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"FIGHTING THE MINOTAUR" A COMPLEX BLUNT CHEST TRAUMA DUE TO A BULL ATTACK: A CASE REPORT

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Abstract

Bull-related injury continues to contribute to an unacceptable number of serious injuries and deaths, and bullfighting continues to be a popular, deeply traditional celebration of the culture of many Iberic-American countries. Most accidents due to bull attacks are horn-related penetrating traumas. Blunt chest trauma can cause a wide range of clinical presentations and injuries, making the diagnostics and therapies extremely challenging. Consequently, it is vital to quickly identify major life-threatening chest wall and intrathoracic injuries. In this case report, we aimed to describe the complexity of the management and the treatment of a blunt trauma patient hit by a bull.

Keywords

Blunt trauma • bull • multiple rib fractures • surgical fixation • pneumothorax • pneumomediastinum

Introduction

The fight between Theseus and the Minotaur is one of the most famous Greek myths. The Minotaur, a ferocious creature with the head and tail of a bull and the body of a man, was the son of the king of the island of Crete, Minos. Due to the Minotaur's ferocity, it was shielded in a maze constructed by the architect Daedalus; it nourished itself by devouring young men and women. An agreement between King Aegeus of Athens and King Minos of Crete stated that every year King Aegeus should send 14 young people to Crete. In exchange, Athens would not be invaded by the Cretan fleet. Theseus, the unrecognised son of Aegeus, decided to slay the Minotaur to reaffirm his right to the throne. The challenge for Theseus in the Labyrinth was long and full of complexity.

Despite the spread of urbanisation and the consequent reduction of rural areas, the threat of animal attacks on people is still an important social and medical problem. The problem of livestock-related injuries has been noted in some of the earliest written laws or civil codes regulating human behavior [1]. A review of the literature might suggest that bull attacks were more of a problem in the past. However, a bull-related injury surveillance project has shown that bulls continue to contribute to an unacceptable number of serious injuries and deaths (2), and bullfighting also continues to be a traditional celebration in many Iberic-American countries (3). Cattle dehorning is a very common procedure in a modern dairy production system and it is considered necessary by most dairy farmers. Indeed, the handling and management of horned animals are deemed impractical for both human and animal safety (4). In our case report, we aimed to describe the complexity of the management of a blunt trauma patient hit by a bull.

Case Description

The patient was a 74-year-old man, with a history of hypertension and diabetes mellitus. He was attacked by a bull of his own on his farmland, and was then transported to our hospital by the Emergency Medical Service (HEMS). The worst was avoided thanks to the intervention of the patient's wife, who was able to fend off the animal by brandishing a pitchfork.

Upon admission to our Emergency Department, the patient was sedated, curarised, and intubated. Respiratory exchanges and hemodynamics were stable. E-FAST and chest X-ray showed right pneumothorax and hemothorax with subcutaneous emphysema, so pleural drainage was positioned. Total body CT scan also showed a left pneumothorax, pneumomediastinum, multiple rib fractures and the absence of lesions of the large vessels (Figure 1). Left pleural drainage was also positioned. Then the patient was admitted to our ICU. On arrival, hemodynamics was unstable and continuous infusion of inotropes was started. We performed transthoracic echocardiography, but the acoustic window was bad given the rib fractures. Consequently, we performed transesophageal echocardiography that showed

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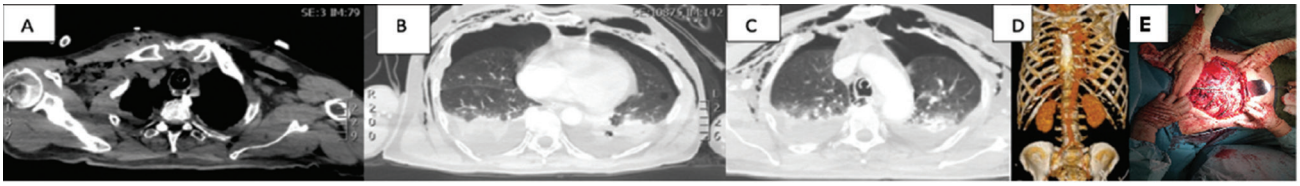

Figure 1. Computed tomography scan showing left pneumothorax, pneumomediastinum, multiple rib fractures (A, B, C) and 3D reconstruction of blood vessels (D). Surgical stabilization of the rib fractures using synthetic plates (E).

a hyperkinetic heart in the absence of pericardial effusion with the limits caused by pneumomediastinum. To have advanced hemodynamic monitoring, a Swan-Ganz catheter was positioned, with no complications. Several transfusions were made to replace blood loss from pleural drainage. After the first few days the inotropic supports were gradually reduced. On the second day, to ensure optimal weaning, the patient underwent surgical stabilisation of the rib fractures using synthetic plates; not all sternocostal joints could be reconstructed due to the disintegration of costal bone material. After surgery, an epidural catheter was placed at T4-T5 level with ropivacaine 0.25% in continuous infusion, to reduce systemic analgesia with opioids and therefore facilitate weaning. A temporary percutaneous tracheotomy was also performed on the fourth day. We obtained good pain control with 0.25% ropivacaine concentration through the peridural catheter. The Swan-Ganz catheter was removed 5 days after placement when the patient was no longer in shock, and pleural drainage was stopped after 10 days.

After 20 days in hospital, the patient was discharged into sub-intensive care where the tracheal cannula was removed, and he was then transferred to an internal medicine unit.

Discussion

Although most accidents caused by bull attacks are horn-related penetrating traumas, blunt force injuries typically involve large animals such as cattle or horses that can kick, crush, or trample a victim, causing head and facial injuries. Farmworkers in particular are at high risk of lethal injuries involving the head and chest (5). In our case report, we aimed to describe the complexity of the management of a blunt trauma patient attacked by a bull. The severity of the injury required a prompt management of airway, respiratory system, hemodynamics, and analgesia control.

The overall management of patients with multiple displaced rib fractures or flail chest consists of four basic tenets: management of pulmonary dysfunction, hemodynamics, surgical fixation, and pain management (7). Flail chest carries a higher mortality risk, and many patients with flail chest suffer from enduring pain and disability. Patients with flail chest often have significant pulmonary contusion, which further contributes to short- and long-term morbidity and mortality (8). Identification of major chest wall and intrathoracic injuries is prominent in the initial management, or 'primary survey,' of the multiply injured trauma patient; physical examination focused on a diagnosis of the life-threatening conditions must be rapidly performed. The vital step is to detect and manage the life-threatening injuries. Advanced trauma life support (ATLS) guidelines should be strictly followed. Blunt chest trauma can cause a wide range of clinical presentations and injuries, making the diagnostics and therapies extremely challenging. Monitoring strategies based on arterial pressure waveform variation, venous oxygen saturation (Svo2), and central venous oxygen saturation (ScvO2), and laboratory parameters such as base excess and lactate have been, or are increasingly becoming, part of the trauma anaesthesiologist's toolbox (9).

In cases of spontaneous breathing, high-flow oxygen therapy via nasal cannula increases airway pressure, ameliorates oxygenation, and reduces the effort of breathing. High-flow oxygen can be delivered through tracheostomy, providing the positive airway pressure in a way that is more comfortable for the patient (10,11). Mechanical ventilation can be begun in patients who suffer from severe hypoxemic or hypercapnic respiratory failure. Recruitment maneuvers and continuous positive airway pressure or pressure support should also be added to improve compliance and decrease shunt. There is no single mode of ventilation that has been found to be best for patients with flail chest or pulmonary contusion (12). Regarding tracheostomy, the timing is still a matter of debate in blunt chest trauma patients (13). Some benefits of early tracheostomy may include decreased requirement for mechanical ventilation, reduced incidence of nosocomial pneumonia, and decreased length of stay in hospital and in the intensive care unit. It is also known that tracheostomy provides tube security with consequent increased patient mobility, it allows for an earlier discharge to a lower level of care, permits vocalisation, allows oral nutrition, reduces the need for sedative drugs, improves pulmonary toilet, increases patient comfort, and accelerates weaning from the ventilator (14).

In cases of low-output syndrome or cardiogenic shock, continuously performed echocardiography represents an essential tool to evaluate the response to fluids and to

facilitate the management of vasopressors versus afterload reduction therapy (15). The use of pulmonary artery catheter (PAC) over many years has likely led to a better overall understanding and categorisation of central hemodynamics in heart failure, myocardial infarction, circulatory shock of all types, complicated pulmonary diseases, and various forms of pulmonary edema. Furthermore, it may have enhanced the bedside evaluation and diagnostic skills of critical care specialists (16). In trauma patients, PAC can be used to either optimise the initial resuscitation or manage intravascular volume and optimise cardiac output during the subsequent hospital course (17). However, vigorous debate persists regarding its clinical use in the critically ill patient. Studies evaluating the benefits associated with the use of PAC in medical and surgical patients have shown contradictory results (18).

In our case report, surgical fixation of flail chest was performed on the third day from admission, with significant improvement in respiratory function. Despite the increasing popularity of surgical treatment, this operation is performed in less than 1% of patients with flail chest. The failure to adopt this technique on a wide scale is likely caused by unfamiliarity, the lack of subspecialty ownership (i.e., trauma, orthopedic, and thoracic surgery), and a perceived lack of evidence-based indications (19). In our Trauma Center, surgical fixation for the specific indication of flail chest is performed routinely, and the data collected are encouraging, showing considerable clinical benefits (20).

Analgesia is extremely important in the care of blunt chest injured patients; multiple modes and types of analgesia have been reported in the literature. The evidence was not stronger for any one form of analgesia, making it difficult to include only one option for analgesia in the care bundle, so a multimodal approach has been included with early and regular delivery of analgesia. Multimodal analgesia consists of the administration of different analgesic agents by one or more routes, allowing the medications to have a synergistic effect.

Conclusions

Despite the urbanisation of contemporary society, animal attacks on people are still an important social and medical problem. Most accidents due to bull attacks are horn-related penetrating traumas, resulting in flail chest. Going back to the myth of the Minotaur, the challenge for Theseus in the Labyrinth was long and full of complexity. He could have managed to kill the Minotaur, but he may have gotten lost, and never escaped from the tangled Labyrinth. Success depended on a thread young Ariadne had given Theseus, fastened at the entrance of the maze, which lead him out of the Labyrinth.

Blunt chest trauma can cause a wide range of clinical presentations and injuries, making the diagnostics and therapies extremely challenging. The general treatment required a prompt management of airway, respiratory system, and hemodynamics, and good analgesia control. In our case report, despite the severity of the injury, the outcome was good. Aggressive treatment and straight integration of hemodynamic monitoring, pain control, respiratory interventions, and surgery allowed us to defeat the Minotaur and get out of the Labyrinth.

Abbreviations

HEMS: Emergency Medical Service
E-FAST: *Extended* Focused Assessment with Sonography for Trauma
CT: Computed tomography
ICU: intensive care unit
ATLS: Advanced trauma life support
Svo2: venous oxygen saturation
ScvO2: central venous oxygen saturation
PAC: pulmonary artery catheter

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