Management of flail chest

Flail chest continues to be a significant injury with serious complications. Controversy exists as to the optimal treatment. The principal dilemmas are whether the patient should be managed conservatively without mechanical ventilation, with ventilation, or via operative chest wall stabilization. This article illustrates a case of flail chest and summarizes the evidence for current treatment options.

THE DILEMMA

Should flail chest be managed with internal pneumatic stabilization?

CASE PRESENTATION

A 31-year-old male presented to accident and emergency following a road traffic accident in which he was thrown 25 m from his motorcycle onto his left side. On admission his airway and breathing were intact. He had paradoxical chest movement posterolaterally on the left and widespread surgical emphysema. Pulse oximetry on air was 75%. He was haemodynamically stable, neurologically intact and complaining of pain in the left side of his chest.

Supplemental oxygen was instituted and the flail segment taped. This improved oxygen saturation to 94%. Intravenous morphine provided analgesia. A trauma series of X-rays revealed the injuries to be multiple left-sided rib fractures from 1–10 and a haemopneumothorax, which was relieved via chest drain insertion under local anaesthesia. Further management was discussed with the consultant cardiothoracic surgeon and anaesthetist on call.

There was controversy over definitive management — should the patient be electively intubated and ventilated because of the chest wall injury?

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Arterial blood gases showed pH 7.3, PaO_2 13.9 kPa, $PaCO_2$ 6.7 kPa, HCO_3 24 mmol/litre and base deficit of 2 mmol/litre with FiO_2 0.7. In view of the patient's condition the following course of action was agreed on. He was admitted to the intensive care unit and a thoracic epidural sited at T7–8. This provided excellent analgesia, allowed chest physiotherapy, the clearance of tracheobronchial secretions and effective coughing. Supplemental oxygen was continued and basal atelectasis minimized using intermittent BiPap. He remained nil-by-mouth and maintenance intravenous fluids were infused. The patient did well and was discharged to the cardiothoracic high dependency unit on day 3 and the ward on day 4 after removal of the thoracic epidural.

DISCUSSION

Flail chest results in inefficient ventilation. Of major importance is the presence of lung parenchymal contusion resulting in altered alveolar ventilation/perfusion ratio. Before 1956 the treatment involved external chest wall stabilization. From 1956 to 1975 early intubation and internal pneumatic stabilization was emphasized. This produced good stabilization but did not reduce mortality. In 1975 Trinkle et al's classic study emphasized a non-ventilatory strategy in selected patients showing a mortality benefit. Miller et al (1983) also reported a lower morbidity, mortality and decreased hospital stay as a result of similar management.

Mechanical ventilation is sometimes indicated. Increased requirement has been suggested when five factors are present: injury severity score of >23, other associated fractures or head injury, blood transfusion within the first 24 hours, shock on admission and the need for bilateral chest drains.

Operative chest wall fixation for patients with flail segments remains controversial. There is lack of evidence demonstrating a treatment advantage over the well-documented non-operative treatment modality. Mouton et al (1997) advocate operative fixation in patients presenting with respiratory insufficiency refractive to appropriate analgesia, without the need for prolonged intubation for other reasons and also in younger patients with severe chest wall impaction to prevent a restrictive lung defect.

CONCLUSION

Reviewing the literature reveals optimal management of the patient with a flail chest does not involve automatic intubation and ventilation but selective management based on the patient's gas exchange with supplemental oxygen and the avoidance of assisted ventilation where possible. Patients who do require ventilation should have this instituted early and limited to as short a time as possible. HM

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Trinkle JK, Richardson JD, Franz JL et al (1975) The management of flail chest without mechanical ventilation. *Ann Thorac Surg* **19:** 356–63

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