RELIEF OF PAIN IN CHEST INJURY

JENNIFER GIBBONS, O. JAMES AND A. QUAIL

SUMMARY

Conservative measures were tried in 57 patients with respiratory failure following chest injury initially who were thought not to require artificial ventilation. In 30 of these thoracic epidural analgesia was considered unsuitable and in these patients pain was managed with either intercostal nerve block or parenteral narcotics. Thirteen of these eventually needed artificial ventilation. Of 27 patients in whom epidural analgesia was considered to be suitable, difficulty in obtaining adequate analgesia was initially encountered in 6 but adequate block was ultimately achieved. In 6 patients artificial ventilation was later needed. Conservative measures were successful in 38 of 57 patients.

A review of the literature reveals that although epidural or intercostal nerve block is a method advocated by several authors for the relief of pain in various conditions there is little stress on the place of regional anaesthesia in the management of patients with respiratory failure following chest injury. Lloyd, Crampton Smith and O’Connor (1965), Bassett, Gibson and Wilson (1968), Brewer and Steiner (1968), Lloyd and Rucklidge (1969), however, all refer to the use of regional techniques in chest injury. Its application was studied in the 130 cases of chest injury referred to in the previous article (Gibbons, James and Quail, 1973). In general, patients were managed as there indicated.

METHODS

Technique of pain relief.

Patients who required immediate pain relief on admission were given morphine sulphate intravenously. The relief of pain obtained in this way did not lead to diagnostic difficulties in the assessment of the patient’s injuries. After the initial assessment period, analgesia for patients who did not require treatment by artificial ventilation was provided either by intercostal nerve block or thoracic epidural block. Bupivacaine 0.25% with adrenaline 1:400,000 was the agent used throughout this series. Other solutions such as amethocaine and local anaesthesia mixtures with dextrose would have been just as suitable.

Intercostal block.

Intercostal blockade was used to provide analgesia in those requiring it for fractures of the 5th rib and above.

With the patient lying on the unaffected side, the area was prepared and draped and the intercostal nerve blocked proximal to the fracture, using a 22 f.w.g. needle and bupivacaine 4 ml, for each nerve. Blocks were repeated as often as necessary, usually every 8-12 hours. Because of the satisfactory pain relief obtained most patients well tolerated this uncomfortable procedure.

Epidural block.

Thoracic epidural block was the preferred technique of pain relief for fractures below the 5th rib. Continuous analgesia was maintained by repeated injections through a catheter whose tip was placed as far as possible in the mid-zone of the affected segments. The catheter was placed with the patient sitting upright where possible.

The anaesthetist gowned and gloved, the site was prepared and draped and after location of the thoracic epidural space, using a 17 f.w.g. Tuohy needle, a polyvinyl catheter was inserted. If technical difficulties prevented insertion in the thoracic region, the lumbar route was used and the catheter tip advanced upwards. The catheters used in the unit are not radiopaque and the catheter tip position was gauged by the block achieved. After the insertion of the catheter the patient was placed supine and the foot of the bed elevated prior to injection of local anaesthetic solution. This position minimized the effects of lumbar sympathetic blockade. Bupivacaine 10 ml was the initial dose.


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The frequently obvious subjective response was confirmed by the finding of sensory loss over the affected segments. Increments of 5 ml were given until satisfactory pain relief was obtained. This usually required a total of 15 ml but depended on the extent of the block desired. This was repeated as often as necessary to maintain continuous analgesia.

In some patients the initial insertion of the catheter did not result in a satisfactory block following injection of bupivacaine and repositioning in another space was necessary. In patients in whom epidural blockade was considered the most suitable form of analgesic therapy the technique was persisted with, even if difficulties in catheter placement were encountered. After satisfactory analgesia had been obtained an antibacterial filter (Swinnex 13 filter unit; Millipore) was attached and the catheter was strapped along the patient's back and over the shoulder. Each epidural catheter was left in place for no longer than 48 hours to reduce the possibility of infection. When analgesia was required beyond this period, another catheter was inserted into an adjacent space. No patient required epidural analgesia for longer than 7 days.

RESULTS

Difficulty in obtaining adequate analgesia was encountered initially in 6 of 27 patients and in 3 the lumbar route with catheter advancement upwards was eventually necessary. However, perhaps fortuitously, adequate block was achieved in all patients managed in this way. Hypotension (viz., a systolic pressure drop of more than 40 mm Hg) was initially encountered in 12 patients and in 2 this was severe enough to produce temporary circulatory arrest. Rapid intravenous fluid infusion restored circulatory adequacy in all cases. No long-term complication of epidural or intercostal block was encountered.

Thirty of the 57 patients initially thought not to require artificial ventilation were unsuitable for institution of thoracic epidural analgesia because of high fractures and these patients were managed with either intercostal nerve block or parenteral narcotics. Seventeen were able to be successfully so dealt with, although 2 of these required tracheobronchial suction as well. Two died during resuscitation of aortic rupture and 13 eventually needed artificial ventilation. Epidural analgesia was initially thought to be a suitable form of management for 27 patients (table I). However, 6 required tracheobronchial suction as well and eventually a further 6 progressed to need artificial ventilation.

<table>
<thead>
<tr>
<th>Initial assessment</th>
<th>No.</th>
<th>TBS</th>
<th>AV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercostal block</td>
<td>30</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Epidural analgesia</td>
<td>27</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>8</td>
<td>19</td>
</tr>
</tbody>
</table>

TBS = tracheobronchial suction.
AV = artificial ventilation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Initial</th>
<th>Final</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesia + tracheobronchial suction</td>
<td>57</td>
<td>38</td>
<td>2</td>
</tr>
<tr>
<td>Ventilation</td>
<td>73</td>
<td>92</td>
<td>22</td>
</tr>
</tbody>
</table>

Thus of a total of 57 patients in whom conservative measures were tried, they were successful in 38 (table II).

DISCUSSION

Multiple rib fractures are extremely painful and result in shallow breathing which leads in turn to a diminution in alveolar gas exchange. Relief of this pain, by permitting more effective ventilation, may prevent complications leading to respiratory failure. Pain relief may be obtained by parenterally administered narcotic drugs, by regional nerve block or by inhalation of anaesthetic gases. This last method was not adopted because of the possible dangers of prolonged administration.

In patients breathing spontaneously the major management problem is to produce analgesia without depression of minute volume, cough or ciliary activity. Regional nerve blocks are eminently suitable for relieving the pain of some chest injuries. The nerve supply to pain-sensitive structures of the thoracic cage may be accurately located and blocked in most patients. With sensory blockade, the patient is freed from pain and yet remains alert and cooperative. The decision between epidural or intercostal block is determined mainly by the anatomical level of pain relief required, thoracic epidural being preferred because it provides a means of continuous pain relief once the catheter has been inserted.

Thoracic epidural block was the preferred technique for patients in whom painful limitation of thoracic movement was the major problem. In patients with combined chest and abdominal injuries, epidural block afforded pain relief both of the
thoracic cage injuries and of the abdominal incision (Gibbons, James and Bissett, 1973).

It was, however, unsatisfactory when lung trauma was extensive enough to limit gaseous exchange. Its use avoided the need to ventilate artificially in 15 patients. However, in some 12 patients managed initially in this manner their condition deteriorated despite the provision of adequate analgesia. Those most likely to progress to failure were patients with pre-existing lung disease or extensive pulmonary damage. This deterioration was indicated by the development of tachycardia, tachypnoea, fatigue, blood-gas deterioration and chest radiological examinations. When incipient or actual respiratory failure is present tracheostomy and artificial ventilation is necessary.

Epidural analgesia is unsuitable for patients requiring pain relief above the 5th thoracic segment because block above this level results in cardiovascular depression from cardiac sympathetic blockade.

Some patients with fractures above and below the 5th thoracic segment were managed satisfactorily with block of only the more painful lower ribs.

Contraindications to epidural block include local sepsis, local trauma, and acute neurological disturbances. However, such situations were not seen in any of our patients managed in this way.

Patients with high rib fractures usually require less analgesia and suffer fewer pulmonary complications than those with lower rib fractures because the pectoral girdle splints and protects the upper thorax, the upper ribs move less on respiration and the underlying lung is well aerated and drained. For analgesia in fractures of the 5th rib and above, intercostal block proximal to the fracture site is preferable.

The regional techniques mentioned above have been particularly useful in the management of chest injuries where pain rather than mechanical instability has been the main threat to life. This has been especially so in patients with chronic lung disease, where the use of regional analgesia avoided the need to ventilate artificially.

ACKNOWLEDGEMENTS

We would like to thank the Nursing Staff of the Unit whose skill, care and devotion has contributed in no small way to the successful management of our patients. We also thank the secretaries of the Department who typed this paper many times.

REFERENCES


FACULTY OF ANAESTHETISTS, ROYAL COLLEGE OF SURGEONS IN IRELAND

St Stephen's Green, Dublin 2

The Annual Scientific Meeting of the Faculty will be held in the College on Saturday, May 18, 1974. The programme will be as follows:

MORNING SESSION: Title: The environmental hazard to operating room personnel.
Contributors: Dr M. D. Vickers (Birmingham): Pollution.
Dr A. A. Spence (Glasgow): Epidemiological study of morbidity and mortality.
Dr C. J. Hull (Newcastle): Electrical hazards.
Professor Ellis N. Cohen (Stanford, California): The effects of trace anaesthetics on the health of operating room personnel.

A Panel Discussion will follow these contributions.

AFTERNOON SESSION: Title: Aspects of ventilation.
Chairman: Professor Gordon Robson (London), Dean, Faculty of Anaesthetists, R.C.S.
Contributors: Dr Alfredo Arias (Madrid): PCO2 homeostasis in mechanical ventilation.
Dr Marian Rice (Dublin): CPAP, PEEP—the present position.
Professor J. F. Nunn (Medical Research Centre, Northwick Park, London): Air versus oxygen during anaesthesia.

The Anniversary Dinner of the Faculty will be held on Saturday evening, May 18, 1974, in the Banqueting Hall of the College, at 8 p.m. preceded by a Sherry Reception at 7.15 p.m.

W. S. WREN, Dean