Damage control resuscitation: A case of thoraco-abdominal impalement

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SUMMARY

Damage Control Resuscitation and Surgery is the concept of controlled hypotension, haemostatic resuscitation and abbreviated surgical procedures following severe trauma; the practice of which has resulted in improved mortality and morbidity. We describe a rare case of thoraco-abdominal impalement successfully managed based on the concept of Damage Control Resuscitation.

KEY WORDS:

Impalement, haemostatic resuscitation, massive transfusion, damage-control resuscitation, trauma

INTRODUCTION

Penetrating chest injuries are associated with high mortalities. However, with improved pre-hospital and resuscitation services, these patients become potentially salvageable.

CASE REPORT

A previously healthy 33-year-old businessman presented to the Emergency Department (ED) 30 minutes after his van skidded, hit a row of chain-linked fence then overturned. One of the rusty, 6-foot line-posts holding the fence had completely pierced his right chest. Rescuers from the Fire Department attempted to shorten the rod to facilitate extrication. Unfortunately, it dislodged resulting in torrential bleeding.

Paramedics at the scene immobilised the cervical spine, instituted oxygen therapy, obtained vascular access, started fluid resuscitation and manually compressed the bleeding wound.

He arrived tachypnoeic and in profound shock. The airway remained patent but there was an open chest wound over the right anterior chest measuring 7cm x 5cm and a 10cm-diameter ragged exit wound posteriorly with corresponding reduced breath sounds. His GCS was 14/15 and both pupils reactive. The Focused Assessment Sonography for Trauma (FAST) revealed no blood in the peritoneal cavity. A right-sided chest tube inserted immediately drained 1 litre of blood. He was given a litre of crystalloid en route to the hospital, followed by blood in the ED and immediate activation of the Massive Transfusion Protocol. He received six units each of packed cells, platelets and fresh frozen plasma within an hour of his arrival with early administration of intravenous tranexamic acid.

We managed to achieve optimal hemodynamics prior to emergency surgery (Figure 1). The systolic blood pressure was kept within 82-91mmHg in keeping with permissive hypotension and the pulse rate came down from 145bpm to a 120bpm. The initial haemoglobin level of 10.7g/dL was optimized to 14.7g/dL prior to surgery. Due to the severity of the injury, no radiological investigations were permissible except a chest radiograph.

He underwent a right thoraco-abdominal exploration, hepatectomy and liver packing with diaphragmatic repair. There was involvement of segment V and VI of the liver and right hemi-diaphragm sparing the right lung. This was followed by interventional hepatic artery pseudo-aneurysm embolization the next day. A second laparotomy, removal of packs and wound debridement was done 7 days later.

DISCUSSION

Injuries that perforate the central body mass are more severe due to a combination of cause, effect and result. The high force required for impalement, proximity of vital structures and contamination of impaling objects contribute to the complexity in managing these injuries.

The impaled object can be shortened to facilitate transport and positioning but its removal is contraindicated as it can induce further damage to displaced organs and lose the tamponade effect.[1] In our patient, the accidental dislodgement resulted in massive bleeding. Our management relied heavily on the principles of damage control resuscitation.

This strategy began with minimal pre-hospital administration of crystalloids and controlled hypotension. While early correction of deficit is essential to prevent irreversible tissue hypo-perfusion, there is concern that more fluids cause deleterious effects such as dilutional coagulopathy, hypothermia and enhanced bleeding.[2] Limited fluid infusion is practiced in our centre, typically less than 1 litre of crystalloid before blood products are

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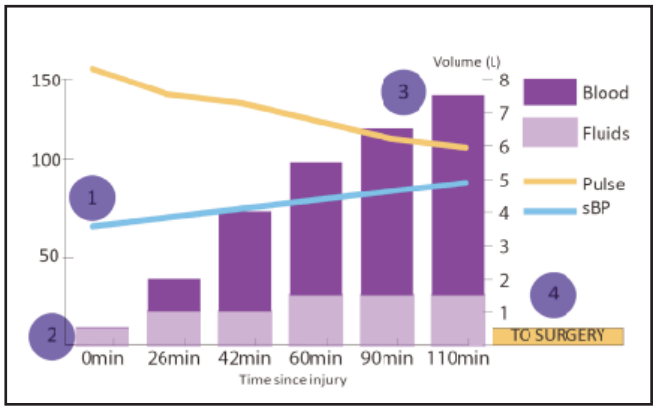

Fig. 1: Hemodynamic and haemostatic parameters during patient resuscitation. (1) Permissive hypotension: the systolic blood pressure was kept around 90mmhg, (2) restrictive fluid resuscitation: only 1 litre crystalloids infused en-route to hospital, (3) haemostatic resuscitation: massive transfusion protocol with balanced blood product transfusion, (4) abbreviated surgical procedures.

administered. We also aimed for a lower target blood pressure, just enough to maintain adequate perfusion and being careful not to "pop the clot".[3]

Massive Transfusion Protocol is an effective system that ensured adequate and uninterrupted supply of blood products for this patient. Our pre-operative goal was hemodynamic and haemostatic preservation in the form of relatively stable vital signs and adequacy of haemoglobin and platelets respectively. We adopted the damage-control approach with a 1:1:1 ratio of fresh frozen plasma, platelet and packed red cells to achieve haemostasis resulting in an appropriate rise in haemoglobin and no worsening of the coagulation profile.[4] Anti-fibrinolytic were also given early as part of the protocol.

Expeditious transfer for surgery meant that preoperative imaging will be bypassed, a standard practice if the patient is unstable. In cases of relative hemodynamic stability, risk to benefit must be assessed; bearing in mind that such stability is often transient.

The damage control strategy continued in the operating theatre, focusing on rapid control of bleeding and contamination and temporary wound closure.[5] This was followed by other modalities such as interventional radiology and delayed definitive surgery that resulted in a favourable end result.

CONCLUSION

Penetrating thoraco-abdominal injuries are rare and its outcomes are poor when the impaling object is removed. Rapid pre-hospital transport and strict adherence to the principles of Damage Control Resuscitation and Surgery successfully prevented our patient from succumbing to the lethal triad of coagulopathy, hypothermia and acidosis frequently seen in exsanguinating injuries.

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