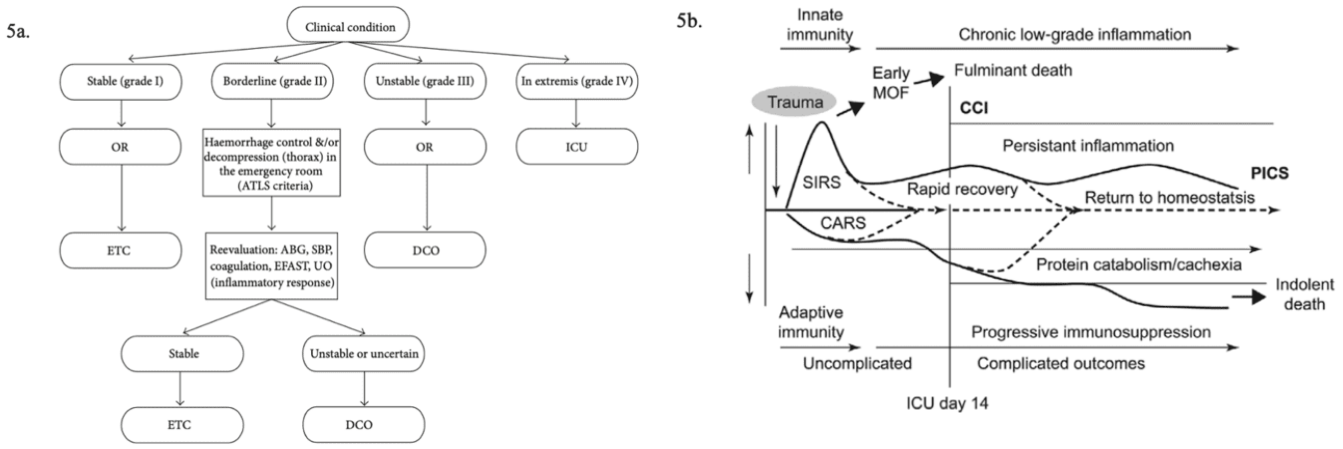

Figure 5. 5a) Chart Decision making based on clinical condition.[10] **5b)** Second Hit Phenomenon.[11]

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