

Sussex Trauma Network  
Guidelines for Management of:  
**Open Fractures**



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# Management of Open Fractures

## Control Page

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## Contents

|       |  |    |
|-------|--|----|
| 1     | Executive Summary.....   | 5  |
| 2     | Introduction .....   | 6  |
| 3     | Purpose of the Guideline .....   | 6  |
| 3.1   | Aims & Objectives .....  | 6  |
| 4     | Definitions.....   | 6  |
| 4.1   | Open Fracture .....  | 6  |
| 4.2   | Gustilo Anderson Classification of Open Fractures.....                     | 7  |
| 4.2.1 | Grade I:.....  | 7  |
| 4.2.2 | Grade II:.....   | 7  |
| 4.2.3 | Grade III:.....  | 7  |
| 5     | Scope.....   | 7  |
| 6     | Relevant Documents and Guidance.....                                       | 7  |
| 7     | Responsibilities, Accountabilities and Duties .....                        | 8  |
| 7.1   | Emergency Medicine Consultant on duty (MTC) .....                          | 8  |
| 7.2   | Emergency Medicine Consultant on duty (TU) .....                           | 8  |
| 7.3   | Polytrauma Consultant on call (MTC only) .....                             | 8  |
| 7.4   | Consultant Plastic/Orthopaedic Surgeon of day (MTC) (Monday – Sunday)..... | 8  |
| 7.5   | Consultant Orthopaedic Surgeon on call (TU) .....                          | 8  |
| 7.6   | Orthopaedic Registrar on call (MTC & TU).....                              | 8  |
| 7.7   | Emergency Medicine Registrar on duty (MTC & TU) .....                      | 9  |
| 7.8   | Consultant Vascular Surgeon on call (MTC) .....                            | 9  |
| 7.9   | Vascular Surgery Registrar on call (MTC) .....                             | 9  |
| 7.10  | Sussex Trauma ODN Board.....   | 9  |
| 8     | Standard Operating Procedure .....   | 9  |
| 8.1   | Pre-Hospital Triage.....   | 9  |
| 8.2   | Initial Assessment.....  | 10 |
| 8.3   | Prophylactic Antibiotics.....  | 10 |
| 8.4   | Tetanus Prophylaxis .....  | 11 |
| 8.5   | Imaging.....   | 11 |
| 8.6   | Specialist Referral.....   | 11 |
| 8.7   | Transfer .....   | 12 |
| 8.8   | Admission .....  | 12 |
| 8.9   | Treatment.....   | 12 |
| 8.9.1 | Initial wound debridement .....  | 13 |

|       |   |    |
|-------|---|----|
| 8.9.2 | Definitive skeletal fixation and definitive soft tissue cover:..... | 13 |
| 8.10  | Rehabilitation .....  | 13 |
| 8.11  | Audit .....   | 13 |
| 9     | Training Implications.....  | 14 |
| 10    | Documentation .....   | 14 |
| 11    | Monitoring Arrangements .....                                       | 14 |
| 12    | Equality Impact Assessment Screening .....                          | 14 |
| 13    | Links to other SOPs and Trust policies .....                        | 14 |
| 14    | References .....  | 15 |
| 15    | Appendices.....   | 15 |
| 15.1  | Appendix 1 – Abbreviations .....                                    | 15 |

## 1 Executive Summary

- Most patients with open fractures will be conveyed to hospital by pre-hospital services, using their existing triage algorithms.
- Most patients with open fractures of long bones, midfoot or hindfoot should be conveyed directly or transferred after assessment to the appropriate Major Trauma Centre (MTC).
- For adult patients, this will be the Royal Sussex County Hospital, Brighton.
- For paediatric patients (under the age of 16), if the patient has polytrauma, they should be referred to the nearest Paediatric MTC. If the patient has an isolated open limb fracture, they can be referred to Orthopaedic specialists at the adult MTC.
- Patients with possible open fractures should be given high priority for assessment in hospital, such that they can be identified as requiring timely antibiotics.
- This assessment should include assessment and documentation of the vascular and neurological status.
- Assessment should also include photographs of the wounds before cleaning, dressing or debridement
- Prophylactic antibiotics should be administered as soon as possible, ideally within 1 hour of injury. For long bone, midfoot and hindfoot fractures, antibiotics should be given intravenously according to the defined protocol in this document.
- All patients with open fractures should have their tetanus state assessed and their wounds assessed to determine if they are tetanus-prone. Appropriate tetanus prophylaxis should be given.
- The wounds near open fractures should be photographed before any cleaning or dressing and the photographs stored securely.
- All suspected open fractures in adult patients should be imaged with CT at the same time as a CT Traumagram, if being done, otherwise initially by x-ray. Children with open fractures should be discussed with a Paediatric Radiologist to determine the need for CT scanning.
- Patients with open fractures should be seen and assessed by an Orthopaedic surgeon.
- Patients with open fractures of the wrist and hand (excluding long bones and fingertip injuries) should be seen by a specialist Hand surgeon, after transfer if necessary.
- Patients with vascular compromise should be seen and assessed by a vascular surgeon, after transfer if necessary.
- Surgical treatment of open fractures of long bones, midfoot or hindfoot should be planned and undertaken concurrently by consultants in orthopaedic and plastic surgery (a combined orthoplastic approach), after transfer if necessary.
- Initial debridement should be done within 24 hours, or earlier if there is gross contamination, vascular compromise, or the result of high-energy injury.
- If a patient requires transfer to get the appropriate urgent surgery, then that transfer should be done urgently and the request for transport for the transfer should convey the urgency.
- All patients should receive information regarding expected functional recovery and rehabilitation, including advice about return to normal activities.

## 2 Introduction

Open limb fractures are potentially limb threatening injuries and can lead to long term disability when complications in healing occur.

National standards of care have been issued jointly by the British Orthopaedic Association (BOA) and the British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS) and for open fractures – ([BOAST 4 Guideline – Open Fractures - Dec 2017](#)). These standards set out very clearly the standards of care expected to be followed by those involved in managing open long-bone fractures.

The standards principally deal with initial wound and fracture management, antibiotic prophylaxis, definitive skeletal and soft tissue management, and timing of this.

A multidisciplinary approach is required for this group of patients. Adverse outcomes such as infection and non-union are strongly linked to delays in definitive management or incorrect initial care and can result in loss of a potentially salvageable limb.

## 3 Purpose of the Guideline

The purpose of this guideline is to clearly define the care pathway for patients with open fractures including referral pathways to and from the Major Trauma Centre (MTC) (Royal Sussex County Hospital (RSCH)) and network Trauma Units (TUs), initial management of the limb, antimicrobial requirements, and definitive skeletal and soft tissue management.

### 3.1 Aims & Objectives

The aims and objectives of this guideline are:

- To provide a system-wide approach for management of patients with open fractures
- To define appropriate patient pathways for these patients
- To list appropriate accepted routes of communication
- To highlight continuing areas of contention
- To help meet TQUINs requirements for creation of network-agreed guidelines for the Network and Trauma Units (TUs)

## 4 Definitions

### 4.1 Open Fracture

Open fractures are breaks in a bone complicated by a wound or wounds. The fracture will be in continuity with the outside environment through the wound(s), not merely adjacent.

## 4.2 Gustilo Anderson Classification of Open Fractures

This classification only occurs after the initial debridement and therefore do not inform the decision on treatment or whether to transfer the patient.

### 4.2.1 Grade I:

The wound is less than 1cm long. It is usually a moderately clean puncture, through which a spike of bone has pierced the skin. There is little soft-tissue damage and no sign of crushing injury. The fracture is usually simple, transverse, or short oblique, with little comminution.

### 4.2.2 Grade II:

The laceration is more than 1 cm long, and there is no extensive soft-tissue damage, flap, or avulsion. There is slight or moderate crushing injury, moderate comminution of the fracture, and moderate contamination.

### 4.2.3 Grade III:

These are characterized by extensive damage to soft tissues, including muscles, skin, and neurovascular structures, and a high degree of contamination. The fracture is often caused by high velocity trauma, resulting in a great deal of comminution and instability.

- III A – Soft tissue coverage of the fractured bone is adequate
- III B – Extensive injury to, or loss of soft tissue, with periosteal stripping and exposure of bone, massive contamination, and severe comminution of the fracture. After debridement and irrigation, a local or free flap is needed for coverage.
- III C – Any open fracture that is associated with an arterial injury that must be repaired, regardless of the degree of soft tissue injury.

## 5 Scope

The guideline covers all major trauma patients with open fractures within the Sussex Trauma Network. It replaces and supersedes all relevant previous STN Guidelines.

It is applicable to adults and children, but relevant sections contain statements where different processes apply to management of children. It is acknowledged that commissioning pathways relevant to children have not yet been finalised and this document will be updated when they are.

## 6 Relevant Documents and Guidance

This guideline assumes and incorporates compliance with the following documents, except where explicitly stated:

- [BOAST 4 Guideline – Open Fractures - Dec 2017](#)
- [NICE Guideline \[NG37\] - Fractures \(complex\): assessment and management](#)
- [NICE Guideline \[NG211\] – Rehabilitation after traumatic injury](#)

## 7 Responsibilities, Accountabilities and Duties

### 7.1 Emergency Medicine Consultant on duty (MTC)

The Emergency Medicine Consultant on duty on the MTC takes overall responsibility for the patients with open fractures from the time they arrive in the ED until the polytrauma consultant takes over care. They also are responsible for ensuring that junior staff are aware of and follow the SOP below and BOAST 4 guidelines for open fractures.

### 7.2 Emergency Medicine Consultant on duty (TU)

The Emergency Medicine Consultant on duty on the TU takes overall responsibility for the patients with open lower limb fractures from the time they arrive in the emergency department until the Orthopaedic Consultant on call (TU) takes over care or the patient is transferred to the MTC. They also are responsible for ensuring that junior staff are aware of and follow the SOP below and BOAST 4 guidelines for open fractures.

### 7.3 Polytrauma Consultant on call (MTC only)

The Polytrauma Consultant takes overall responsibility for patients with open lower limb fractures once notified of their arrival. Duties include ensuring patients are managed according to the SOP and that junior orthopaedic staff are aware of the SOP below and BOAST 4 guidelines. The Polytrauma Consultant of the day will ensure availability to assess patients with open fractures and liaise with the Plastic Surgery Consultant of the day regarding joint surgical procedures and soft tissue coverage plans.

### 7.4 Consultant Plastic/Orthoplastic Surgeon of day (MTC) (Monday – Sunday)

The Plastic Surgery Consultant of the day in the MTC will ensure availability to assess patients with open fractures and liaise with the Polytrauma Consultant on call regarding joint surgical procedures and soft tissue coverage plans.

### 7.5 Consultant Orthopaedic Surgeon on call (TU)

The Orthopaedic Surgery Consultant on duty on the TU takes overall responsibility for the patient's with open lower limb fractures from the time they are notified of the patient's arrival in the TU until discharge or the patient is transferred to the MTC. They are responsible for ensuring patients that need to be transferred to the MTC are transferred safely and promptly in accordance with transfer protocols. They also are responsible for ensuring that junior staff are aware of and follow the SOP below and BOAST 4 guidelines for open fractures.

### 7.6 Orthopaedic Registrar on call (MTC & TU)

The Orthopaedic Registrar on call (MTC) is responsible for implementation of the SOP below and managing the patient accordingly.



## 7.7 Emergency Medicine Registrar on duty (MTC & TU)

The Emergency Medicine Registrar on duty (MTC) is responsible for implementation of the SOP below and managing the patient accordingly.

## 7.8 Consultant Vascular Surgeon on call (MTC)

The Consultant Vascular Surgeon on call (MTC) takes joint responsibility with the Polytrauma Consultant and Plastic Surgical Consultant for patients with open fractures and vascular injuries or dislocated joints with vascular injuries. The Vascular Surgery Consultant on call in the MTC will ensure availability to assess patients with vascular injuries and liaise with the Polytrauma Consultant and Plastic Surgical Consultant on call regarding joint surgical procedures and vascular surgery plans.

## 7.9 Vascular Surgery Registrar on call (MTC)

The Vascular Surgery Registrar on duty is responsible for implementation of the SOP below and managing the patient accordingly for patients with a vascular injury and an open fracture.

## 7.10 Sussex Trauma ODN Board

Sussex Trauma ODN Board is responsible for disseminating this guideline and for investigation of non-compliance with the SOP below. They are also responsible for ensuring that the SOP is updated to reflect newer clinical guidelines as necessary.

# 8 Standard Operating Procedure

## 8.1 Pre-Hospital Triage

Most patients with open fractures are conveyed to hospital and have pre-hospital triage by one or both of the two main pre-hospital service providers – SECAMB and AAKSS. Each of these services cover a wider area than the STN and has its own pre-hospital triage algorithms to determine which hospital an individual patient is conveyed to.

NICE Guideline NG37 recommendation 1.1.12 includes the statement that patients with suspected open fracture should be conveyed directly to a MTC or specialist centre that can provide orthopaedic care if a long bone, hindfoot or midfoot are involved, but other open fractures can be conveyed to the nearest Emergency Department. Similarly, [BOAST 4 Guideline – Open Fractures](#) have the same recommendation.

According to SECAMB guidelines current at the time of printing (see [STN Patient Pathways](#)) this recommendation for long bone, hindfoot or midfoot open fractures is not specifically complied with, unless there is another indication. This is a consequence of the COVID-19 pandemic and may change in the future – after which this guideline will be updated. It is the Sussex Trauma Network's aspiration and belief that most patients with open fractures of long bones requiring orthopaedic surgery should be conveyed directly to the MTC, rather than a TU and will continue discussions to achieve this.

All adult patients with serious open fractures (at present meaning only mangled limb or amputation proximal to wrist or ankle, though this may change) conveyed by AAKSS within the STN will be taken to the MTC. Paediatric patients with polytrauma will be conveyed to the nearest Paediatric MTC.

Pre-hospital assessment should include assessment of vascular status of the limb. Consideration should be given to splintage of the fractured limb and appropriate analgesia.

## 8.2 Initial Assessment

Patients with possible open fractures should be given high priority for assessment in hospital, such that they can be identified as requiring timely antibiotics (see below).

This assessment should include assessment and documentation of the vascular and neurological status, which should be repeated at intervals, particularly after reduction of fractures or the application of splints.

If possible, this assessment should also include photographs of the wounds before cleaning, dressing or debridement. These photographs should be part of the clinical records and stored/transmitted in a manner that meets information governance policies

Prior to formal debridement, the wound should be handled only to remove gross contamination and to allow photography, then dressed with a saline-soaked gauze and covered with an occlusive film. 'Mini-washouts' outside the operating theatre environment are not indicated.

If required, the limb should be re-aligned and splinted.

## 8.3 Prophylactic Antibiotics

Prophylactic antibiotics should be administered as soon as possible, ideally within 1 hour of injury. For long bone, midfoot and hindfoot fractures, antibiotics should be given intravenously.

The preferred regime for intravenous prophylactic antibiotics, to be given for 72 hours or until definitive wound closure whichever is sooner, is:

- In adult patients not allergic to penicillin:
  - Co-amoxiclav (1.2g) 8 hourly.
  
- In penicillin allergic adult patients:
  - Teicoplanin 400mg iv 12 hourly for three doses, then 400mg once daily (increase to 600mg once daily if over 100kg)
  - plus Gentamicin 5 mg/kg iv as per protocol
  - plus Metronidazole 500 mg iv 8 hourly.

NB. Use [British National Formulary for Children \(BNFc\)](#) for all doses of these drugs in < 16 year olds.

## 8.4 Tetanus Prophylaxis

All patients with open fractures should have their tetanus state assessed. Also, their wounds should be assessed to determine if they are tetanus-prone. Appropriate tetanus prophylaxis should be given. See [British National Formulary – Tetanus Prophylaxis](#) for detailed guidance.

## 8.5 Imaging

All suspected open fractures should have appropriate imaging.

In adult patients where an initial “Trauma CT” is indicated there should be local protocols to maximise the useful information and minimise delay in management of open fractures requiring urgent surgery, by using clinical correlation to direct further specific limb sequences during that initial CT examination.

In children, the routine use of adult trauma protocols is inappropriate. Exposure to ionising radiation should always be kept to a minimum using as low as reasonably achievable principles.

Where initial CT is not required, anteroposterior (AP) and lateral x-rays of the full length of affected bone(s) should be performed.

There should be a local policy on the inclusion of angiography in any extremity CT related to open fractures, especially if there is suspicion of vascular compromise.

## 8.6 Specialist Referral

Any patient at a Trauma Unit (TU), who meets the criteria for immediate transfer to the MTC (patients with life-threatening conditions) should be referred directly to the duty MTC ED Consultant (see [STN Patient Pathways](#)).

All other patients should be referred to and assessed by an Orthopaedic specialist at the hospital they are in, except at facilities that do not have this service.

All patients with open fractures of long bones, midfoot or hindfoot should be referred by the TU Orthopaedic Surgeons to the duty Trauma and Orthopaedic services at the appropriate MTC. For adults, this will be the Royal Sussex County Hospital.

For children under 16 with polytrauma they should be referred to the nearest Paediatric MTC. For children with isolated open limb fractures the commissioning pathway is still not

clear, but they can be referred or discussed with the adult MTC specialists who will agree a priority and suitable placement.

If the patient is not at the MTC, referral to the Trauma and Orthopaedic services at the adult MTC should be done using the system described in the document [Processes for Urgent Referral to the Trauma and Orthopaedic Service at the Major Trauma Centre at the Royal Sussex County Hospital](#). This referral should be done by local Orthopaedic specialist, to allow negotiation about accuracy of the diagnosis and timing of transfer.

If the patient is transferred to the MTC, arrangement must be made for transfer of images and photographs to the MTC.

The polytrauma on call team should be informed of the patient's arrival in the MTC and their status.

The plastic/orthopaedic surgeon of the day (Monday – Sunday) is informed by the polytrauma team of the patient.

If there is evidence of vascular compromise, the patient should also be referred to a vascular surgeon.

Patients with open fractures of the wrist and hand (excluding long bones and finger tip injuries) should be referred to the nearest facility with a specialist Hand Surgeon. This may include Queen Victoria Hospital, East Grinstead.

## 8.7 Transfer

If the advice of the orthopaedic surgeons at the MTC, for a patient at present at a TU, is that the patient requires orthopaedic surgery and should be transferred to the MTC, then that transfer should be done urgently so that surgery can occur within the required timeframe. Requests for transport for the transfer should convey that urgency.

## 8.8 Admission

If admission is required, this will be decided and arranged by the relevant Orthopaedic specialist / Hand surgeon.

## 8.9 Treatment

The formation of the management plan for surgery for initial debridement, fixation, and coverage of open fractures of long bones, midfoot and hindfoot should be undertaken concurrently by consultants in orthopaedic and plastic surgery (a combined orthopaedic approach) at the MTC.

### 8.9.1 Initial wound debridement

The timing of debridement will depend on factors as follows:

- Surgery should be immediate for highly contaminated open fractures or when there is an associated vascular compromise from compartment syndrome or arterial disruption producing ischaemia.
- within 12 hours of injury for high-energy open fractures (likely Gustilo–Anderson classification type IIIA or type IIIB) that are not highly contaminated
- within 24 hours of injury for all other open fractures

The primary surgical treatment (wound excision and fracture stabilisation) of severe open lower limb fractures only takes place in a non-specialist centre if the patient cannot be transferred safely.

If definitive skeletal and soft tissue reconstruction is not to be undertaken in a single stage, then vacuum foam dressing or an antibiotic bead pouch is applied until definitive surgery.

### 8.9.2 Definitive skeletal fixation and definitive soft tissue cover:

Definitive skeletal stabilisation and wound cover are achieved within 72 hours and should not exceed 7 days. This should be done at the time of definitive skeletal fixation if possible and in conjunction with the Plastic/Orthoplastic Consultant if possible.

Vacuum foam dressings are not used for definitive wound management in open fractures.

## 8.10 Rehabilitation

Clinicians should be aware of and follow the principles of rehabilitation laid down in the

All patients should receive information regarding expected functional recovery and rehabilitation, including advice about return to normal activities such as work and driving.

## 8.11 Audit

- All patients with open long bone are eligible for inclusion in and should be entered into the ongoing national Trauma Audit and Research Network (TARN) audit (see [www.tarn.ac.uk](http://www.tarn.ac.uk) ).
- All patients treated at the MTC with open lower limb fractures should be entered on the Lower Limb Database.
- Any patients whose treatment falls outside this guideline should be raised onto the network [Clinical governance log](#) and discussed through internal clinical governance mechanisms.

## 9 Training Implications

STN aims to provide an online training module supporting the specific and unique elements of this pathway.

## 10 Documentation

There is no formal documentation of this process, other than the following:

- Written and computer patient medical records including order comms, PACS etc
- E-mailed online referrals
- Rehabilitation prescriptions
- Repatriation referral forms

## 11 Monitoring Arrangements

These include:

- [STN Clinical Governance log](#)
- TARN Audit
- Lower Limb Database

## 12 Equality Impact Assessment Screening

None in process.

## 13 Links to other SOPs and Trust policies

This guidance refers to and links with the following STN and Trust publications:

- STN Patient Pathways (present version called Patient Pathway v9.5a) from [www.bsuh.nhs.uk/stn/docs/](http://www.bsuh.nhs.uk/stn/docs/)
- STN Repatriation Policy (present version called Repatriation Policy v4) from [www.bsuh.nhs.uk/stn/docs/](http://www.bsuh.nhs.uk/stn/docs/)
- Processes for Urgent Referral to the Trauma and Orthopaedic Service at the Major Trauma Centre at the Royal Sussex County Hospital (present version is v1) from [www.bsuh.nhs.uk/stn/docs/](http://www.bsuh.nhs.uk/stn/docs/)
- STN Guideline – Imaging for Trauma – still pending but will be at [www.bsuh.nhs.uk/stn/docs/](http://www.bsuh.nhs.uk/stn/docs/)
- STN Guideline - Specialist Rehabilitation Services – still pending but will be at [www.bsuh.nhs.uk/stn/docs/](http://www.bsuh.nhs.uk/stn/docs/)

## 14 References

- [BOAST Guidelines – Open Fractures](#)
- [Gustilo Classification - Orthobullets](#)
- [British National Formulary for Children \(BNFc\)](#)
- [British National Formulary – Tetanus Prophylaxis](#)
- [NICE Guideline \[NG37\] - Fractures \(complex\): assessment and management](#)
- [NICE Guideline \[NG211\] – Rehabilitation after traumatic injury](#)

## 15 Appendices

### 15.1 Appendix 1 – Abbreviations

|        |   |
|--------|---|
| AAKSS  | Air Ambulance Kent Surrey Sussex                                      |
| ATLS   | Advanced Trauma Life Support  |
| BOA    | British Orthopaedic Association                                       |
| BOAST  | British Orthopaedic Association Standards for Trauma                  |
| BAPRAS | British Association of Plastic, Reconstructive and Aesthetic Surgeons |
| CT     | Computerised Tomography   |
| ED     | Emergency Department  |
| MTC    | Major Trauma Centre   |
| RSCH   | Royal Sussex County Hospital  |
| SECAMB | South East Coast Ambulance Service                                    |
| SOP    | Standard Operation Procedure  |
| TQUINs | Trauma Quality Indicators   |
| TU     | Trauma Unit   |
| TUs    | Trauma Units  |
| QVH    | Queen Victoria Hospital, East Grinstead                               |