

# Insertion of metal rib reinforcements to stabilise a flail chest wall

Interventional procedures guidance

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[nice.org.uk/guidance/ipg361](https://www.nice.org.uk/guidance/ipg361)

## Your responsibility

This guidance represents the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take this guidance fully into account. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

Commissioners and/or providers have a responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

## 1 Guidance

- 1.1 Current evidence on insertion of metal rib reinforcements to stabilise a flail chest wall is limited in quantity but consistently shows efficacy. In addition, there are no major safety concerns in the context of patients who have had severe trauma with impaired pulmonary function. Therefore the procedure may

be used provided that normal arrangements are in place for clinical governance, consent and audit.

- 1.2 Patient selection should be carried out by critical care specialists, chest physicians and thoracic surgeons with appropriate training and experience.

## 2 The procedure

### 2.1 *Indications and current treatments*

- 2.1.1 Chest wall injury is common as a result of major blunt trauma (for example, motor vehicle accidents). It varies in severity from minor bruising or an isolated rib fracture, to severe crush injuries leading to respiratory compromise.

- 2.1.2 A flail chest occurs when a segment of the thoracic cage moves independently from the rest of the chest wall. A flail chest causes paradoxical movement of this segment of the chest wall – in-drawing on inspiration and moving outwards on expiration – and this segment of chest wall fails to contribute to lung expansion. Flail chest has been defined in a variety of ways, but at least 2 fractures per rib in at least 2 ribs are needed to produce a flail segment. Large flail segments may extend bilaterally or involve the sternum, and may compromise respiration sufficiently to require mechanical ventilation.

- 2.1.3 Management of chest wall injury is directed towards protecting the underlying lung, achieving adequate ventilation and oxygenation, and preventing infection. Analgesia sufficient to allow normal respiration and coughing may be adequate for mild cases. More severe cases require ventilatory support, and suction to remove mucus or secretions from the airways to prevent atelectasis.

### 2.2 *Outline of the procedure*

- 2.2.1 Surgical stabilisation with metal rib reinforcements aims to allow earlier weaning from ventilator support, reduce acute complications, and avoid chronic pain sometimes associated with permanent deformity of the chest wall.
- 2.2.2 With the patient under general anaesthesia, an incision is made over the rib fractures to be treated, and the fractured ribs are reduced. The affected ribs are

stabilised using struts or metal plates, fixed with screws or intramedullary wires. These metal plates and screws are usually left in place in the long term.

- 2.2.3 There are many variations in the materials and techniques used to stabilise flail chest with metal rib reinforcements. It should be noted that Kirschner wires, used alone, are not covered by this guidance.

Sections 2.3 and 2.4 describe efficacy and safety outcomes from the published literature that the Committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [overview](#).

## 2.3 Efficacy

- 2.3.1 A randomised controlled trial (RCT) of 37 patients treated by surgical stabilisation (n = 18) or mechanical ventilation (n = 19) reported a significantly lower proportion of patients with pneumonia at day 21 in the surgical stabilisation group compared with the mechanical ventilation group (22% [4/18] vs 89% [17/19]) (p < 0.05).
- 2.3.2 The RCT of 37 patients reported a mean critical care stay of 16.5 days in the surgical stabilisation group and 26.8 days in the mechanical ventilation group (p < 0.05).
- 2.3.3 The RCT of 37 patients treated by surgical stabilisation (n = 18) or mechanical ventilation (n = 19) reported a mean percentage of forced vital capacity at 12 months of 96% and 80% respectively (p < 0.05). A case series of 66 patients reported that 52% (26/50) of patients had normal pulmonary function at 6-month follow-up.
- 2.3.4 The RCT of 37 patients reported that a significantly higher percentage of patients had returned to full-time employment at 6 months in the surgical group compared with the mechanical ventilation group (61% [11/18] vs 5% [1/19]) (p < 0.01).
- 2.3.5 The Specialist Advisers listed additional key efficacy outcomes as survival, duration of ventilation, long-term stabilisation of chest wall, reduced pain and patient satisfaction.

## 2.4 Safety

- 2.4.1 Death was reported in 30% (3/10) of patients with pulmonary contusion treated by surgical stabilisation in a non-randomised comparative study of 42 patients. Of these deaths, 2 were from massive haemorrhage and 1 was from sepsis with multi-organ failure. No deaths were reported in patients without pulmonary contusion who were treated by surgical stabilisation.
- 2.4.2 Persistent pain at the operative site was reported in 11% (6/57) and 24% (5/21) of patients in a case series of 66 patients at 6-month follow-up and a case series of 23 patients at 3-month follow-up respectively. This improved in 3 and 2 patients respectively after stabilisation plates and screws were removed at 6 months.
- 2.4.3 The Specialist Advisers considered theoretical adverse events to include migration of metalwork, fracture of stabilisers, lung injury from stabilisers, screw loosening or separation, infection and allergy.

## 3 Further information

- 3.1 For related NICE guidance see our [website](#).

### *Information for patients*

NICE has produced [information on this procedure for patients and carers](#) ('Understanding NICE guidance'). It explains the nature of the procedure and the guidance issued by NICE, and has been written with patient consent in mind. A large print version is also available.

## 4 About this guidance

NICE interventional procedure guidance makes recommendations on the safety and efficacy of the procedure. It does not cover whether or not the NHS should fund a procedure. Funding decisions are taken by local NHS bodies after considering the clinical effectiveness of the procedure and whether it represents value for money for the NHS. It is for healthcare professionals and people using the NHS in England, Wales, Scotland and Northern Ireland, and is endorsed by Healthcare Improvement Scotland for implementation by NHSScotland.

This guidance was developed using the NICE [interventional procedure guidance](#) process.

We have produced a [summary of this guidance for patients and carers](#). Information about the evidence it is based on is also [available](#).

## Changes since publication

3 January 2012: minor maintenance.

## Your responsibility

This guidance represents the views of NICE and was arrived at after careful consideration of the available evidence. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. This guidance does not, however, override the individual responsibility of healthcare professionals to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to avoid unlawful discrimination and to have regard to promoting equality of opportunity. Nothing in this guidance should be interpreted in a way which would be inconsistent with compliance with those duties.

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## *Endorsing organisation*

This guidance has been endorsed by Healthcare Improvement Scotland.

## *Accreditation*

