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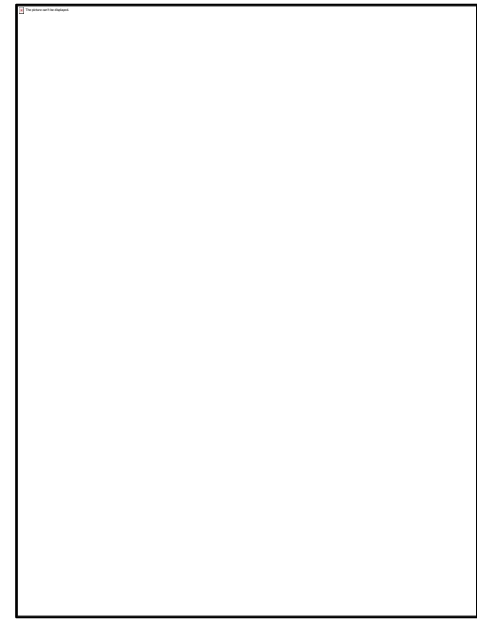
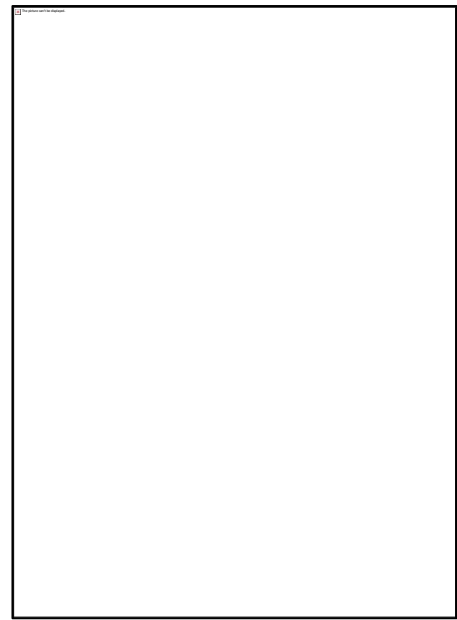
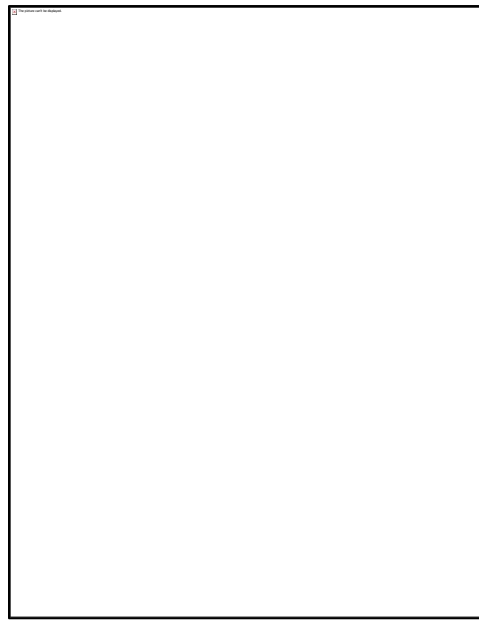
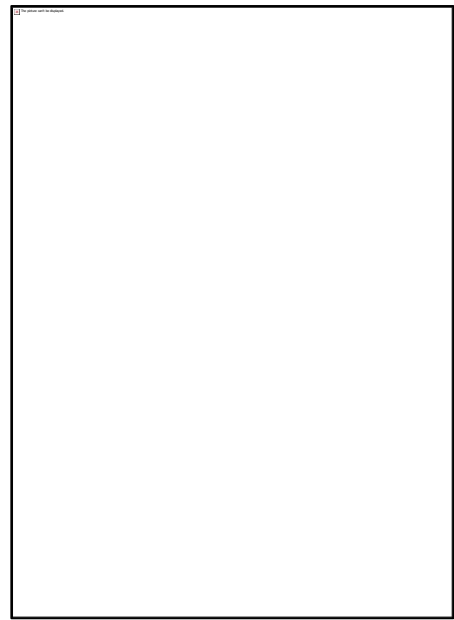
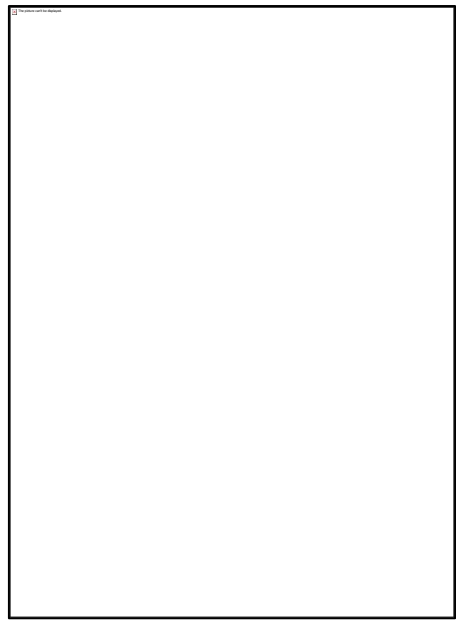
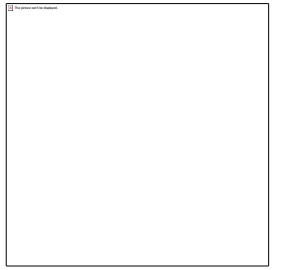
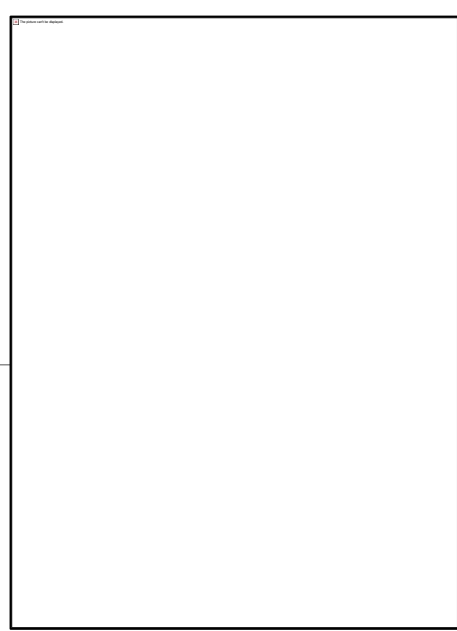
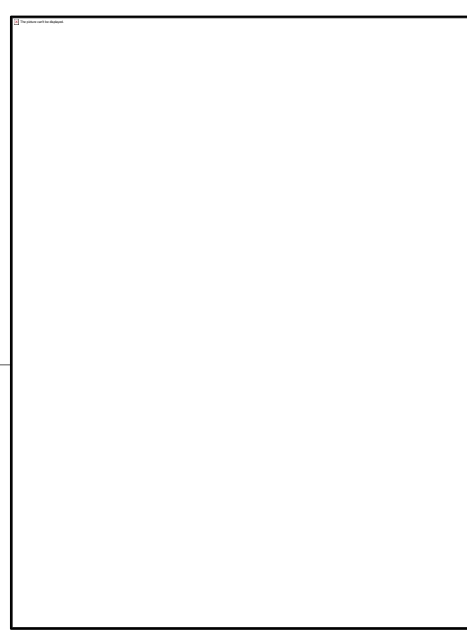
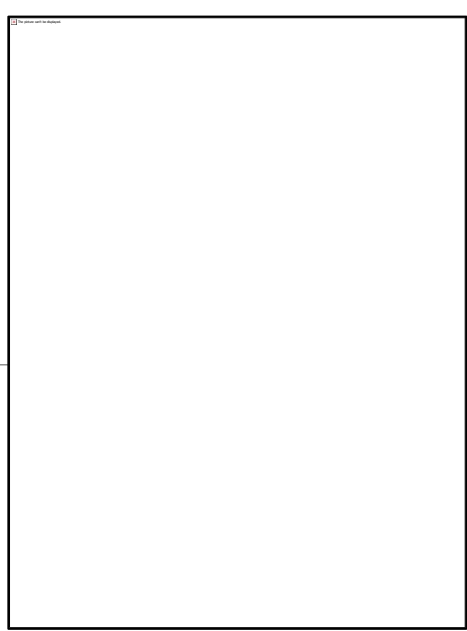
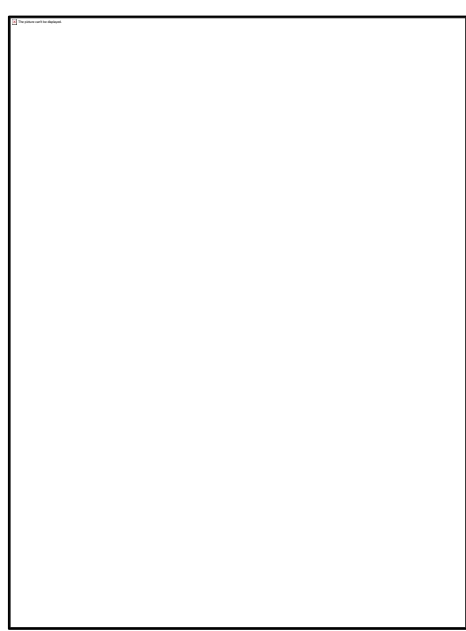
# Chest Wall Injury Society Guidelines for SSRF

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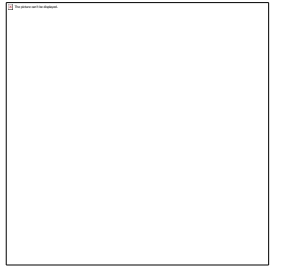
Injury, Int. J. Care Injured 48 (2017) 307–321

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# Consensus statement: Surgical stabilization of rib fractures rib fracture colloquium clinical practice guidelines

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Indications

Timing

Regionalization of surgical centers

Preoperative planning

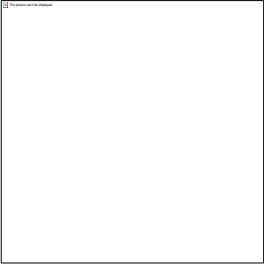
- Antimicrobial prophylaxis
- VTE prophylaxis
- Preoperative imaging

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# Consensus statement: Surgical stabilization of rib fractures rib fracture colloquium clinical practice guidelines



Selection of ribs for repair

Surgical approaches

- Open
- Percutaneous
- Thoracoscopic

Modes of fixation

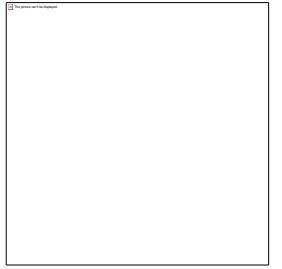
- Plates vs intra-medullary struts
- Bicortical vs unicortical fixation
- Plate placement on outer vs inner cortex
- Permanent vs absorbable plates

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# Consensus statement: Surgical stabilization of rib fractures rib fracture colloquium clinical practice guidelines

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Management of multiple fracture series

Management of bone loss

Management of muscle loss

Management of the pleural space

Loco-regional anaesthesia

Post-operative care

Management of chronic non-union

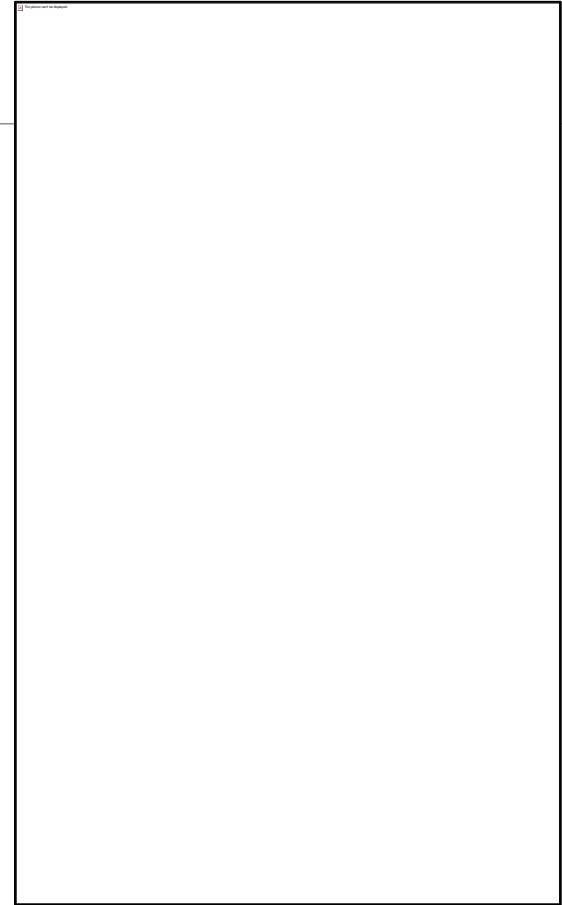
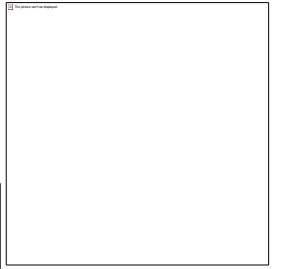
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Summary of Recommendations

Explanatory Text

Flowchart

References

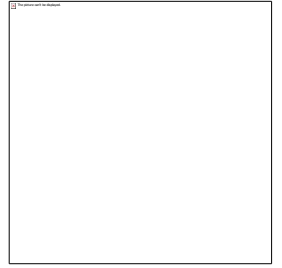
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# Ventilated Patients



## **1. Chest wall instability:**

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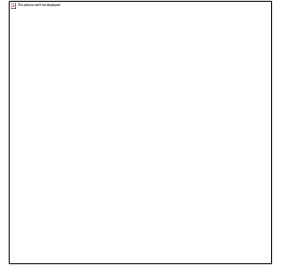
- a. Three or more bi-cortical rib fractures with greater than 50% displacement on CT scan
- b. Paradoxical chest wall motion (May not be seen with positive pressure ventilation)
- c. Significant chest wall deformity (volume loss  $\geq 20\%$ )

## **2. Failure to wean from mechanical ventilation due to chest wall instability**

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# Non-Ventilated Patients



## **1. Chest wall instability:**

- a. Three or more bi-cortical rib fractures with greater than 50% displacement on CT scan
- b. Paradoxical chest wall motion (May not be seen with positive pressure ventilation)
- c. Significant chest wall deformity (volume loss  $\geq 20\%$ )

## **2. Progressive respiratory failure or failure to improve despite multimodal analgesia**

## **3. Three or more displaced rib fractures with two or pulmonary physiologic derangements:**

- a. Respiratory rate  $\geq 20$
- b. Measured volumes on incentive spirometry  $< 50\%$  -  $75\%$  of predicted
- c. Numeric pain score  $> 5/10$
- d. Poor cough

## **4. Abnormal/worsening stratification score (i.e. SCARF, STUMBL etc)**

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# Other Indications

1. **“On the Way Out”**: Patients undergoing thoracotomy for other reasons, such as evacuation of haemothorax, or those with an iatrogenic rib fracture secondary to thoracotomy, may benefit from SSRF
2. **Costochondral junction fracture**: These cartilaginous injuries often accompany bony rib fractures and are increasingly recognised as important elements of successful surgical repairs
3. **Symptomatic rib fracture non-union**: Based on current literature, SSRF of symptomatic rib non-union (SSNURFs) is safe and feasible with a low post-operative complication rate. These patients require careful analysis of the risk/benefit ratio – with clear expectations and anticipated outcomes

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# Contraindications

## Absolute

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1. Haemodynamic instability with ongoing resuscitation
2. Non-survivable brain injury

## Relative

1. Paediatric patients
2. Significant co-morbidities, following multi-disciplinary discussion
3. Post CPR fractures
4. Severe traumatic brain injury (TBI)
5. Spinal cord injury / unstable spinal fracture
6. Empyema
7. Pulmonary contusion
8. Acute cardiac event
9. Uncorrected coagulopathy

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# Absolute Contraindications



## 1. Haemodynamic instability with ongoing resuscitation

SSRF is best avoided in patients who are haemodynamically unstable from non-respiratory causes

Patients with respiratory failure secondary to major chest wall injury suffer pain, increased effort of breathing, and hypercarbia. They may benefit from early SSRF as this may facilitate the weaning of pain medications and sedation

## 2. Non-survivable brain injury

SSRF patients with non-survivable or catastrophic brain injuries should be avoided

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# Relative Contraindications



## 1. Paediatric patients

There is a lack of literature regarding SSRF in paediatric patients, along with a theoretical concern about normal rib growth post-surgical intervention. There are, however, several case reports describing successful SSRF in paediatric patients with severe injuries

## 2. Significant co-morbidities / frailty

Elderly patients with frailty may not be ideal candidates for SSRF with the inherent increased risk of surgery and anaesthesia. Multiple recent studies, however, demonstrate a mortality benefit in geriatric trauma patients (age>65) undergoing SSRF. Early SSRF is associated with decreased rate of ventilator associated pneumonia (VAP), ICU Length of stay (LOS) and hospital LOS. Early SSRF is likely to improve outcomes in a select geriatric trauma population with multiple rib fractures.

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# Relative Contraindications



## 3. Post CPR Fractures

Case reports and small series of successful SSRF following CPR for failure to wean from mechanical ventilation have recently been published. Chest wall injuries suffered in this manner are often complex and patients are often medically unstable, requiring careful evaluation of the risk: benefit ratio for SSRF

## 4. Severe traumatic brain injury (TBI)/Intracranial hypertension

Significant controversy persists regarding the role and timing of SSRF in the patient with traumatic brain injury. The data is limited but an improvement in mortality has been demonstrated in recent retrospective publications involving select patients with moderate to severe TBI.

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# Relative Contraindications

## 5. Spinal Cord Injury / Unstable Spinal Fracture

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Spinal cord injury can occur on a spectrum and therefore patients should be evaluated for SSRF on an individual basis, Unstable fractures of the spine should be addressed prior to SSRF and limited available experience suggests combined procedures (e.g. ribs and/or sternum and spine) are feasible and safe.

The patient's level of spinal cord injury should influence the decision to perform SSRF for symptomatic relief and/or tracheostomy prevention

## 6. Empyema

Empyema increases the risk of hardware infections, but SSRF may still be appropriate in select cases. Isolated case reports indicate successful SSRF without inevitable hardware removal

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# Relative Contraindications

## 7. Pulmonary contusion

Historically, the presence of severe pulmonary contusion has represented a contraindication to SSRF. Currently there are mixed results in patients with pulmonary contusion (in any level of severity), hence with represents a role for careful surgical judgement

## 8. Acute cardiac event

Patients experiencing an acute cardiac event should not undergo early semi-elective operation given their need for anticoagulation/antiplatelet medication, SSRF may produce undue stress on these haemodynamically unstable patients. Please note the “post-CPR Fractures” section regarding relative contraindications

## 9. Uncorrected coagulopathy

Ideally, coagulopathy will be corrected prior to SSRF, however, surgical intervention may be considered for patients with deranged coagulopathy as clinically indicated

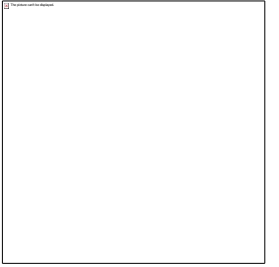
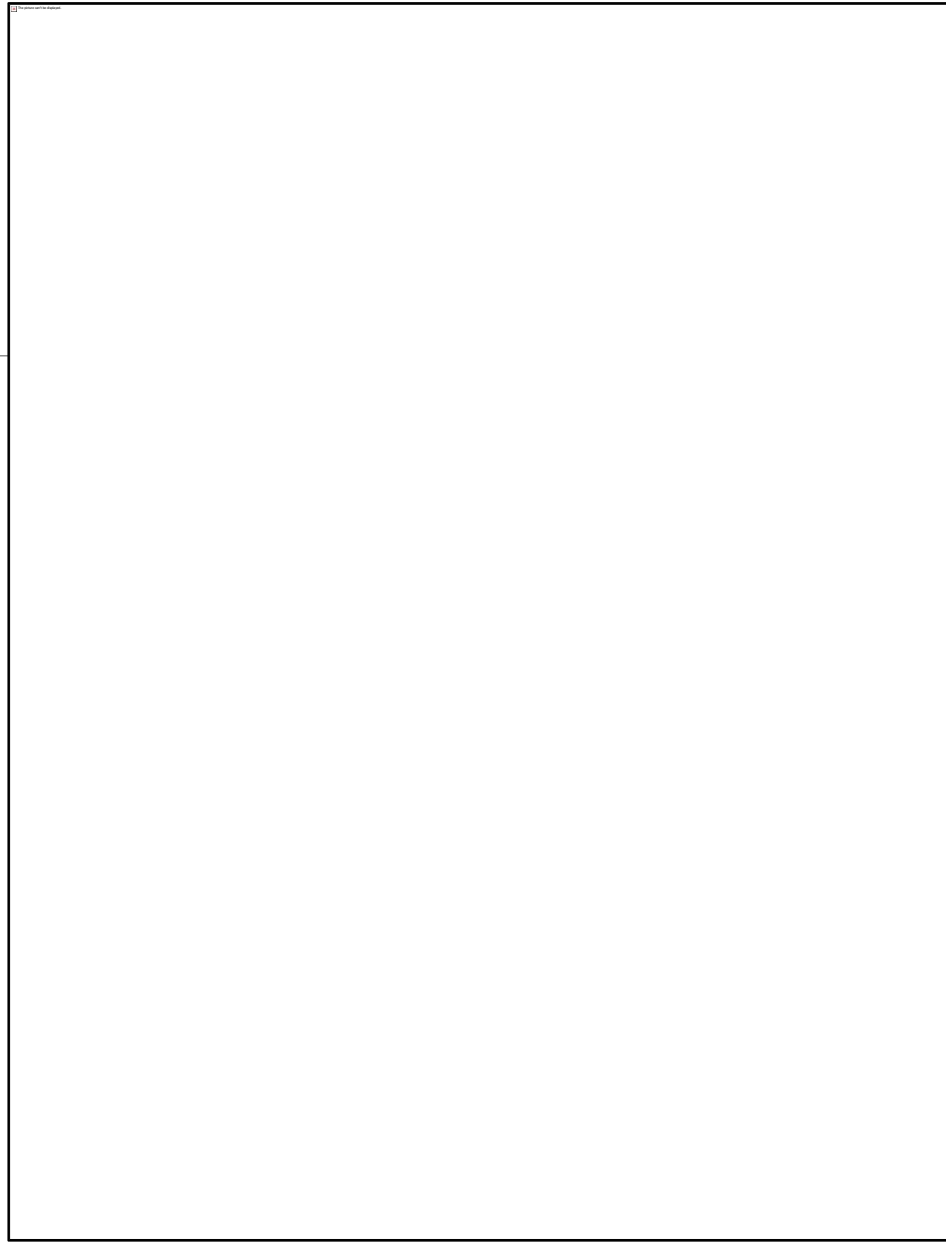
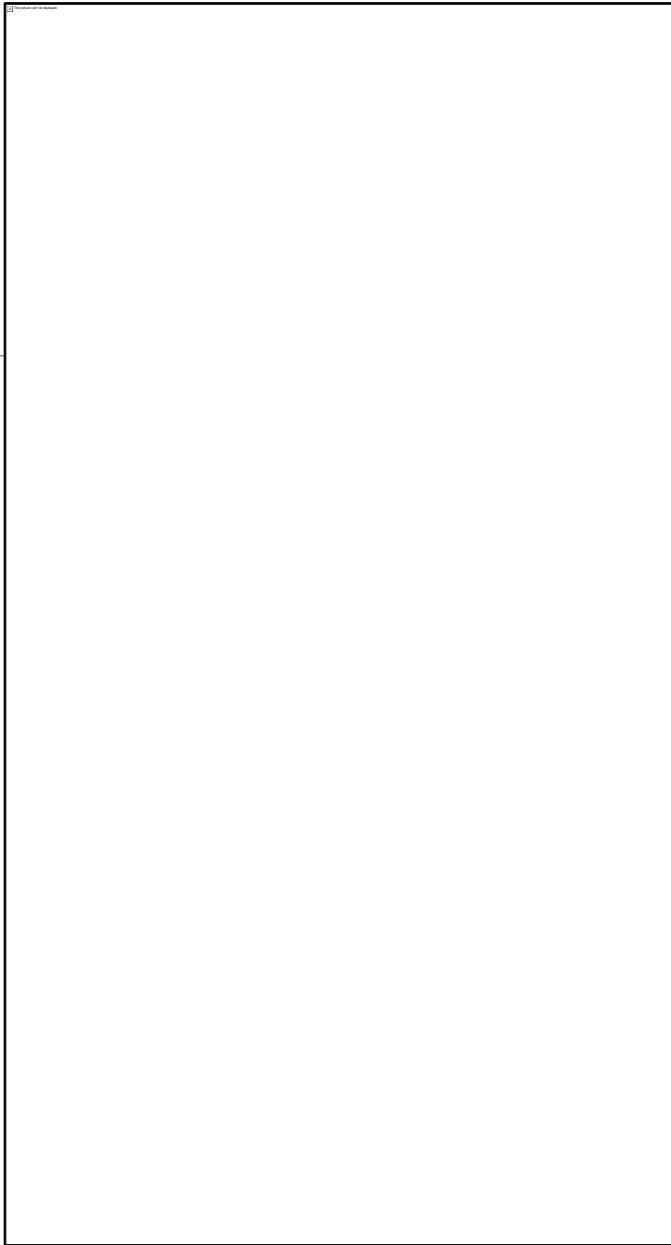
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# Timing of SSRF

1. SSRF should be performed at the earliest feasible time for patients with an unstable chest wall. If SSRF cannot be performed within 72 hours for unstable chest wall indications, delayed fixation is still recommended in those patients whose respiratory failure / ventilator dependence is secondary to the chest wall injury
2. SSRF may be delayed in the face of higher priority injuries. Order and timing of surgical procedures should be at the discretion of surgical team and resource availability
3. The multi-disciplinary approach for polytrauma patients may be cause to prioritise or combine SSRF with other surgical procedures. These may include, but are not limited to, open abdomens, unstable spine fractures, external fixators precluding positioning, and significant vascular injuries

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