# Trust Guideline for the Management of:
Acute Compartment Syndrome in Adults with Tibial Fractures

## A clinical guideline recommended

<table>
<thead>
<tr>
<th>For use in:</th>
<th>Trauma and Orthopaedic Directorate</th>
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<tbody>
<tr>
<td>By:</td>
<td>All Professionally qualified staff</td>
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<tr>
<td>For:</td>
<td>Adults with Diaphyseal Tibial Fractures</td>
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<td>Division responsible for Document:</td>
<td>Division 2 - Surgical</td>
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</table>
| Key words: | Acute Compartment Syndrome (ACS)  
Continuous Compartment Pressure Monitoring  
Differential Pressure (ΔP) |
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| Job title of document author: | Consultant Trauma and Orthopaedic Surgeon |
| Name of document author's Line Manager: | Mr John Nolan |
| Job title of author's Line Manager: | Clinical Director Trauma and Orthopaedics |
| Assessed and approved by the: | Clinical Guidelines Assessment Panel (CGAP) |
| Date of approval: | 20 February 2018 |
| Ratified by or reported as approved to (if applicable): | Clinical Standards Group and Clinical Safety and Effectiveness Sub-Board |
| To be reviewed before:  
This document remains current after this date but will be under review | 20 February 2021 |
| To be reviewed by: | Mr A D Patel |
| Reference and/ or Trustdocs ID No: | ID: 1264 |
| Version No: | 4 |
| Description of changes: | No changes |
| Compliance links: (is there any NICE related to guidance) | No |
| If Yes – does the strategy/policy deviate from the recommendations of NICE?  
If so, why? | N/A |

This guideline has been approved by the Trust's Clinical Guidelines Assessment Panel as an aid to the diagnosis and management of relevant patients and clinical circumstances. Not every patient or situation fits neatly into a standard guideline scenario and the guideline must be interpreted and applied in practice in the light of prevailing clinical circumstances, the diagnostic and treatment options available and the professional judgement, knowledge and expertise of relevant clinicians. It is advised that the rationale for any departure from relevant guidance should be documented in the patient's case notes.

The Trust's guidelines are made publicly available as part of the collective endeavour to continuously improve the quality of healthcare through sharing medical experience and knowledge. The Trust accepts no responsibility for any misunderstanding or misapplication of this document.
Trust Guideline for the Management of: Acute Compartment Syndrome in Adults with Tibial Fractures

Quick reference Guideline/s

ADULT ADMITTED WITH SOFT TISSUE INJURY/FRACTURE OF LOWER LIMB

Monitored Patients

- Neurovascular Status Checked Hourly
- Continuous Compartment Pressure Monitoring Hourly Readings

Differential Pressures > 30mmHg
- Yes
  - Neurovascular status intact
    - Yes
      - Differential Pressures > 30mmHg
        - Yes
          - Monitor for 48 hours post nailing/pre cast application
            - Discontinue Monitor and send cannula tip to microbiology for C&S

    - No
      - Call SHO/SPR for clinical review

- No
  - No
  - Yes
    - Call SHO/SPR for clinical review

EXTREME PAIN (On passive stretch/out of proportion to injury)
- Yes
- No

Call SHO/SPR for clinical review

FASCIOTOMY
ADULT ADMITTED WITH SOFT TISSUE INJURY/FRACTURE OF LOWER LIMB
Non-monitored patients

Neurovascular Status Checked Hourly

- Neurovascular status intact
  - No
  - Yes

- EXTREME PAIN (on passive stretch/out of proportion to injury)
  - No
  - Yes

  Call SHO/SPR for clinical review

  No
  Yes

FASCIOTOMY
Objective

To inform all staff involved in the care of patients at risk of developing Acute Compartment Syndrome (ACS). For all staff to fully understand what ACS is; to recognise early symptoms; to be competent in using the continuous monitoring equipment and to be able to act early to avoid missing ACS.

Rationale

ACS is a complication of trauma with serious sequelae if not diagnosed early. The end result of unchecked ACS includes neurological deficit, muscle necrosis, ischaemic contracture, infection and delayed fracture healing. Irreversible damage can also lead to amputation, renal failure and even loss of life (Appendix 3). It is widely acknowledged that early diagnosis is essential in preventing the complications associated with ACS leading to urgent intervention before irreversible damage occurs.

Traditionally the diagnosis of ACS has been based on the detection of clinical signs and symptoms and routine monitoring of the extremities for neurovascular status is current practice within this Trust. Neurovascular checks alone, however, have led to missed ACS, and this method has also been recognised as being unreliable in the literature. Diagnostic tools have been developed to provide an objective measurement of compartment pressures as an adjunct to signs and symptoms in detecting ACS: One such tool frequently referred to within the literature is continuous compartment pressure monitoring.

Timely diagnosis of acute compartment syndrome has remained of clinical and medico legal concern. Early use of continuous compartment pressure monitoring significantly reduces the delay to fasciotomy and therefore the long term sequelae to ACS. Since 2002, to avoid unnecessary delay to treatment and the risk of missed compartment syndrome and its associated devastating effects, the Trauma and Orthopaedic department has introduced a policy: All patients who have sustained diaphyseal tibial fractures or who are deemed at risk of developing ACS, are to have compartment pressure monitoring via continuous compartment pressure monitoring.

What is ACS?

“A condition in which the circulation and function of tissues within an enclosed space is compromised by increased pressure within that space” (Matsen, M 1975)

“Occurs when raised pressure within a closed osteofascial compartment compromises the circulation and function of tissues within the compartment” (McQueen, M 1998)

Causes:

A Fracture or contusion

- Most common cause

Soft tissue trauma

- Not to be excluded
Constriction and external compression

- Unconscious patients following anaesthesia or alcohol/substance misuse leading to entrapment of the limb
- Entrapment of the limb under a heavy load
- Prolonged inflation of air splints
- Incorrect application of circumferential casts (POP, Scotchcast™)

Revascularisation

- Postischaemic swelling after circulation restored following vascular reconstruction - particularly if restoration of the circulation is delayed > 6 hours

Surgical procedures with elevation of the lower limbs

- e.g. Lloyd Davies/Lithotomy position for > 4 hours

Thermal Injuries

- Circumferential burns
- Electrical burns (raised interstitial pressure resulting from associated oedema)

Intravenous extravasation

- Occlusion or spasm of a major vessel with an inadequate collateral circulation can also cause swelling of the contents to a muscle group
- Patients taking anticoagulants or with bleeding disorders are at greater risk

Signs and Symptoms – The 6 ‘P’s

Pain

- Out of proportion to the injury
- Unrelieved by narcotics
- Excessive use of analgesic devices (PCA)
- Increased by movement of the distal digits
- Described as deep or throbbing
- Increases with elevation of the extremity
- May not be present if central/peripheral sensory deficits are present

Parasthesia

- Subtle first symptom
- Best elicited by direct stimulation
- Patient complains of tingling or burning sensation
Trust Guideline for the Management of:
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- Can lead to hypoesthesia (numbness)

**Pressure**
- Involved compartment or limb will feel tense and warm on palpation
- Skin will be tight and shiny
- Skin occasionally appears cellulitic

**Pallor**
- Late sign
- Pale/whitish tone to the skin
- Prolonged capillary refill - > 3 seconds
- Cool feel to skin due to lack of capillary reperfusion

**Paralysis**
- Late sign
- May start as weakness in active movement of involved or distal joints
- Leads to inability to move joints or digits actively
- No response to direct neural stimulation due to damage of myoneural junction

**Pulselessness**
- Late sign
- Very weak or lack of palpable or Doppler audible pulse

**ACS - Important Points to Remember**

**Parasthesia/hyperparasthesia** (Sensory changes in the nerve)
- Develop within 30 minutes of the onset of ischemia

**Irreversible functional changes**
- Start in the muscle after 4 hours

**Irreversible nerve damage**
- Begins after 12/24 hours of total ischaemia

**The lower leg and forearm**
- More prone to ACS

**Contact sports**
- Most common cause of injury to the lower limb (particularly football)
Fracture blisters

- Represent areas of necrosis of the epidermis and separation of the skin layers
- Often occur in areas of swollen skin over a fracture site. When the intracompartmental pressure is too high to be relieved by normal physiological means, blisters occur as the body attempts to relieve the pressure
- Associated swelling must be noted as a sign of significant interstitial pressure

Elevation

- Too high - can contribute to the risk
- Should not be above the level of the heart

Renal Failure

- All patients are at risk of renal failure
- Monitor renal function and urine output regularly

Patient Information Sheet

- Enables patient to recognise early symptoms
- Enables patient to alert nursing staff of any symptoms

Recordings:

- The diastolic blood pressure and the compartment pressures are recorded hourly on the compartment pressure monitoring form.
- The mean compartment pressure is subtracted from the diastolic blood pressure to produce the Differential Pressure ($\Delta P$).
- This should be above 30mmHg to be considered within normal range.
- If the $\Delta P$ falls below 30mmHg for two consecutive readings, the SHO/SPR should be informed.
- A falling trend signifies the onset of ACS and early return to theatre for Fasciotomy is desirable.
- The monitor remains in situ for 48 hours post fixation/pre POP if non-operative treatment.
- The differential must always be above 30. If it is below 30 for two consecutive readings, inform SHO/SPR
A TREND OF FALLING DIFFERENTIAL PRESSURES (ΔP) INDICATES A RISING COMPARTMENT PRESSURE

Using the Monitor:

- To set Auto BP Recording, press NIBP button, the bottom of the screen will display AUTO On/Off press ON; the machine will now read every hour after the first reading.
- Press Normal Screen and the STAT B/P button to commence cycle.
- Record the diastolic
- At the same intervals record the mean compartment pressure = ‘PRS’ on screen
- Subtract the mean CP from the diastolic NIBP Record the resulting value as ‘Differential’

Display Trends

- Top graph is ‘PRS’ (CP) /lower graph is NIBP
- If you get lost or confused, return to ‘Previous Screen’ or back to the beginning via ‘Normal Screen’

Tones

To turn off sounds -

- Press ‘monitor set up’- this displays ‘tones’ button in bottom left of the screen
- Press ‘tones’ button and then ‘local alarms’ button – press off to silence the tone
- Repeat the procedure for ‘remote alarms’
- Return to Normal Screen

Monitoring Procedure – Important Points to Remember

- Call theatre orthopaedic ODP’s (operating department practitioners) for trouble shooting - they are contactable via the bleep system.

- The Transducer is not to be purged by recovery/ward staff. No saline to be used to purge any blockages as this increases the pressure within the compartment.

- Clinical symptoms must be taken into account and the individual assessed accordingly.

- If there are unequivocal positive clinical signs but inconclusive readings, the clinician must make an early decision to return the patient to theatre to relieve the compartment pressures with a fasciotomy.
Where there are persistently low \( \Delta P \) readings but the patient has no clinical signs, the clinician assessing the patient must make the decision whether to perform a fasciotomy.

Rarely, when spurious readings occur (i.e. possible monitoring fault/misplaced cannula) where there is a persistently low \( \Delta P \), but neurovascular status is intact, clinical symptoms are negligible, and the consultant has decided there is no ACS - then he may decide to discontinue monitoring. However, neurovascular observations should be continued.

The person ultimately responsible for this decision is the patient’s Consultant Orthopaedic Surgeon and if the clinician has any doubts regarding this decision, then they should refer to the consultant.

On discontinuation of continuous compartment pressure monitoring, the ward nurse will cut the tip off, place in a sterile jar and send it to the Microbiology department for Culture and Sensitivity.

All patients who have been monitored will have the monitoring data collected and stored on a secure database for research and audit purposes.

Summary of development and consultation process undertaken before registration and dissemination

The authors listed above, on behalf of a guideline development group, which has agreed the final content, drafted the guideline. During its development it has been circulated for comment to: Mr AD Patel, Consultant Trauma and Orthopaedic Surgeon; Clare Darrah, Research Manager, Orthopaedics; Mr Simon Donell, Consultant Orthopaedic Surgeon and Honorary Reader UEA; Stanley Swanepoel, Experienced Practitioner, Theatres and Andy Barker, Clinical Leader, Theatres. Any amendments required following receipt of this feedback were then made before the final draft was produced.

<table>
<thead>
<tr>
<th>Claire Brown, Kay Marrington, Mary Collins, Emma Dolman</th>
<th>Sister - Earsham, Denton, Gateley, Buxton</th>
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<tbody>
<tr>
<td>Robert Smith</td>
<td>Clinical Manager Orthopaedic Theatres</td>
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<tr>
<td>Karen Morton</td>
<td>Specialist Nurse Practitioner - Recovery</td>
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<tr>
<td>Steve Hume</td>
<td>Deputy Charge Nurse EAUS</td>
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<td>Helen Fordham</td>
<td>Deputy Sister EAUS</td>
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<td>Alison Smith</td>
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<td>Elaine Freeman</td>
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<tr>
<td>Jim Wimhurst</td>
<td>Consultant Orthopaedic Surgeon – T &amp; O</td>
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</table>
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Distribution list / dissemination method

To be distributed to all those involved in continuous compartment pressure monitoring –

Denton Ward                     EAUS
Earsham Ward                  Theatre Recovery
Gateley Ward                    Orthopaedic Theatres

Buxton ward for reference only –

not to be used in Paediatrics

The guidelines will be distributed in hard copy form to each of the above departments and will also be accessible via the Intranet. Training will be given to all relevant staff bi-annually via Powerpoint Presentations and Practical Workshops. Original neurovascular observation chart created by Helen Fordham in consultation with staff on EAUS. The original version was then updated by Steve Hume and Karl Rich to version 2. All are staff on EAUS.

Further information and references can be obtained from Adele Cooper, Orthopaedic Clinical Research Practitioner, Institute of Orthopaedics, CBL4, and NNUH.

References

O’White, T; Howell, GED; Will, EM; Court-Brown, CM; McQueen, MM. Elevated Intramuscular Compartment Pressures Do Not Influence Outcome after Tibial Fracture J Trauma (2003); 55:1133-1138

McQueen MM. Acute Compartment Syndrome
Acta Chir Belg (1998); 98:166-170

McQueen, MM and Court-Brown, CM. Compartment Monitoring in Tibial Fractures
Journal of Bone and Joint Surgery (Br) (1996); 78-B: 99-104

Whitesides, E; Haney, TC; Morimoto, K; Harada, H. Tissue Pressure Measurements as a Determinant for the Need of Fasciotomy
Clinical Orthopaedics and Related Research (1975); 113:43-51

McQueen, MM. How to Monitor Compartment Pressures
Techniques in Orthopaedics (1996); 11(1):99-101

McQueen, MM; Christie, J; Court-Brown, CM. Acute Compartment Syndrome in Tibial Diaphyseal Fractures
Journal of Bone and Joint Surgery (Br) (1996) (1); 78B:95-98

Matsen, FA. Compartmental Syndrome. A Unified Concept.
Clinical Orthopaedias (1975); 113:8-14

Tornetta, P and Templeman, D. Compartment Syndrome Associated with Tibial Fractures
Journal of Bone and Joint Surgery (1996); 78-A (9):1438-1444

McQueen, MM; Gaston, P; Court-Brown, CM. Acute Compartment Syndrome; who is at Risk?

Kirsten, G and Johnstone, AJ. Diagnosing Acute Compartment Syndrome
Journal of Bone and Joint Surgery (Br) (2003); 85(5):625-632

Choudhary, RK; Waseem, M; Thalva, R; Dunlop, DG. Acute Compartment Syndrome: Diagnosis and Immediate Care
Hospital Medicine (2003); 64(5):296-298

Ovre, S; Hvaal, K; Holm, I; Stromsoe, K; Nordsletten, L; Skjeldal, S; Compartment Pressure in Nailed Tibial Fractures: a threshold of 30mmHg for decompression gives 29% Fasciotomies
Arch orthop Trauma Surg (1998); 118:29-31

Azar, FM in Conale, St (Eds) Traumatic Disorders

Harvey, C. Compartment Syndrome: When is it least Expected?
Orthopaedic Nursing (2001); 20(3):15-26

Janzing, H. and Broos, PLO: Routine Monitoring of Compartment Pressure in Patients with Tibial Fractures: Beware of Overtreatment!
Injury (2001); 32(5):415-421

Blick, SS et al: Compartment Syndrome in Open Tibial Fractures
JBJS (A) (1996); 68A: 1348-53

Middleton, C: Compartment Syndrome: the Importance of Early Diagnosis
Nursing Times (2003); 99: 21, 30-32

Willis, RB; Rorabeck, CH: Treatment of compartment syndrome in children

Mars, M; Hadley, GP; Raised Compartment Pressures in Children: a Basis for Management
Injury (1998); 29: 183-5

ed. 6, St. Louis (2001) pg. 1301. Mosby Inc.

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<th>Date (dd/mm/yyyy)</th>
<th>Time (24hr clock)</th>
<th>Colour *</th>
<th>Warmth</th>
<th>Skin Condition</th>
<th>Pulse</th>
<th>Pain State Site (See VAS) **</th>
<th>Sensation</th>
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NUMERICAL RATING SCALE

0      1      2      3      4      5       6      7      8      9     10
No Pain  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Worst possible pain

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Author's title: As per front page
Approved by: CGAP
Date approved: 20/02/2018
Review date: 20/02/2021
Available via Trust Docs Version: 4
Trust Docs ID: 1264
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### Compartment Pressure Monitoring

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![NUMERICAL RATING SCALE](image)

0 1 2 3 4 5 6 7 8 9 10

No Pain Worst possible pain
## Compartment Pressure Monitoring

### Table

<table>
<thead>
<tr>
<th>Time</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Mean Compartment Pressure</th>
<th>Differential</th>
<th>Initials</th>
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Appendix 3  Systemic Response to Soft-tissue Injury

Severe damage can also lead to a marked inflammatory response (MOD, multi organ dysfunction syndrome) with the release of proinflammatory cytokines (TNFα, IL-1, IL-6, IL-10) and damage to central organs away from the injury site (remote organ injury). Pathophysiological changes in damaged tissue after soft tissue trauma – a vicious circle, comprising:

1. Impairment of microvascularity with hypoxia
2. Acidosis
3. Permeability damage
4. Oedema
5. Increase in interstitial pressure due to oedema in the presence of constriction of the swelling tissue by fasciae or skin with secondary disturbance to perfusion
6. Metabolic dysfunction of the tissue and necrosis
7. Greater vulnerability to infection of the damaged tissue. Acidosis of the poly-traumatised patient
8. Protraction of all mechanisms in the presence of generalised hypoxia and acidosis of the poly-traumatised patient
What is it?
Thick layers of tissue called fascia separate groups of muscles in the leg from each other. Inside each layer of fascia is a confined space called a compartment that includes the muscles, nerves, and blood vessels (they are surrounded by the fascia much like wires surrounded by insulation). Significant swelling can follow trauma, such as a broken bone (fracture), and pressure can sometimes build up in the compartment. This may lead to a condition called ‘Acute Compartment Syndrome’.

Unlike a balloon fascia does not expand so any swelling in a compartment will lead to increasing pressure in that compartment, which will compress the muscles, blood vessels, and nerves. If the pressure lasts long enough, there can be permanent damage to these structures. In the worst case scenario, Acute Compartment Syndrome may even lead to the loss of a limb (amputation).

How do I recognise the symptoms?
The most important symptom of Acute Compartment Syndrome is severe pain. Typically, this pain will occur when a muscle running through a compartment is passively moved. For example, when a doctor moves the toes up and down a patient with compartment syndrome in the foot or leg will experience severe pain. In more advanced cases there may be decreased sensation, weakness, and paleness of the skin.

How is Acute Compartment Syndrome diagnosed?
A test that assists the doctors in diagnosing this condition involves measuring the pressure in the compartments by inserting a needle attached to a pressure meter into one of the compartments of your leg (continuous compartment pressure monitoring). The pressures within the compartment are measured and your blood pressure is taken every hour. The differences between your blood pressure and your compartment pressures are then compared to give a differential pressure. This should usually be more than 30. If your readings drop below this a doctor will be asked to come and review your condition and ask you about any symptoms you have been experiencing.

Treatment
The treatment for Acute Compartment Syndrome is to relieve the pressure. This may be as simple as releasing a tight dressing or plaster but often will require surgery (fasciotomy). Incisions are made in the skin of the leg to release the compartments and thus the pressure building inside. The wounds are generally left open (covered with a sterile dressing) and closed during a second surgical procedure 48-72 hours later. Sometimes skin grafts may be required to close the wounds.

Prevention
While there is probably no way to prevent Acute Compartment Syndrome you being very aware of this condition and receiving early diagnosis and treatment will help to prevent many of the complications. A nurse will observe the swelling in your leg, the colour and condition of the skin and will check the blood and nerve supply. You will be asked about any pain you may have and about the sensation in your leg and foot. Please tell the nurse if you experience any of the following:

- Extreme pain that is not helped by the pain relieving medications you are taking.
- Tingling sensation in the leg or foot.
• Loss of sensation (numbness) in the leg or foot.