Consensus of the 12th Round Table
Sheffield, June 2025

Preventing and Managing Complications

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OrthoSolutions Group

Advancing Foot & Ankle Care

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Course Facilitator:
Dishan Singh

Chairpersons:
Carolyn Chadwick
Robert Clayton
Rod Hammett
Karan Malhotra
Lyndon Mason
Timothy Williams

Hosted by:
OrthoSolutions Group

Distilled in this document are the thoughts and opinions, with consensus where possible, of 25 Orthopaedic Foot and Ankle Consultant Surgeons who gathered from across the United Kingdom, and Austria.
A basis of invited lectures introduced open and frank discussion from which consensus was sought. The statements herein only represent those of individuals and no claim is made that they are irrefutable.
All the percentage figures quoted represent the proportion of the surgeons present who voted on the subject in discussion.

Preface

You are a true surgeon from the moment you are able to deal with your complications.
Professor Owen H Wanjesteen

The 1st Round Table meeting was held in Padua, Italy in June 2011 and, thereafter, rapidly became a prominent highlight in the annual foot and ankle calendar. About 25 senior members of BOFAS and one or two invited international participants meet in a hotel setting for 3 days to discuss selected topics with ample time for an informal discussion. This Round Table approach is conducive to a more effective learning experience and generates considerable debate, but the group is able to reach a consensus on many issues.
The proceedings of the meeting, the literature review, the personal experience, the discussions and the consensus views of all those who participate are collated in this booklet with the thorough, skilful and diligent assistance of 2 scribes (Junaid Aamir and Ciaran Nolan).

The theme for the 2025 Round Table which was held in Sheffield, England was the rarely discussed topic of “Preventing and Managing Complications”.
Our distinguished local participants had the privilege of an international perspective from Hans-Jörg Trnka from Vienna, Austria.

Orthosolutions Ltd have kindly provided financial and administrative support to the meeting since its inception. I would like to express my gratitude to Emma Keech and Sheena Easton for their hard work in ensuring the smooth running of the course.

This booklet collates the literature review and the views of all those who participated. This booklet does not represent Level I evidence derived from prospective randomized controlled trials but represents the compilation of the combined experience of 25 British and international orthopaedic surgeons.

We have selected a short list of references to keep the booklet concise and easily readable.

I hope that you will find something of use and relevant to your own practice.

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Summary of Sessions

Session 1 General Issues
Chair: *Robert Clayton*

1.1	Definition and classification of complications	Mark Davies
1.2	Thromboprophylaxis	Robert Clayton
1.3	Diagnosis of DVT/PE	Jane Madeley
1.4	Managing a suspected nerve injury	Rick Brown
1.5	Complex regional pain syndrome	James Ritchie
	Consensus	

Session 2 Healing of Bone and Skin
Chair: *Tim Williams*

2.1	Measures to prevent delayed union/non-union	Roland Walker
2.2	How to approach a non-union	Tim Williams
2.3	Preventing and addressing delayed wound healing	Hari Prem
	Consensus	

Session 3 Hallux Valgus
Chair: *Carolyn Chadwick*

3.1	Recurrence of hallux valgus	Carolyn Chadwick
3.2	Hallux varus	Hans-Jörg Trnka
3.3	Transfer metatarsalgia	Nick Duncan
3.4	Non-union/mal-union first tarsometatarsal joint	Devendra Mahadevan
	Consensus	

Session 4 Hallux Rigidus/Lesser Toes
Chair: *Karan Malhotra*

4.1	Failed first MTPJ arthrodesis/arhroplasty	Karan Malhotra
4.2	The floating toe	Hans-Jörg Trnka
4.3	Non-union/malunion lesser metatarsals	Claire Topliss
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Session 5 Achilles Tendon
Chair: *Lyndon Mason*

5.1	Rerupture Achilles tendon	Jitendra Mangwani
5.2	Assessing the gap and psychology of Achilles rupture	Lyndon Mason
5.3	Wound dehiscence and infection after Achilles repair	Krishna Vemulapalli
	Consensus	

Session 6 Midfoot Hindfoot and Ankle
Chair: *Rod Hammett*

6.1	Failed flatfoot correction	Rod Hammett
6.2	Recurrence after pes cavus correction	Karan Malhotra
6.3	Ankle cysts after TAR	Andy Goldberg
6.4	Loose TAR, suspected loosening	Hisham Shalaby
	Consensus	

Session 1: General Issues

Chaired by Robert Clayton

1.1. Definition and Classification of Complications *Mark Davies*

Defining a complication is more complex than you might first think, and important to differentiate from sequelae of surgery.

In the literature it has been defined as, 'any undesirable and unexpected result of an operation affecting the patient that occurs as a direct result of the operation which would not have occurred had the operation gone as well as could reasonably be helped.'[1]

Complications will be dependent upon the level of surgical skill, difficulty of case and the facilities available. Paradoxically however, as our skills improve through surgical exposure, fellowship training and collaborative working, patient expectations also increase and therefore it is likely our complication rates may rise.

Classifications used for surgical complications:

- Clavien Classification system, which was originally produced in 1992 and updated later to include Dindo. The adaptation in 2004 added classifications noting organ dysfunction and ITU involvement because of the complication.
- This has been adopted by the WHO and is used to categorize surgical complications based on their severity and management.
- This system is widely adopted and helps standardize reporting and comparison of surgical outcomes.

Clavien - Dindo Classification of surgical complications.[2] (CDC)

Grade	Definition
I	Deviation from normal post-operative course without need for pharmacological treatment or surgical, radiological, or endoscopic intervention
II	Requiring pharmacological treatment, including transfusion or total parenteral nutrition
III	Requiring surgical, endoscopic, or radiological intervention
IIIa	Intervention not under general anesthesia
IIIb	Intervention under general anesthesia
IV	Life-threatening complication requiring management in intensive therapy unit
IVa	Single organ dysfunction
IVb	Multiorgan dysfunction
V	Death

Accordion Severity Classification of Post-operative Complications: Expanded Classification[3]

1. Mild complication:
   Requires only minor invasive procedures that can be done at the bedside such as insertion of intravenous lines, urinary catheters and nasogastic tubes, and drainage of wound infections. Physiotherapy and the following drugs are allowed-antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy.
2. Moderate complication:
   Requires pharmacologic treatment with drugs other than such allowed for minor complications, for instance antibiotics. Blood transfusions and total parenteral nutrition are also included.
3. Severe: invasive procedure without general anesthesia
   Requires management by an endoscopic, interventional procedure or re-operation* without general anesthesia.
4. Severe: operation under general anesthesia
   Requires management by an operation under general anesthesia.
5. Severe: organ system failure.†
6. Death:
   Post-operative death.

- Used more readily for small as well as large studies.
- Introduces standard definition of simple quantitative terms.
- Presents a standard tabular reporting system.

Comprehensive complication index (CCI)[4]

- A mathematical formula creating a sliding scale from 0 to 100 ranking severity of any combination of complications in an individual.
- Summarizes all complications.
- More sensitive than existing morbidity endpoints.
- Good for trials.
- Small study attempting to validate showed that the CCI reflected the complication status with a more detailed distribution compared with CDC[5].

* An example would be a wound reexploration under conscious sedation and/or local anesthetic.
† Such complications would normally be managed in an increased acuity setting but in some cases patients with complications of lower severity might also be admitted to an ICU.

Classification systems in relation to Foot and Ankle Surgery

The Clavien-Dindo Classification has recently been modified to greatly improve the reporting of complications in foot and ankle surgery.

The main modification of the classification system is to split the first 3 grades of complication into A/B with A an adverse event which does not affect overall outcome and B being a complication which does.[6]

Table 1
Clavien-dindo complication modified specifically for foot and ankle orthopaedic surgery.

Grade		Definition	Surgeon's opinion regarding risk of clinical impact	Potential additional therapeutic treatment	Examples of foot and ankle specific complications
Grade I	IA	Perioperative or post-operative adverse event with minimal clinical relevance that causes no deviation from routine follow-up during the post-operative period.	Likely negligible	Antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy	Intraoperative additional fixation required which does not change post-operative protocol (additional screw). Intraoperative broken or malpositioned hardware (screw, wire, anchor) left in situ or requiring intraoperative retrieval.
	IB	Perioperative or post-operative adverse event with minimal clinical relevance that causes minor deviation from routine follow-up during the post-operative period.	Likely minimal	Pharmacological treatment with drugs other than such allowed for grade IA compications	Post-operative wound dehiscence <u>not</u> requiring antibiotics. Intraoperative additional fixation required which changes post-operative protocol (transcutaneous wire required when initial plan was for internal fixation only).
Grade II	IIA	Complication that is treatable without additional surgical intervention and is likely to lead to a final outcome similar to surgery without complication.	Likely minimal	Analgesia, antibiotics, and physiotherapy, unplanned blood transfusion, orthotics, steroid injection	Post-operative wound dehiscence or cellulitis requiring antibiotics. Minor residual/recurrent deformity (minor persistent valgus following hindfoot fusion for stiff pes planus or minor residual hallux valgus following correction) which requires only simple shoewear choice modification. Transient neuropraxia which settles and does not require long term neuroleptic medication. Delayed union/asymptomatic non-union/malunion. Stiffness which settles with time, physiotherapy or steroid injection.
	IIB	Complication that is treatable without additional surgical intervention but is unlikely to lead to a final outcome similar to surgery without complication.	Likely significant	Analgesia, antibiotics, and physiotherapy, unplanned blood transfusion, orthotics, steroid injection	Transfer metatarsalgia. Moderate/severe residual/recurrent deformity requiring ongoing orthoses or lifelong podiatric support. Transient neuropraxia which causes ongoing pain and symptoms and requires ongoing neuroleptic medication. Symptomatic non-union/malunion.

Grade III	IIIA	Complication that is treatable and requires surgical intervention or an unplanned hospital admission and is likely to lead to a similar outcome to surgery without complication.	Likely minimal	Requiring surgical, endoscopic or radiological intervention	Removal of prominent hardware with otherwise successful arthrodesis/union. Small tendon release for residual single lesser toe deformity following complex forefoot reconstruction. Scar revision for prominent scar.
	IIIB	Complication that is treatable and requires surgical intervention (s) or an unplanned hospital admission and is unlikely to lead to a similar outcome to surgery without complication.	Likely significant	Requiring surgical, endoscopic or radiological intervention	Deep infection requiring removal of hardware. Periprosthetic fracture. Non-union requiring revision surgery.
Grade IV	IV	Life-threatening complication (including CNS complications) requiring ICU management. Single-organ dysfunction (IV A). Multi-organ dysfunction (IV B).	Serious		Pulmonary Embolism. Myocardial Infarction. Stroke.
Grade V	V	Death			

Summary

- Clavien-Dindo is the simplest classification system, easy to understand for all healthcare professionals.
- The Comprehensive Complication Index is more complex. Best as a research tool for large studies. Relates individual's complications to outcome.

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1.2. Thromboprophylaxis

Robert Clayton

Early NICE Guidelines - 2007

- 25,000 preventable deaths per annum in UK from VTE.
- Meta-analysis showed OR 0.99 (0.78-1.24) for drug prophylaxis reducing mortality.
- The true rate of VTE is hard to ascertain.

Data on symptomatic venous thromboembolism events and mortality within 90 days, over a period of 42 months was reviewed and published.[1]

	DVT incidence (90 days)	**PE incidence (90 days)**	**All-Cause Mortality (90 days)**
HV correction	0.01%	0.02%	0.04%
Hindfoot fusions	0.03%	0.11%	0.11%
Ankle fracture surgery	0.12%	0.17%	0.37%
Ankle replacement	0	0.06%	0

NICE Guidelines 2019

Foot and ankle orthopaedic surgery

1.11.14 Consider pharmacological VTE prophylaxis for people undergoing foot and ankle surgery:

- That requires immobilisation (for example, arthrodesis or arthroplasty): consider stopping prophylaxis if immobilisation continues beyond 42 days (see the recommendation on lower limb immobilisation) **or**
- When total anaesthesia time is more than 90 minutes **or**
- The person's risk of VTE outweighs their risk of bleeding. **(2018)**

Risk of VTE in Achilles Injury:

- Higher risk of both PE and DVT when compared to above procedures.[2,3]
- Highlighted in UK FATE Study - patients 6.5-times more likely to experience symptomatic VTE than those recovering from surgery for other foot and ankle pathology.[4]
- Patients developing symptomatic VTE after Achilles injuries were significantly older than those who did not.[4]

UK FATE Study[5]

- 13569 UK patients from 68 sites Total 99 VTE (0.87%).
- 36 lower leg only VTE.
- Mortality 0.03%.
- 3.7% risk in Achilles rupture.
- All elective foot cases below 1% risk.

Variations in practice in the UK:

FATE study showed[6];

- 11 different chemical anticoagulation treatments recorded.
- The most common chemical anticoagulation prescribed was low molecular weight heparin (LMWH) - 84.4% of patients receiving chemical anticoagulation (6303/7469).
- Aspirin was given in 4.1% (308 patients).
- A Factor Xa inhibitor in 10% (744 patients).
- Other anticoagulants (e.g. Warfarin) in 1.5% (114 patients).
- The duration of Post-operative chemical prophylaxis used by participants for most anticoagulants was 6 weeks (64.50%).

Drug	Type	Licensed for Foot/Ankle Surgery (UK)	Notes
Dalteparin	LMWH	✓ Yes	Widely used
Enoxaparin	LMWH	✓ Yes	Most common
Rivaroxaban	DOAC	× No (Hip/Knee only)	Off-label if used
Aspirin	Antiplatelet	× No	Sometimes used off-label

BOFAS Position statement on Venous Thromboembolism (VTE) - 2025

- All patients with foot and ankle injuries requiring immobilisation (with cast/splint/boot) and patients undergoing foot and ankle surgery should be individually risk assessed for risk of venous thromboembolism (VTE).
- If sufficient risk factors are present, VTE prophylaxis through mechanical and/or chemical interventions should be considered and weighed against the potential risks of the prophylaxis.
- It appears that ROUTINE use of chemical thromboprophylaxis is not beneficial for low-risk patients with foot and ankle injuries or those undergoing foot and ankle surgery.
- Achilles ruptures are also associated with increased VTE risk, irrespective of non-operative or operative treatment methods.
- A multimodal approach to VTE prophylaxis should be adopted for patients at increased risk of a thromboembolic event. This includes addressing any modifiable risk factors, minimising immobilisation and encouraging early weight bearing where possible.
- The specific type of chemical thromboprophylaxis used should be in accordance with local hospital protocols, and the duration of prophylaxis is currently undefined.

Summary

- **Foot and Ankle Procedures have a low VTE risk:** Bunion surgery, hindfoot fusion, and ankle fracture surgeries have a low incidence of symptomatic VTE.
- **Achilles Tendon Ruptures have a higher risk:** Whether treated operatively or non-operatively, these cases require closer consideration for prophylaxis.
- **Risk Stratification Is now standard:** Current practice encourages individualized risk assessment rather than blanket prophylaxis.
- **LMWH Remains Standard but not perfect:** Still widely used due to licensing restrictions, but compliance and effectiveness are unclear.
- **Aspirin Gaining Ground:** Emerging evidence suggests aspirin may be effective for selected patients, though not yet fully endorsed in foot and ankle guidelines.

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1.3. Diagnosis of DVT/PE

Jane Madeley

Overview & Epidemiology

- VTE includes Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE).
- Incidence 1-2 VTE per 1000 adults per year worldwide.
- Relatively low global incidence but carries significant morbidity and mortality.
- Most symptomatic DVTs are proximal, while calf DVTs often resolve spontaneously but can propagate proximally.
- VTEs arise due to Virchow's Triad of hypercoagulability, stasis of blood flow and endothelial injury.

Surgical Risk

- High-risk surgeries (e.g., total hip replacements) increase VTE risk 10-20x baseline, with overall 2-3% VTE rate.[1]
- Majority of VTE events occur post-discharge, between discharge and 90 days post-op.
- Achilles tendon injuries, diabetic patients, and trauma patients are at higher risk due to compromised calf muscle pump.

Risk Assessment Tools

- Wells Score for DVT:
  - Score ≥2: likely DVT → ultrasound
  - Score <2: unlikely → check D-dimer
  - D-dimer (+) → ultrasound; (–) → rule out DVT
- Wells Score for PE:
  - Uses criteria like HR >100, hemoptysis, recent surgery, malignancy, immobilization
  - Score >4 → likely PE
  - Score ≤4 → combine with D-dimer

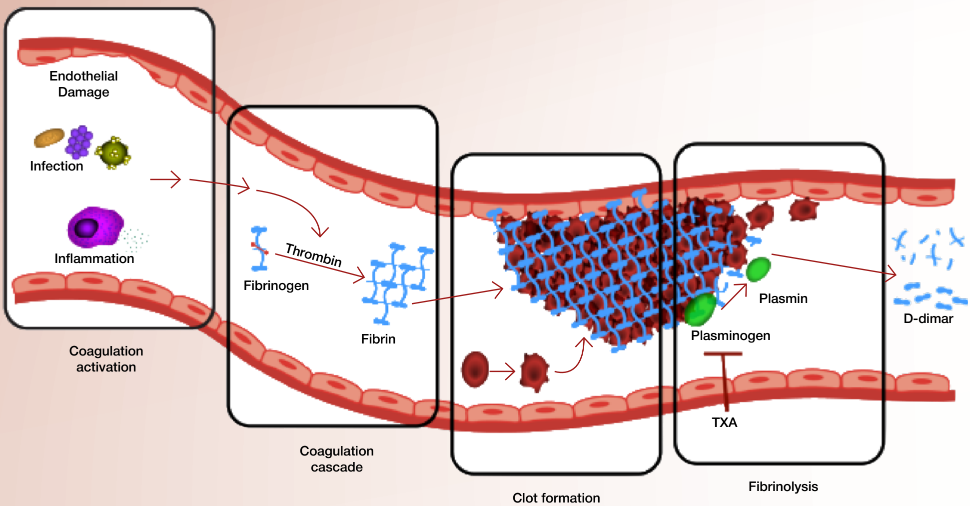
Clinical feature	Points
Active cancer (treatment ongoing, withhin 6 months, or palliative)	1
Paralysis, paresis or recent plaster immobilisation of the lower extremities	1
Recently bedridden for 3 days or more, or major surgery within 12 weeks requiring general or regional anaesthesia	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than asymptomatic side	1
Pitting oedema confined to the sympomatic leg	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternative diagnosis is at least as likely as DVT	-2
Clinical probability simplified score	**Points**
DVT likely	2 points or more
DVT unlikely	1 point or less

Two-Level DVT Wells Score adapted from work by Wells.[3]

Diagnostic Tools

- D-dimer:
  - High sensitivity (97%), low specificity (41%)[4]
  - Levels increase post-surgery, in hospitalizations → interpret with caution
  - Threshold often 500 ng/mL, but varies between labs
- Ultrasound (Doppler):
  - First-line for DVT
  - Proximal scanning sufficient unless symptoms suggest otherwise
  - Non-invasive, no radiation
  - Sensitivity - 96%/Specificity 98%
- CT Pulmonary Angiography (CTPA):
  - Gold standard for PE
  - May miss small peripheral clots
  - Contrast required
  - 96-98% specificity

- V/Q Scan:
  - Alternative if CTPA contraindicated
  - Looks for perfusion-ventilation mismatch



D-Dimer a protein fragment produced by the breakdown of vascular thrombi by fibrinolysis.[5]

NICE Guidelines (Diagnosis & Management)

- DVT Pathway:
  - Assess risk with Wells → D-dimer → ultrasound (within 4 hours ideally).
  - If scan delayed: start interim anticoagulation.
  - Repeat ultrasound at 6-8 days if initial scan negative but D-dimer positive.
- PE Pathway:
  - Similar: Wells score + D-dimer + CTPA.
  - If PE unlikely & D-dimer negative → rule out PE.
- For people with unprovoked DVT or PE who are not known to have cancer, review the medical history and baseline blood test results and offer a physical examination.[6]

Asymptomatic Screening

- Not routinely recommended in orthopaedic or general surgery patients.
- Evidence for screening exists in oncology and critical care due to higher baseline risk.
- Routine screening risks overdiagnosis of clinically insignificant DVTs.

Investigations in Special Populations

- Post-op D-dimer rises naturally → false positives.
- AI and future biomarkers (e.g., specific fibrin-related proteins) may improve specificity of diagnosis.
- AI could also assist in automated CT reading and clinical risk stratification.

Summary

- Most VTE events happen post-discharge: patients and GPs need proper education on symptoms and when to seek help.
- Calf DVTs usually resolve but can propagate → follow-up scans may be needed.
- Clinical signs alone are unreliable → use validated tools (Wells, D-dimer).
- Current diagnostic pathways are effective, but future tools (AI, better biomarkers) could improve care and reduce over-investigation.

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1.4. Nerve injury

Rick Brown

Which Nerves are at Risk?

Almost all nerves in the lower limb can be affected, but the most commonly injured include:

- **Superficial peroneal nerve -** lateral approach to fibula, anterolateral portal anterior ankle arthroscopy.
- **Sural nerve -** posterolateral approach to ankle, Achilles repair, lateral approach to hindfoot, posterior arthroscopy portals.
- **Saphenous nerve -** medial ankle approach/ORIF, ankle fusion screws, anteromedial ankle arthroscopy portal.
- **Tibial nerve -** Tibial cut in TAR, posterior ankle arthroscopy.
- **Medial dorsal cutaneous nerve -** hallux valgus surgery.
- **Sciatic nerve** (especially proximal injuries from tourniquets or double-crush syndrome with lumbar pathology).

Causes of Nerve Injury

Nerve injuries can occur **before, during, or after surgery.**
Common causes include:

<u>External Factors:</u>

- Tight casts or dressings
- Nerve blocks (e.g., popliteal)
- Patient positioning
- Tourniquet use - see BOAST guideline on Tourniquet use.

<u>Intraoperative Causes:</u>

- Direct trauma during surgery (e.g., posterior ankle arthroscopy)
- Misplaced hardware or screws
- MIS
- Thermal injury
- Inadequate anatomical knowledge

Standards

1. Tourniquets should only be used when clinically justified.

2. Details of the type of tourniquet should be recorded.
    a. Only tourniquets approved by regulatory bodies should be used.
    b. Tourniquet width should be more than half the limb diameter or contoured for patients with conical limbs.
    c. Finger or toe tourniquets should be highly visible or applied using instruments included in the surgical instrument count so that they cannot be inadvertently retained.

3. The following details should be recorded in the operative record:
    a. The condition of the tourniquet site prior to and at the end of the procedure.
    b. The method of isolation used to exclude skin preparation fluids from seeping under the tourniquet.
    c. The method of exsanguination:
        i. Compressive exsanguination should not be used in the presence of infection, history of malignancy or risk of DVT.

    d. The pressure and duration of tourniquet use:
        i. A limb tourniquet with a timer alarm should be used.
        ii. If a pneumatic tourniquet is utilised, a pressure gauge must be used.
        iii. Tourniquets should be applied over a thin, even layer of padding.
        iv. Patients <16 years should have a tourniquet pressure of limb occlusion pressure plus 50 mmHg[i] or systolic blood pressure plus 50 - 100 mmHg.
        v. Patients >16 years should have a tourniquet pressure of systolic blood pressure plus 70 - 130 mmHg for the lower limb and 50 - 100 mmHg for the upper limb.[ii][iii]
        vi. The ischaemic tourniquet time should ideally be less than 120[iv] minutes and only extended beyond this after a clinical assessment of the relative risks and benefits, by the operating surgeon. Audible reminders must be given to the operating surgeon every 10 minutes beyond 120 minutes, and tourniquet use beyond 150 minutes is rarely justified.

4. If a tourniquet related burn is suspected in the operating theatre, the following steps must be taken at the conclusion of the procedure:
    a. Detailed documentation of the site and dimension of the injury.
    b. Documentation of skin preparation fluid including duration of contact.
    c. Digital photography, uploaded to the patient record.
    d. Discussion with a plastic surgical and/or tissue viability team.

5. If a tourniquet related burn is confirmed, an ongoing management plan should be documented. This must include shared decision making with a plastic surgical and/or tissue viability team.
6. If tourniquet related ischaemia and/or nerve damage are suspected refer to the condition specific BOAST.

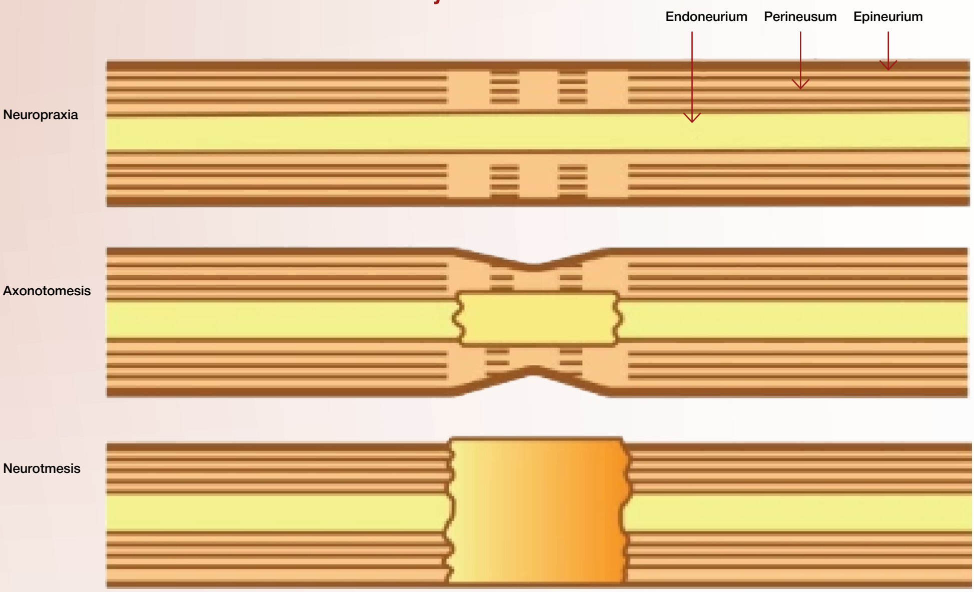
BOAST Guideline on tourniquet use.

Nerve Injury Classifications (Seddon):

- **Neuropraxia -** transient, good recovery
- **Axonotmesis -** damage to axons, possible recovery
- **Neurotmesis -** full transection, requires repair

Note: Nerve conduction studies have to be interpreted carefully for the first **4 weeks** post-injury (Wallerian degeneration).

Seddon's Classification of Nerve Injuries



Type of Injury	Description	Pathology	Recovery Potential
Neuropraxia	Temporary conduction block without axonal disruption	Localized myelin damage; axon and connective tissue intact	**Full recovery** in days to weeks
Axonotmesis	Axonal disruption with intact connective tissue (endoneurium, perineurium, etc.)	Wallerian degeneration distal to injury	**Good recovery**, but takes weeks to months
Neurotmesis	Complete severance of the nerve and surrounding connective tissue	Axon and connective tissue destroyed	**Poor recovery** without surgical intervention

Consent and Pre-operative Considerations

- **Always consent** for potential nerve injury, even in “simple” procedures (e.g., anterior ankle arthroscopy).
- Pre-operative **neurovascular exam and documentation** is essential, especially in trauma.
- Plan your incisions and approaches carefully.
- Patients must be aware of potential symptoms and red flags.

Prevention During Surgery

- Know your anatomy.
- Use careful dissection and proper retraction.
- Avoid excessive pressure (e.g., tourniquet time, retraction).
- Use ultrasound where helpful.
- Avoid hardware positioning near nerve paths.

Detection of Nerve Injury

Post-op assessment should include:

- **10g monofilament testing.**
- **Two-point discrimination.**
- **Local anaesthetic nerve block** (to identify neuroma-related pain).
- **Ultrasound** - preferred for superficial nerves.
- **MRI** - useful for deeper nerves or complex scarring.
- **X-ray** to assess screw or implant position.
- **Nerve conduction studies** - done after 4 weeks.

Management and Treatment Options

Immediate (Intraoperative or Early Post-op):

- **Primary repair** (epineural suturing) if nerve is clearly transected.
- Re-operate if hardware is impinging on a nerve.

Medical Management (for pain):

- **Gabapentin** - requires several weeks (up to 5) to be effective.
- **Other neuropathic pain agents** as appropriate.

Surgical Options for Neuroma or Delayed Injury:

A. <u>Neuroma Management:</u>
- **Neurectomy** - most commmonly performed operation. High risk of persistent pain.[1]
- **Scar excision and direct repair.**
- **Interposition nerve graft** (e.g., sural or saphenous nerve).
- **Implanting nerve end into:**
  - Muscle (83% good results in saphenous neuroma series).[2]
  - Bone (75% pain relief into bone).[3]
  - Vein (novel technique, ~56% pain relief).[4]

B. <u>Grafting:</u>
- If a gap remains, options include:
  - **Autograft** (sural/saphenous).
  - **Conduits** (less successful - 10 - 15mm nerve gaps.
  - **Vein grafts** (cheap and effective).

C. Emerging Techniques

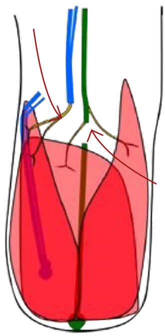
RPNI (Regenerative Peripheral Nerve Interface):

- Wrap a de-innervated muscle graft around the cut nerve end.
- Reduces neuroma formation and pain.[5]

Muscle Wrap

TMR (Targeted Muscle Reinnervation):

- Cut above neuroma and leave it in tact.
- Redirect the proximal nerve to a functioning motor unit.
- Good outcomes in amputees and traumatic injuries.[5]
- Reduces pain and analgesic requirements.
- Some patients develop "uncovered" pain from other nearby nerves.



Summary

- **Appropriate Consent** about nerve risks and pre-operative **neurology exam and documentation are essential.**
- Surgical planning and being aware of at risk structures minimise risks.
- Nerve studies can be arranged after 4 weeks where nerve injury is being considered.
- **Primary repair is** best if early.
- **New methods:** RPNI, TMR - promising outcomes.

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1.5. Complex Regional Pain Syndrome *James Ritchie*

Definition

- **Complex Regional Pain Syndrome (CRPS)** is a **syndrome**, meaning a collection of symptoms without a fully defined pathology.
- It is **complex** because it is not well understood.
- It's **regional**, not confined to a specific nerve distribution.
- The **"P" stands for pain** - a disproportionate, persistent pain in response to stimuli.

Symptoms:

- Pain
- Hyperaesthesia (extreme sensitivity to touch).
- Mottled skin (red and pale patches), shiny/glossy appearance.
- Avoidance of air or touch.
- Tissue shrinkage and dryness.

Types:

- **Type 1 (RSD):** No confirmed nerve injury.
- **Type 2 (Causalgia):** Definite nerve injury.

Terminology Clarified

- **RSD (Reflex Sympathetic Dystrophy):** Old term for CRPS Type 1.
- **Causalgia:** Greek for "heat pain"; used for Type 2 CRPS.
- **Sudeck's Atrophy:** X-ray finding of patchy osteopenia, often after wrist fractures.
- **Allodynia:** Pain from non-painful stimuli.
- **Neuropathic pain:** From direct nerve injury (CRPS Type 2).
- **Neurogenic pain:** From nervous system dysfunction.

Where and When CRPS Occurs

- Most commonly in **hands/wrists (67%)** or **feet/ankles (22.6%).**
- Rare in the **trunk, arms,** or **thighs.**[1]

Incidence:

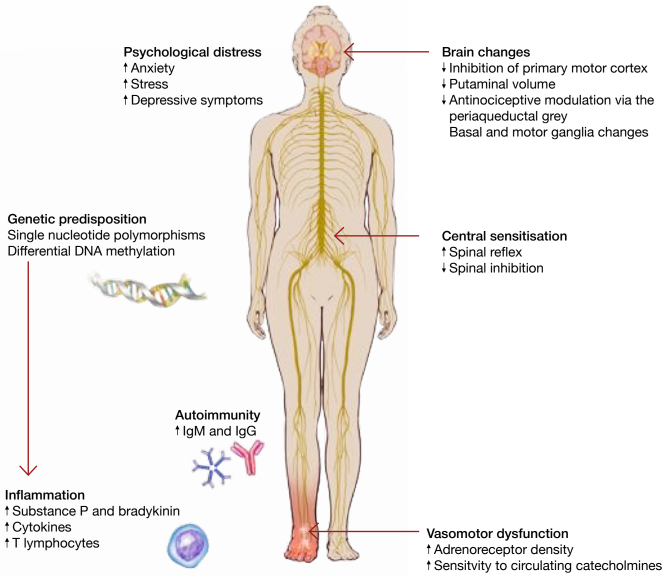
- Occurs in **4-7%** of fractures (especially hand/wrist).[2]
- **4.36%** in elective foot and ankle surgery.[3]

Risk Factors & Triggers

- **Triggers:** Injury, surgery, crush trauma, prolonged immobilization.
- **Medical Risks:** Diabetes, asthma, ACE inhibitors.
- **Demographics:** Middle-aged or older adults, more common in females (2-4:1).
- **Psychosocial:** Anxiety, depression, substance abuse.
- **Reperfusion injury** and **spontaneous onset** are also documented.
- **Previous CRPS/Chronic pain.**

Pathophysiology: Still Unclear

- No single cause identified.
- Early high pain scores predict future CRPS.
- Involves **central sensitization** (dysfunctional nerve signalling in the spinal cord and brain).
- Brain imaging shows reduced representation of the affected limb.



Diagnosis

Main Criteria:

- **IASP Valencia Consensus (2021) on Budapest Criteria (2012)**
  - Must have **3 of 4** symptom categories (e.g., temperature asymmetry, oedema, motor/sensory signs).

New IASP diagnostic criteria for complex regional pain syndrome ("Budapest criteria"[2]) (A-D must apply).			
A. The patient has continuing pain which is disproportionate to any inciting event ☐ B. The patient reports at least one symptom in 3 or more of the categories ☐ C. The patient displays at least one sign in 2 or more of the categories ☐ D. No other diagnosis can better explain the signs and symptoms ☐			
Category		**Symptoms (the patient reports a problem)**	**Sign (you can see or feel a problem on examination)**
1 "Sensory"	*Allodynia* (to light touch/ brush stroke and/or temperature sensation and/ or deep somatic pressure and/or joint movement), and/or hyperalgesia (to pinprick)	Reported hyperesthesia also qualifies as a symptom ☐	☐
2 "Vasomotor"	Temperature asymmetry and/or skin colour changes and/or skin colour asymmetry	☐	☐
3 "Subomotor/ oedema"	Oedema and/or sweating changes and/or sweating asymmetry	☐	☐
4 "Motor/ trophic"	Descresed range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair/nail/skin)	☐	☐

New IASP diagnostic criteria[4]

No definitive tests, but the following may **support diagnosis:**

- **Bone scintigraphy:** May show increased uptake.
- **Infrared thermography:** Shows temperature differences.
  - Both have **<93% specificity**, but only **50-60% sensitivity.**

Treatment Evidence Review

Treatment	Effectiveness
NSAIDs	No better than placebo
Opioids	No significant benefit
Corticosteroids	No long-term benefit
Gabapentin	One study shows mild benefit[5]
Pregabalin	Evidence only in neuropathic pain, not CRPS
Bisphosphonates	Improved VAS scores with IV neridronate compared to control.[6]
Tadalafil	Mild short-term pain relief, no strength/temperature benefit
Guanethidine Blocks Spinal cord Stimulators	Once popular, now shown to increase pain - **avoid** Improvement in pain, no functional improvement. High complication rate.[7]
Rehabilitation	Encouraged: graded motor imagery, mirror therapy
Psychotherapy	No proven effect, but can help emotionally
Performance Art/Dance	Not evidence-based

Management Approach

Core Pillars:

1. Education
2. Pain Relief
3. Physiotherapy
4. Psychological Support

Primary Goal:

- Achieve diagnosis

First-line:

- Paracetamol, NSAIDs, codeine
- Gentle movement, loading, desensitization
- Reassurance and early referral to pain services

If Unresolved by 4 Weeks:

- Multimodal CRPS rehab
- Neuropathic medication
- IV Bisphosphonates (if <6 months)
- Neuromodulation (>18 months)

Caveat: Most treatments lack high-quality evidence - current guidelines are based on expert opinion.

Prevention

Vitamin C:

- 1g/day for 40 days post-injury/surgery has shown reduced CRPS incidence.
- Prospective RCT 329 F&A patients.
- High risk patients excluded.[8]

Prognosis

- **Majority of acute cases improve** within **6 months.** Despite this only 5.4% were symptom free at 12 months.[9]
- **20% still symptomatic** at 1 year.
- **Long-term disability** possible if symptoms persist >1 year.[10]
- **40% do not return** to previous work, even with pain improvement.[11]

Recurrence and Reoperation

- Risk of recurrence **higher if symptoms still present** before revision surgery.
- Use of **regional block** may reduce recurrence risk.
- General advice:
  - Wait **>1 year symptom-free**
  - Avoid **tourniquet**
  - Use **pain-trained anaesthetist**
  - Give **vitamin C**
  - Provide **clear counselling** on recurrence risk

Summary

- **CRPS = Regional, disproportionate pain syndrome** with unclear pathology.
- **Burning pain, hypersensitivity, and autonomic changes** are hallmark signs.
- **Diagnosis** is clinical; Budapest criteria is gold standard.
- **No single treatment is definitively effective** - focus on function and support.
- **Vitamin C** may help **prevent CRPS** in some cases.
- **Avoid re-operation** unless necessary and only after complete symptom resolution. High risk of recurrence otherwise.
- **Long-term disability and recurrence** are real risks - **clear patient counselling is essential.**
- **Refer to pain teams early,** involve MDT, and support patient through rehabilitation and education.

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Consensus Questions

1. Do you routinely consent for death in trauma and elective Foot and Ankle surgery?

a. Always	2/16 (12.5%)
b. Most of the time	2/16 (12.5%)
c. Some of the time	1/16 (6.3%)
d. Rarely	8/16 (50%)
e. Never	3/16 (18.7%)

2. Do you routinely consent for amputation in trauma and elective Foot and Ankle surgery?

a. Always	2/16 (12.5%)
b. Most of the time	2/16 (12.5%)
c. Some of the time	5/16 (31.3%)
d. Rarely	7/16 (43.7%)
e. Never	0/16

3. Do you routinely consent for metalwork removal in trauma and elective Foot and Ankle surgery?

a. Always	10 (62.5%)
b. Most of the time	4 (25%)
c. Some of the time	2 (12.5%)
d. Rarely	0
e. Never	0

4. Do you routinely consent for CRPS in trauma and elective Foot and Ankle Surgery?

a. Always	9 (56.3%)
b. Most of the time	2 (12.5%)
c. Some of the time	5 (31.2%)
d. Rarely	0
e. Never	0

5. Is there a need for a specific/BOFAS F&A complication classification system?

a. Yes	16 (100%)
b. No	0

6. Clinical cases
   All scenarios are based on a patient with a BMI of 25, aged 45 with no past medical history of VTE or DVT with no contraindications to medication.

   A) In the case of an ankle fracture that could be managed in a walking boot and the patient was allowed to full weight-bear, would you prescribe chemical thromboprophylaxis?

Yes	5 (31.3%)
No	11 (68.7%)

   B) If the same patient was managed conservatively, but was non-weight bearing in plaster, would you give chemical thromboprophylaxis?

Yes	15 (93.8%)
No	1 (6.2%)

   C) If the same patient required surgical fixation and was allowed to fully-weight bear post-operatively in an aircast boot, would you give chemical thromboprophylaxis?

Yes	14 (87.5%)
No	2 (12.5%)

   D) If the same patient required surgical fixation and was non-weight bearing post-operatively, would you give chemical thromboprophylaxis?

Yes	16 (100%)
No	0

7. In your current hospitals - Is Aspirin considered as adequate prophylaxis for moderate/low risk patients?

Yes	3 (18.8%)
No	13 (81.2%)

8. Under ideal circumstances - do you consider Aspirin as adequate prophylaxis for moderate/low risk patients?

Yes	12 (75%)
No	4 (25%)

9. In your current hospitals - Is Rivaroxaban considered adequate prophylaxis for moderate/low risk patients?

Yes	16 (100%)
No	0

10. Forefoot deformity correction - Do you advise your patients to stop HRT or COCP - any Oral oestrogen containing contraceptive prior to surgery?

Yes	5 (31.3%)
No	11 (68.7%)

11. TTC Fusion - Do you advise your patients to stop HRT or COCP - any Oral oestrogen containing contraceptive prior to surgery?

Yes	13 (81.3%)
No	3 (18.7%)

12. Is there a role for D-Dimer post-operatively for detection in DVT?

Yes	11 (68.7%)
No	5 (31.3%)

13. Scan detected symptomatic calf (Below popliteal vein) DVT - Should it be treated?

Yes	14 (87.5%)
No	2 (12.5%)

14. Would you give Tranexamic Acid prior to trauma or elective Foot and Ankle Surgery?

Yes	16 (100%)
No	0

15. If you have established neurogenic pain with a known cause/driver (non-union etc) for symptoms - Would you attempt to treat the driver?

Yes	12 (75%)
No	4 (25%)

16. For routine elective surgery - do you have access to a regional block anesthesia?

Always	8 (50%)
Most of the time	7 (43.8%)
Rarely	1 (6.2%)

17. How many perform elective foot surgery without a tourniquet (arthroscopy excluded)?

No Tourniquet	3 (18.8%)
Yes Tourniquet	13 (81.2%)

Session 2: Healing of Bone and Skin

Chaired by Tim Williams

2.1. Measures to prevent delayed union/Non-union *Roland Walker*

Introduction and Initial Thoughts

- In the context of foot and ankle surgery, delayed union and non-union are topics which cause large amounts of grief for surgeons.
- Factors which affect delayed and non-union can be broken down into the pre-operative and patient factors, technical factors intraoperatively and then some post-operative factors.
- Currently, there is limited evidence around all the above factors relating to foot and ankle surgery, as such, surrounding evidence relating to lower limb surgery will also be presented.

Pre-operative Factors

<u>Smoking</u>

- Smoking impairs bone healing through vasoconstriction (nicotine), reduced oxygen delivery (carbon monoxide), and mitochondrial dysfunction (hydrogen cyanide).
- These factors reduce neovascularisation, inhibit osteoblastic activity and impair fracture callus formation.[1]
- Smoking increases time to union by ~1 month and doubles the risk of non-union.[2]
- Cessation ≥4 weeks before surgery halves the risk of wound complications.[1]

<u>Alcohol</u>

- Alcohol is associated with delayed union (~12 weeks longer) and 1.7× higher infection risk.[1]
- No statistically significant link to non-union, likely due to small sample sizes.[1]

<u>Diabetes</u>

- Chronic hyperglycemia causes oxidative stress, poor callus quality, and impaired angiogenesis.
- The subsequent poor callus leads to weaker mechanical structure of bone.
- Peripheral neuropathy and HbA1c >7% are strong predictors of impaired healing.[3]
- Doubles risk of non-union, especially in lower extremities and short bones (e.g., foot).[4]

Obesity

- Obesity Increases systemic inflammation through pro-inflammatory adipokines and additional mechanical stress on fixation constructs.[5]
- Poor patient adherence and increased risk of complications (though limited statistical backing for non-union specifically in foot and ankle).

Nutrition & Vitamin D

- Deficiencies in vitamin D, calcium, iron, albumin, and overall malnutrition are linked to increased non-union risk.[6]
- Vitamin D is essential for calcium absorption and osteoblast function.
- Supplementation:
  - **Maintenance:** 600-800 IU/day.
  - **Treatment of deficiency/stress fractures:** 2,000-4,000 IU/day.
  - **Severe deficiency:** Up to 10,000 IU/day until levels normalise.
- Within foot and ankle surgery - low vitamin D has been associated with non-union. Although evidence is still limited in this area of surgery.[7]

Pre-Rehabilitation (Prehab)

- Moderate evidence in joint arthroplasty (e.g., TKR) for improved function at 6 weeks.[8]
- No strong evidence for non-union prevention in foot and ankle surgery, though may reduce hospital stay.

Intraoperative Factors

Limiting Tourniquet Times

- No direct evidence linking tourniquet duration to non-union.[9]
- Still advisable to minimise use to reduce other complications.
- Trending topic within knee surgery in limited tourniquet use to facilitate faster recovery and reduce complications.

Surgical Approach

- No significant difference in union rates among anterior, anteromedial, and trans-fibular approaches in ankle fusion.[10]
- Arthroscopic fusion yields similar union rates to open procedures but with fewer complications and shorter hospital stay.[11]

Joint Preparation

- Mechanical reamers (cup/cone) associated with lowest non-union rates in some studies.[12]
- Bone heated >50°C becomes non-viable irrigation is essential when using power tools.[13]

Bone Graft

- **Primary fusions:** No benefit from routine autografting.[14]
- **Revisions/non-unions:** Autograft (especially iliac crest) is superior to allograft or BMP. Resulting in faster union and lower risk of non-union.[15]

Biologics

- **Protein Rich Plasma (PRP):** Lab and animal models show benefit; clinical results are mixed and inconclusive in foot and ankle.
- **Bone Marrow Aspirate Concentrate (BMAC):** Promising results when harvested from anterior iliac crest, better results than PRP; improves union rates especially when combined with Beta-Tricalcium Phosphate (β-TCP).[16]
- **Inorganic Fillers (e.g., bioactive glass, calcium phosphate):** No reliable clinical data supporting effectiveness.
- **Bone Morphogenic Proteins (BMPs):** Effective in spinal and open tibial fracture surgery, limited foot/ankle data.[17]

Fixation Construct

- Compression (lag screws) plus neutralisation (plate/staple) favoured.
- Headless vs headed screws - no significant difference in union.
- Tight-fitting hindfoot nail with miss-a-nail compression screws ideal for diabetic reconstructions.[18]

Post-operative Factors that Prevent Non-union

NSAID Use

- Associated with increased non-union risk (OR ~3.47).[19]
- Short courses (<2 weeks) may not significantly impact union.
- Safer to avoid altogether due to risk of prolonged or misinterpreted use.

Splinting and Immobilisation

- Early use of boots improves mid-term function and reduces healthcare burden.
- **Boot vs cast:** No difference in union if patient is neurologically intact.[20]
- **Wound risk:** Slightly higher with boots, especially in warm weather-ensure wounds are healed before use.[21]

Weight Bearing Status

- Early weight bearing (1-2 weeks) is safe in non-neuropathic patients.
- No difference in union time or complications compared to prolonged non-weight bearing.[22]

Mobility Aids

- Hands-free crutches (e.g., iWALK) preferred by patients, reduce fatigue and cardiovascular strain.[23]
- No evidence they directly reduce non-union but may improve compliance and protect healing limbs.

LIPUS (Low Intensity Pulsed Ultrasound)

- No RCTs supporting use in foot and ankle surgery.
- Animal studies suggest benefit, but clinical utility remains unproven.
- Use should be selective, not routine.

Summary

- Smoking, alcohol intake and nutrition are key factors for the patient to address.
- There is limited evidence on biologic use in foot and ankle surgery.
- Avoid non-steroidal anti-inflammatory drugs.
- Boots are safe to use once the wound has healed.
- Early weightbearing is promoted in the neurologically intact patient.

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2.2. How to Approach a Non-union

Tim Williams

Introduction and Initial Thoughts

- Non-union is a multifactorial process.
- Although adequate fixation may be achieved intraoperatively, non-union is a problem within foot and ankle surgery.
- **There is an accepted rate of non-union within foot and ankle surgery.**
- As such, this topic is designed to provide practical advice breaking down all the factors contributing to non-union and how to address them.

Optimising Patient Factors

Infection

- Have high level of suspicion of infection in any non-union.
- Standard approach: two-stage procedure with biopsy, debridement, antibiotic spacer, and delayed fixation with bone graft.
- Use enriched broth culture, extended sensitivities, PCR testing, and histology for accurate diagnosis.
- Single-stage procedures with local antibiotic cements (e.g., Cerament) are possible but less reliable.[1]

Smoking

- Strongly associated with non-union.[2]
- Complete cessation before and after surgery is recommended.

Alcohol

- Direct toxic effects on bone healing.[3]
- Indirect effects through poor nutrition.[3]
- Patients should be advised to abstain or reduce intake.

Assessing Vasculature

- Adequate blood supply essential for fusion.
- Perform vascular assessment (clinical exam, Doppler if needed).
- Consider peripheral vascular disease and diabetes.

Diabetes Optimisation

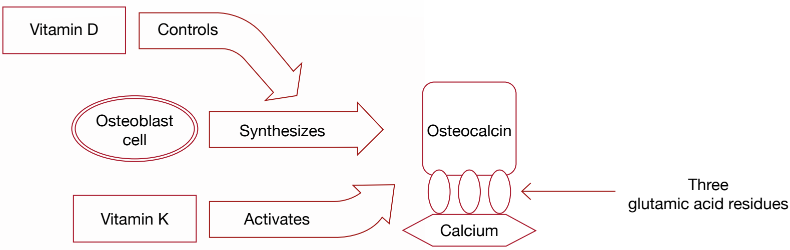
- Aim for HbA1c <7%.
- Recognise peripheral neuropathy as a complicating factor.
- May require extended immobilisation post-operatively.

Hormone Replacement Therapy (HRT)

- Oestrogen supports osteoblast function and bone quality.
- Risk-benefit balance needed against DVT risk.
- Selective continuation may be beneficial in non-union cases.

Nutrition

- Ensure good protein intake to support healing.
- Dietitian referral useful in complex cases.
- Vitamin C: essential for osteoclast activity and bone turnover; avoid mega-doses as they overstimulate osteoclasts.
- Vitamin D: deficiency is harmful to fusion; supplement, with higher doses if baseline is low.
- Vitamin K: regulates calcium and vitamin D metabolism; not routinely tested but may explain unexplained non-union.



Vitamin K helps convert three glutamic acid residues so that osteocalcin can bind calcium in bones.

Figure - The role of Vitamin K in calcium and vitamin D metabolism

Intra-operative Factors

Principles of Fixation

- Apply correct tension in plate/screw constructs.
- Ensure adequate rigidity without over-constraining healing.
- Avoid shear forces through careful implant and screw positioning.

Addressing Bone Loss

- Bone grafting: autograft (iliac crest, proximal tibia, calcaneum) remains gold standard.
- Structural grafts: fibular struts, tricortical iliac crest, femoral head allograft, or cages for defects >1cm.
- Stimulation: consider EXOGEN ultrasound, shockwave therapy, or prolonged casting if appropriate.

Use of Ortho-biologics

- Mix autograft with Ortho-biologics (e.g., Cerament) to create a putty and fill gaps.
- Can deliver local antibiotics and improve bone regeneration.
- Evidence remains largely anecdotal but promising.

Operative Strategies

- Debride to healthy, bleeding bone.
- Avoid repeating failed techniques.
- Extend fusion mass to adjacent joints if necessary.
- Fill every gap to avoid recurrence of non-union.
- Accept minor limb shortening if it improves stability.
- Prepare patients for the possibility of staged bone stimulation or secondary grafting.

Summary

- Management of non-union cases requires a comprehensive, methodical approach emphasising thorough patient optimisation and meticulous intra-operative planning.
- Understanding and addressing underlying causes, systemic health, local conditions, and adherence to sound surgical principles significantly enhance successful fusion outcomes.

Algorithm for Managing Non-Union in Foot & Ankle Surgery

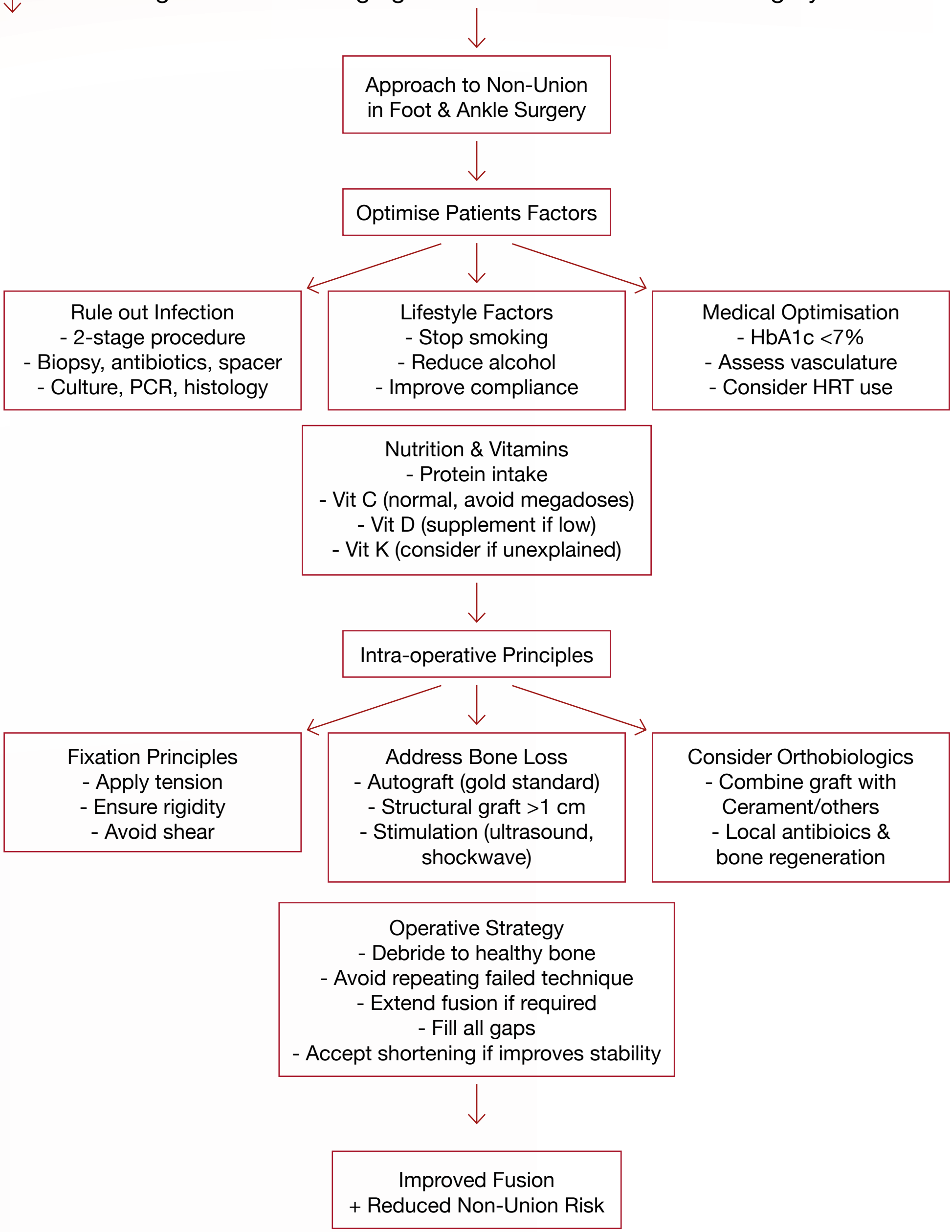


Figure - An Algorithm on how to approach a non-union in foot and ankle surgery.

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2.3. Preventing and Addressing delayed wound healing *Hari Prem*

Understanding Delayed Wound Healing

Delayed wound healing occurs when wounds fail to heal within the expected timeframe, leading to prolonged recovery, patient stress, and increased healthcare costs. It also raises infection risks and may require additional interventions such as debridement, antibiotics, or revision surgery.

Causes and Risk Factors

- **General causes:**
  - Age >60
  - Smoking and nicotine vaping
  - Inadequate blood supply
  - Tourniquet time >90 minutes
  - Diabetes and other comorbidities (Rheumatoid Arthritis, cancer therapy, neuropathy)
  - Open fractures
  - Medications inhibiting healing[1]
  - Patient non-compliance[1]

- **Specific to ankle fractures:**
  - Heel pad edema index >1.4 (3.4× higher risk)[2]
  - BMI >25
  - Smoking
  - Prolonged surgery[3]
  - Non-ambulatory status[3]
  - Multiple combined factors can raise complication rates up to 96%

- **Total Ankle Replacement (TAR):**
  - Diabetes[4]
  - Female sex
  - Corticosteriod use
  - Inflammatory arthritis (highest risk for severe complications)[4]

Preventive Measures Before Surgery

- **Patient assessment:** Thorough evaluation of comorbidities, previous medical history (e.g., DVT, infections, psoriasis, steroid use).

- **Smoking cessation:** No smoking or vaping pre-surgery.
  Diabetes management: Monitor HbA1c closely.

- **Nutritional support:** Vitamin D and C supplementation included in standard patient information at many centres.

- **Chronic oedema/venous disease:** Referral to vascular specialists for compression therapy.
- **Lifestyle optimisation:** Encourage low-impact exercise, weight loss, and healthy living resources.

Peri-operative Care and Monitoring

- **Soft tissue management:**
  - Reduce swelling before surgery (elevation, wrinkle test).
  - External fixation in high-energy or complex cases.
- **Surgical preparation:**
  - Chlorhexidine washes pre-op, alcoholic Betadine intra-op.
  - Careful suture choice: nylon for hindfoot, Monocryl for forefoot, avoid strangulating mattress sutures, use minimal fat stitch closure.
  - Avoid routine suction drains.
- **Intra-op strategies:**
  - Release tourniquet mid-way to control bleeding.
  - Trendelenburg positioning for haemostasis.
- **Post-op immobilisation:**
  - 2–3 weeks immobilisation for most cases; delayed suture removal to allow swelling reduction.
- **Dressing technique:**
  - Non-adhesive base layer, gauze tiling to heel, cotton roll wrap; avoid tight scarfing around the ankle to prevent blisters or strangulation.

Post-operative Care and Patient Journey

- **Wound monitoring:** Early recognition of problems, prompt action (antibiotics, admission if needed).
- **Multidisciplinary involvement:** Frequent reviews, flexible scheduling, input from other surgeons/plastic teams if needed.
- **Patient education:** Stress importance of compliance (especially in Type A personalities such as doctors), stock home supplies, plan living arrangements.
- **Psychological impact:** Viewing a dry, healing wound reassures patients, reducing stress and improving adherence.

Addressing Complications

- **Decision-making:** Do not delay, escalate concerns early.
- **Team communication:** Use appropriate communication channels for updates and rapid second opinions.
- **Site of review:** Problem dressings often managed in theatre plaster room for better access to senior input.
- **Dressings:** Keep wounds dry, avoid maceration, and allow pain-free suture removal with simple techniques.

Emerging Trends

- **Tranexamic Acid (TXA):** Reduces bleeding but no clear evidence it improves wound healing.
- **Advanced dressings and biologics:** Ongoing research, often guided by tissue viability nurses.

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Consensus Questions

Vitamin D

1. Do you prescribe vitamin D supplementation pre-operatively prior to a primary ankle arthrodesis?
   Yes 9/19 (47%)
   No 5/19 (26.5%)
   After appropriate risk assessment and counselling 5/19 (26.5%)

1a. What dose do you believe to be necessary?
   Supermarket Dose 8/19 (42%)
   2000iu 4/19 (21%)
   4000iu 4/19 (21%)
   Higher than 4000iu 3/19 (16%)

2. Do you routinely test the Vitamin D pre-op prior to performing a revision Ankle Arthrodesis in a non-infected case?
   Yes 13/19 (68%)
   No 6/19 (32%)

3. Do you test for any other vitamin profiles other than Vit D prior to revision surgery?
   Yes 0/19
   No 19/19 (100%)

4. Would you perform a primary ankle arthrodesis on a patient who is a cigarette smoker?
   Proceed with surgery 7/19 (37%)
   No Surgery 12/19 (63%)

5. In a non-infected non-union revision setting - would you proceed to a revision if the patient is a smoker?
   Proceed with surgery 7/19 (37%)
   No Surgery 12/19 (63%)

6. Is autologous bone grafting required in a primary **open** fusion of ankle, without bone loss?
   Required 19/19 (100%)
   Not Required 0/19 (0%)

7. Is autologous bone grafting required in a primary **open** fusion of the hindfoot, without bone loss?
   Required 19/19 (100%)
   Not Required 0/19 (0%)

8. Do you allow Day 1 weightbearing after an arthroscopic or open ankle fusion?

Yes	1/19 (5%)
No	18/19 (95%)

9. Do you allow Day 3 weightbearing after an arthroscopic or open ankle fusion?

Yes	1/19 (5%)
No	18/19 (95%)

10. Do you allow Day 10-14 weightbearing after an arthroscopic or open ankle fusion?

Yes	14/19 (88%)
No	5/19 (12%)

11. If there is a suspicion of wound infection at the first wound check - Do you delay your weight bearing decision?

Yes	15/19 (79%)
No	4/19 (21%)

12. Have you adopted the British Orthopaetic Association Standards for Trauma (BOAST) on Weight Bearing guidance in your unit?

Yes	7/19 (37%)
No	12/19 (63%)

13. Do you review your own patients' wounds Post-operatively?

Reviewed by operating team	17/19 (89%)
Reviewed by alternative team	2/19 (11%)

14. Do you use Negative pressure dressings for TTC fusions?

Always	0/19 (0%)
Occasionally	3/19 (16%)
Never	16/19 (84%)

15. Would you routinely stop NSAIDs before a primary ankle fusion?

Yes	11/19 (58%)
No	8/19 (42%)

16. Would you allow continuous use of NSAIDs post-operatively?

Yes	0/19 (0%)
No	19/19 (100%)

17. Would you allow short course of up to 14 days of NSAIDs post-operatively?

Yes	19/19 (100%)
No	10/19 (53%)

18. In a routine ankle fracture fixation that does not have blood filled blisters - would you proceed with surgery regardless of swelling?

Yes	9/19 (47%)
No	10/19 (53%)

Session 3: Hallux valgus

Chaired by Carolyn Chadwick

3.1. Recurrence of Hallux Valgus

Carolyn Chadwick

Incidence & Definitions

- Reported recurrence varies widely from 5-50% depending on procedure, follow-up, and definition.[1, 2]
- Systematic review evidence displayed a 9.3% recurrence after proximal osteotomies.[1]
- A 2021 meta-analysis (~3,000 patients) displayed a pooled prevalence ~25%.[3]
- Despite this, definitions are inconsistent, most use hallux valgus angle (HVA) >20° (some >15°).[1,2,3]
- Recurrence is considered significant only if the patient is symptomatic with pain and deformity.[2]

Anatomical Risk Factors

- **Adolescent/Juvenile hallux valgus:** recurrence 10-50%.[4, 5]
- **Metatarsus adductus angle:** recurrence up to 29%; severe cases (>31°) these patients, however, may recur less due to stronger procedures being used (e.g. Lapidus).[6]

Figure - Red Star highlighting the MAA

- **Distal metatarsal articular angle (DMAA):** evidence shows immediate Post-operative non-weightbearing DMAA ≥17° is associated with recurrence but reliability poor.[7]
- **Hypermobility & TMT joint instability:** this topic remains controversial but is relevant in recurrent cases.
- **First ray length:** post-operative excessive length of the first ray is associated with recurrence, especially if pre-operative HVA >40°.[8]

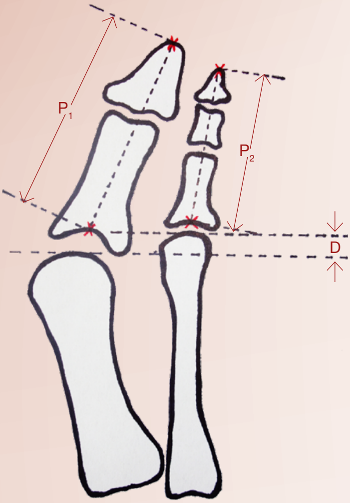

Figure - Highlighting excessive First Ray Length (EL), EL = P1 – P2 - D

- **Pes planovalgus (flatfoot):** increasing severity of flatfoot leads to a higher recurrence rate (up to 50% if talo-1st met angle <10°).[9]

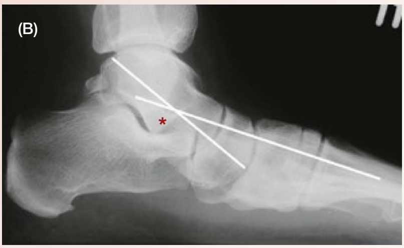

Figure - Talo-1st Metatarsal Angle – Marked with Blue Star

- **Metatarsal head shape:** A round head of the first metatarsal is linked to recurrence vs square/intermediate shapes.[10]
- **Pronation of 1st metatarsal:** Has been found to be present in ~87% of hallux valgus patients; rotational correction may be necessary.[10]
- **Joint incongruity:** Found to be an independent predictor of recurrence (100% recurrence in scarf series with incongruity).[11]

Systemic & Patient Factors

- **Systemic conditions:** Surgeons should consider connective tissue disorders (e.g. Ehlers-Danlos, Marfan's), inflammatory disease (Rheumatoid Arthritis, gout), neuromuscular disorders (Cerebral Palsy, stroke) within their work up.
- **Social factors:** smoking, poor footwear, non-compliance.
- **Early forefoot weight-bearing:** evidence mixed; some studies show no increased recurrence.

Surgical Error & Technical Factors

- Inappropriate procedure choice (e.g. distal osteotomy for severe deformity).
- Under-correction or poor technique.
- Failure to correct secondary deforming forces (e.g. pronation, instability).
- **Revision surgery must be as powerful or more powerful than primary procedure.**

Radiographic Predictors

- Pre-op HVA >40° (strong risk factor).[10]
- Residual Post-opoperative intermetatarsal angle >10°.[7]
- Post-operative sesamoid malposition (grades 4-7).[7]
- Pre-operative metatarsus adductus angle.[7]
- Post-op DMAA: less reliable.[7]
- Weight-bearing 3D CT may improve assessment of rotation but not widely available.[7, 10]

Treatment Options

- **Repeat osteotomy:** if the original procedure was appropriate but under-corrected.[12]
- **More powerful procedure (Lapidus fusion):** if initial surgery is insufficient.[13]
- **Double osteotomies:** Can be used for high DMAA or congruent joint deformity.[13]
- **Fusion (MTP or TMT):** Should be considered in systemic inflammatory disease, neuromuscular causes, hypermobility, severe degeneration.[13]
- **MIS (minimally invasive surgery):** early evidence is promising in recurrence but not yet proven superior to open procedures.

Summary

- Recurrence is **multifactorial** (anatomy, systemic disease, surgical error, compliance).
- Surgery should only be indicated for **symptomatic patients** (pain + deformity).
- Surgeons should have careful pre-operative planning and procedure selection is critical.
- Revision must correct underlying cause with adequate power and stability.

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3.2. Hallux Varus

Hans-Jörg Trnka

Definition

- Medial deviation (adduction) of the big toe at the first MTP joint.
- Often involves:
  - Medial deviation
  - Supination
  - Extension
  - "Cock-up" deformity at IP joint
  - Medially displaced, taut EHL tendon

Incidence

- Often **iatrogenic**, following hallux valgus surgery.
- Reported rates:
  - Hansen/McBride procedure ~13%[1]
  - Frodes/Crescentic osteotomies ~10%[1]
  - Scarf osteotomy up to ~30%[1]

Symptoms

- Shoe wear problems (especially with pointed/fashion shoes) .
- Pain over medial forefoot.
- Callus formation around great toe.
- Early arthritis (develops within 2-3 years in severe deformity).
- Loss of ground purchase, secondary hallux rigidus.

Clinical Findings

- Medial displacement of MTP joint .
- Supination and extension of the hallux.
- Medial bowstringing and tight EHL.
- Medially displaced sesamoid (painful).
- Hammertoe deformity at IP joint with bursitis.

Pathogenesis

- Excessive release of lateral MTP structures during bunion surgery.
- Over-tightening of medial capsule.
- Aggressive post-op dressing pulling toe into varus.
- Excessive resection of medial eminence.
- Overcorrection of intermetatarsal angle (IMA).
- Fibular sesamoid resection (McBride procedure).
- When using a Bosch technique it can result in fixed deformity if K-wire keeps the overcorrection for too long.

Therapy Options

<u>Differentiate flexible vs rigid deformity:</u>

- **Flexible deformity:**
  - Early: taping/splinting
  - Persistent: medial release + lateral tightening
  - Tendon transfers: EHB, EHL split, abductor hallucis (Hawkins), interosseous
  - Osteotomies: contra-chevron, reverse scarf
  - Tightrope technique (dynamic, less invasive)
- **Rigid deformity:**
  - Painful/arthritic: MTP fusion (preferably via dorsal incision)

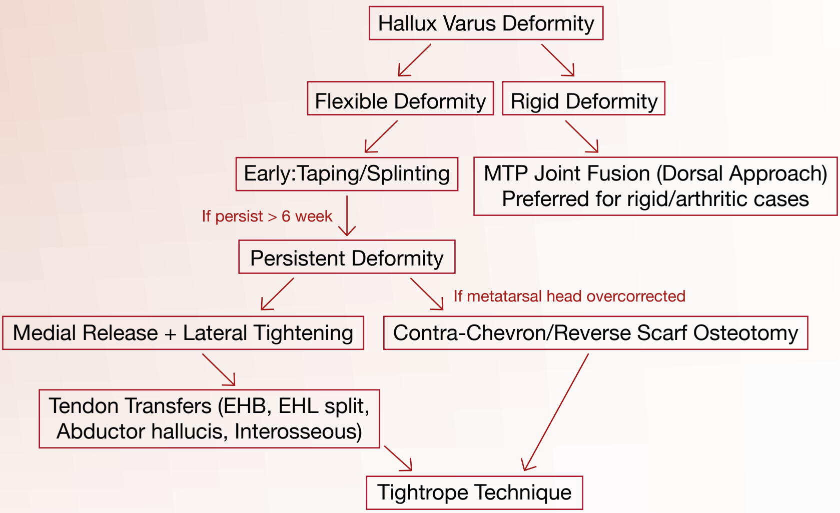
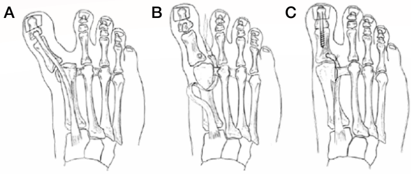
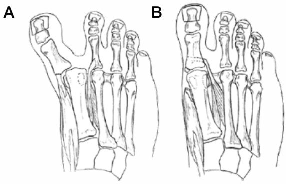


Figure - A Treatment algorithm for iatogenic hallux valgus[2]

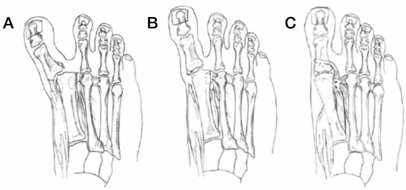
Dynamic Reconstructions



1^{st} IPJ Fusion and EHL Transfer[3]

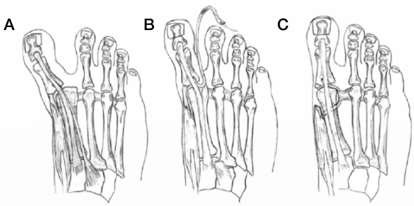


Transfer of the 2^{nd} Interosseous Tendon[3]

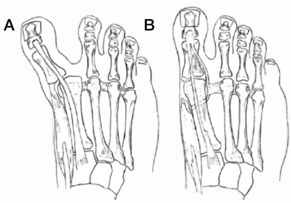


Adductor Tendon Transfer, according to Hawkins[3]

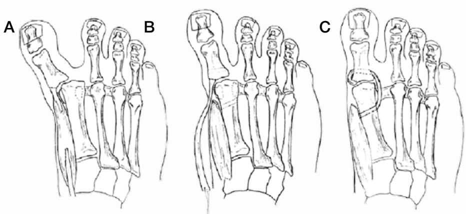
Static Reconstructions



Extensor Hallucis Brevis Tenodesis[3]



Extensor Hallucis Longus Split Transfer[3]



Static Abductor Hallucis Transfer[3]

Outcomes

- Generally **low-level evidence**, mostly small case series:
  - **Johnson et al. 1984:** 14 pts (EHL transfer + IP fusion), mixed results (some excellent, some fair).[4]
  - **Skalley & Myerson 1994:** 42 pts, 17 patients underwent medial soft tissue release and tendon transfer, of which, outcomes were variable with regards to patient satisfaction, 7 excellent, 6 good, 3 fair, 1 poor.[5]
  - **Myerson & Komenda 1996:** Small series of 6 pts (EHB transfer), resulting in correction of deformity but reduction in range of movement of the great toe of up to 10° of loss of extension.[6]
  - **Maynou et al. 2000:** 12 pts (Abductor Hallucis Transfers (Hawkins)/IPJ Fusions with EHL Transfers). Eleven satisfactory results post-operatively with patient questionnaires.[7]
  - **Leemrijse et al. 2008:** reverse abductor hallucis transfer, 7 pts, reporting satisfactory correction.[8]

Overall: evidence displayed results often limited by loss of motion and persistent symptoms.

Prevention

- Avoid excessive medial translation of metatarsal head.
- Do not resect bunion before osteotomy.
- Do not overtighten medial capsule.
- Avoid overcorrection Post-operatively.

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3.3. Transfer Metatarsalgia *Nick Duncan*

Definition & Overview

- Transfer metatarsalgia can be defined as forefoot pain from increased pressure on lesser metatarsals.
- It is usually due to dysfunction, elevation, or shortening of the first ray.
- Transfer metatarsalgia can be common after hallux valgus correction or other forefoot surgeries but can also result from biomechanical abnormalities.

Functional Classification

- **Stance phase (2nd rocker):**
  – Due to poor loading of medial column.
  – Causes: hallux valgus, 1st ray instability, elevated 1st ray.
  – Callosities directly under central metatarsal heads.
- **Dynamic phase (3rd rocker):**
  – Related to ray length discrepancy.
  – Short 1st ray or long lesser rays.
  – Pain more distal, under base of proximal phalanx.

Clinical Assessment

- Assess standing alignment (pes cavus/planovalgus).
- Gait pattern analysis.
- Examine hallux (recurrence, stiffness, arthritis).
- Check for 1st metatarsal elevation.
- Assess 1st TMT joint for instability (radiographs often more reliable).
- Evaluate 2nd/3rd TMT for degeneration.
- Callosity patterns assess for localisation.
- Check lesser toes for deformity, plantar plate tears, synovitis, degeneration.
- Assess gastrocnemius tightness.

Investigations

- **First-line:** Weight-bearing radiographs (3 views).
- **CT:** for bony anatomy, malunion.
- **MRI:** joint degeneration, plantar plate, soft tissues.

- **Pedobarographic Imaging:** useful for subtle cases & orthotic planning.

Non-Surgical Management

- **Orthotics:**
  - Insoles with domes or cut-outs under lesser metatarsal heads.
  - Aim for elevation of the first ray.
- **Footwear:**
  - Rocker-bottom shoes helpful for dynamic-phase overload.

Iatrogenic Metatarsalgia - Correcting the Planes of Deformity

Current evidence suggests addressing the planes of deformity will provide a comprehensive treatment of metatarsalgia.[1]

- **Sagittal plane Correction:**
  - Causes:
    - **In the forefoot this can be because of** extension malunion of the osteotomy (Mitchell, scarf) or inadequate plantarisation of the osteotomy.
    - **In the midfoot this can be because of** 1st TMT instability, Lapidus extension malunion or intercuneiform instability.
  - Treatment:
    - Opening wedge osteotomy (forefoot malunion).
    - 1st TMT fusion (instability).
    - Inter-cuneiform fusion (persistent instability).
- **Frontal Plane Correction (ray length discrepancies):**
  - Severe shortening of the 1st Metatarsal or Ray imbalance (>7mm). This can be addressed with a lengthening scarf ± shortening lesser metatarsals.
  - Moderate (5-7mm)/mild (<5mm) Shortening can be addressed with a diaphyseal osteotomy, Weil osteotomy or Distal Metaphyseal Metatarsal Osteotomy (DMMO).
  - If there is no discrepancy, a Barouk-Rippstein-Toullec (BRT) osteotomy can be considered to elevate without altering parabola.

Evidence suggests that biomechanically, shortening of the first metatarsal of >6 mm leads to increased central load within the foot and plantarisation can offset this.[2]

- **Transverse plane:**
  - Causes: recurrence or under-correction of hallux valgus, IMA not corrected, 1st TMT instability.
  - Treatment: repeat or more powerful osteotomy, 1st MTPJ fusion (degenerative), 1st TMT fusion ± inter-cuneiform fusion.
- **Multiplanar deformity:**
  - If there is sagittal and frontal plane deformity - Consider elevated and short 1st ray. Hence a lengthening scarf osteotomy should be considered (angle of cut allows length/plantarisation).
  - If there is sagittal and transverse plane deformity - Consider elevated 1st Metatarsal with recurrent valgus. Hence a scarf osteotomy with greater inclination, or Lapidus procedure should be considered.

Indications for Hallux Surgery

- Sagittal imbalance (elevated 1st MT).
- 1st TMT instability.
- Severe shortening of 1st MT.
- Recurrence or under-correction of hallux valgus or IMA.

Other Considerations

- **1st MTPJ arthritis/sesamoid OA,** in these cases, consider fusion.
- **Degenerate 2nd/3rd TMT,** in these cases, consider fusion ± shortening/dorsiflexion to offload.
- **Degenerate 2nd MTPJ** (often post-Mitchell osteotomy):
  - Cheilectomy (often recurs).
  - Weil or Gauthier osteotomy.
  - Capsular interposition (using dorsal capsule of proximal phalanx as resurfacing).
  - Early results promising.

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3.4. Non-union/Mal-union of the 1st Tarsometatarsal Joint

Dev Mahadevan

Importance of a Stable 1st TMTJ

- A Stable 1st TMTJ Provides **forefoot stability**, even weight distribution, arch preservation, and effective push-off.
- A **non-union** (unstable/hypermobile) function like a **short or elevated ray** (mal-union).
- Leads to: transfer metatarsalgia, pain, instability, and recurrence of deformity.

Indications for 1st TMTJ Fusion

- Hallux valgus (esp. severe/big bunions)
- Progressive collapsing foot deformity
- Lisfranc injuries
- Osteoarthritis
- Revision for failed Lapidus (non-union or mal-union)

Causes of Non-union/Mal-union

Surgeon factors:

- Over-resection, poor planar cuts, excessive wedge removal.
- Malpositioning of the fusion resulting in shortening, elevation, or rotational errors.
- Inadequate triplane correction (IMA reduction, de-rotation, plantarflexion).

Implant factors:

- Insufficient rigidity of fixation.
- Inappropriate hardware positioning (plate inside vs. outside compression screw).

Patient factors:

- Smoking, poor compliance.
- Early weight-bearing without stable fixation.

Surgical/Technical Considerations

- **Joint preparation:** Planar cuts preferred, avoid over-resection, use limited wedges.
- **Correction:** Must address triplanar deformities (IMA reduction, derotation, plantarflexion of 1st metatarsal).

Implant Factors & Fixation Techniques

- **Crossed screws:** Still viable (esp. in young patients or flatfoot correction with long immobilisation).[1,2]
- **Plate and separate compression screw (outside plate):** Superior biomechanical stability vs. screws alone or compression screw through the plate.[3,4]
- **Plantar vs dorsal plating:**
  - Plantar plating stronger (higher load to failure, more cycles to failure).[5]
  - Must avoid peroneus longus and tibialis anterior tendon insertions.[6]
- **Nitinol staples:**
  - Traditional staples poor.
  - New 4-leg nitinol staples (with screw) display some superiority compared to plate and screw construct (dynamic compression).[7]
- **Intraosseous fixation (IO FIX®):**
  - Inferior to plantar plate and screw, but better than screws alone.[8, 9, 10]
- **Cross-fixation to 2nd ray:**
  - Rigid screws or flexible (tightrope).
  - May reduce splaying and improve stability, though no strong comparative evidence.[11, 12]

Weight-Bearing

- **Early weight-bearing (≈2 weeks in boot)** is safe with rigid fixation.[13]
- Does not significantly increase non-union risk.[14]

Revision for Non-union/Mal-union

- Return to basic orthopaedic principles:
  - **Optimise host factors:** stop smoking, exclude infection.
  - **Improve biology:** meticulous bone prep, bone grafting if needed.
  - **Restore anatomy:** correct alignment, restore length/height with bone block if required.
  - **Enhance construct stability:** use plate and separate compression screw, nitinol staples, and consider cross-fixation to 2nd ray.

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Consensus Questions

Hallux Valgus

1. Revision for HV surgery should only be performed for deformity and pain or ulceration/soft tissue threatening?
   Yes 19/19 (100%)
   No 0/19 (0%)

2. Should a specific risk of recurrence be provided during the consent process for primary HV surgery?
   Yes 19/19 (100%)
   No 0/19 (0%)

3. All patients should be allowed to immediately WB in a forefoot loading post-operative shoe?
   Yes 9/19 (47%)
   No 10/19 (53%)

4. Should intra-operative X-Rays be **routinely** performed in all open primary HV surgery?
   Yes 12/19 (63%)
   No 7/19 (53%)

5. Is a mild remaining hallux valgus more acceptable than hallux varus?
   Yes 16/19 (84%)
   No 3/19 (16%)

6. Can a mild, flexible hallux varus be accepted?
   Yes 19/19 (100%)
   No 0/19 (0%)

7. Is joint preserving surgery successful for flexible hallux varus?
   Yes 18/19 (95%)
   No 1/19 (5%)

8. Elevation of the 1st MT or 1st Ray instability requires correcting in transfer metatarsalgia?
   Yes 19/19 (100%)
   No 0/19 (0%)

9. It is reasonable to consider isolated 2nd ray shortening with a patient with 2nd Metatarsalgia if the cascade is restored?
   Yes 18/19 (95%)
   No 1/19 (5%)

10. What is your primary indication for Modified Lapidus Procedure?

HV with 1st TMTJ OA	19/19 (100%)
No	0/19 (0%)

11. In a procedure to stabilise the 1st TMTJ for HV or recurrent HV - what is the preferred operation?

Screws	0/19 (0%)
Plate and Screw	16/19 (84%)
Dual Plating	0/19 (0%)
Compression Staples	2/19 (10%)
Screw and Staple	0/19 (0%)
IO Fix	1/19 (5%)

12. After stabilisation of the 1st TMTJ what choice of immobilisation would be preferred for offloading?

Long Aircast Boot or Plaster	16/19 (84%)
Post-operative Shoe	3/19 (16%)

13. What is the post-operative non weight bearing status?

Immediate	5/19 (26.5%)
2 Weeks	9/19 (47%)
6 Weeks and beyond	5/19 (26.5%)

Session 4: Hallux Rigidus and Lesser Toes

Chaired by Karan Malhotra

4.1. Failed first MTPJ arthrodesis and first MTPJ arthroplasty

Karan Malhotra

Why MTPJ Fusion?

- Primarily used to relieve pain, typically from arthritis or arthrosis.
- May also address deformities and instability.
- Surgical technique options:
  - Flat cuts - not technically challenging, risk of shortening.
  - Conical reamers - good union rates, risk of shortening and fracture.
  - Wedge cuts - technically demanding, lowest potential for shortening and biomechanically most stable.

Fixation methods:

- Cross screws.
- Screws and plates (Greatest biomechanical stability).
- Staples (increasing popularity due to continuous compression and preserving fusion surface area).[2]

I. Biomechanics and Fixation

- Fully threaded screws may offer stability comparable to screws + plates.
- Key goal: pain-free, stable joint in the correct position.
- High union rates (~90%), patient satisfaction ~80%.
- MTPJ fusion improves functional scores significantly (e.g., MOxFQ).

Causes of Fusion Failure

1. **Failure to Fuse (Non-union)**
   a. Occurs in 6-15% of cases; ~50% of those non unions are symptomatic.[3]
   b. Often manageable if alignment is preserved.
2. **Failure to Correct Deformity**
   a. Commonly results in over-dorsiflexion.
   b. May involve unstable IP joints.
3. **Fractures, Ongoing Pain, Transfer Symptoms**
   a. 5% transfer symptoms; 8% IP joint problems.

Risk Factors

Patient-related:

- Smoking, diabetes, poor vascularity, low bone density, revision setting i.e previous bunion surgery, poor compliance.

Surgical-related:

- Incorrect indications, poor joint preparation - inadequate or thermal damage, inappropriate fixation construct, bone loss.
- Theoretical risk of thermal damage with conical reamers.

Best Evidence Overall for Avoiding a Non-union

Flat cuts - more surface area and more biomechanically stable than conical joint prep, plus avoids potential for thermal injury risk with reamers.

+

Locking plate + Screw or **fully threaded compression screws.**

There is insufficient evidence in the literature to single out a single factor as having a major impact on non-union risk.

II. Revision Surgery for Failed MTPJ Fusion

When to Consider Revision

- Failed fusion with pain, deformity, or instability.
- Diagnostic tools: CT, MRI, SPECT, blood tests to rule out infection.
- Get the diagnosis correct in the first instance.

Revision Principles

- Address original cause of failure.
- Maintain or restore length and alignment.
- Optimize bone stock and biology.
- Achieve rigid fixation.

Bone Grafting Options

- **Tricortical iliac crest grafts** (commonly used, structural).
- **Synthetic grafts, cancellous allografts.**
- **Custom metal cages** (growing in popularity).
- **Dowel grafts, vascularized grafts** (rare, e.g., medial femoral condyle free flap).

Surgical Approach

- Debride back to bleeding bone.
- Achieve rigid long fixation.
- If reduced vascularity consider vascularised graft.

Fixation Techniques

- Locking plates with screw orientation outside the plate's plane.
- Interposition bone block arthrodesis is most supported in literature.

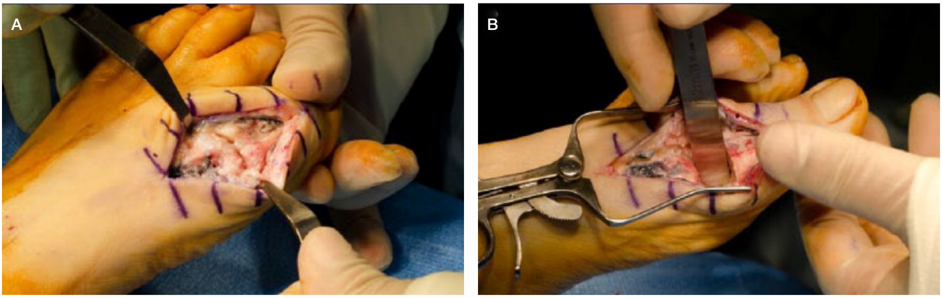
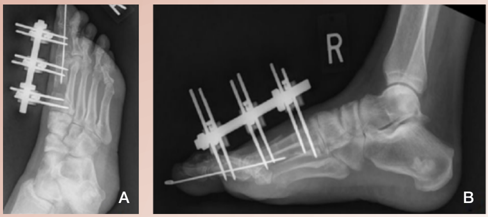


Figure: Interposition bone grafting - debride back to bleeding bone, try not to overlengthen or shorten significantly.

Alternative Techniques:

- Dowel Graft technique[4]

- Distraction osteogenesis[5]



- Hemicap prosthesis[6]

Outcomes and Complications

- ~20% non-union rate in revision surgery; only half symptomatic.
- High rates of transfer metatarsalgia.
- Issues: wound complications, recurrent shortening, malunion, periprosthetic fractures.
- Total complication rate ~40%.[7]

III. Dealing with Malunion & Periprosthetic Fractures

- Use 3D imaging (e.g., weight-bearing CT) for accurate deformity correction.
- Correct via osteotomies (single or multi-planar) performed at the CORA if possible.
- Periprosthetic fractures: treat conservatively if stable; revise fixation if displaced.

IV. Interphalangeal (IP) Joint Pain After Fusion

- More common with hypermobile IP joints.
- Difficult to balance when both IP and MTPJ are fused.
- Treatment: IP fusion or re-adjusting MTPJ fusion alignment.
- Double fusion success rate ~50%.
- Take down arthrodesis to interposition or arthroplasty - only single centre case series.

V. MTPJ Arthroplasty

Indications

- Arthritis/pain without severe deformity.
- Preserved joint motion.
- Patients with prior fusions elsewhere.
- Take down of fusion.

Materials used:

- Silicone (silastic) - thought to be inert and avoid stress shielding.
- Metal - usually cobalt chrome, sometimes titanium.
- Ceramic
- Synthetic (e.g., Cartiva).

Design Considerations

- Bone-sparing approaches favoured.
- Emerging 3D-printed and additive manufacturing implants.

Modes of Failure

- **Aseptic loosening (silicones particularly susceptible to), subsidence** (e.g., Cartiva), **fragmentation** (early generations of silicone), **osteolysis, malalignment, infection, stiffness.**

Complication Management

Limited literature available

Start with history, investigations before determining a treatment strategy.

1. **Infection** - implant removal, debridement with or without a temporary spacer, potential two-stage revision.
2. **Loosening/Failure** - often converted to fusion, may require bone grafts.
3. **Re-implantation** - option of exchanging a silastic. Limited evidence to support this approach.

Some patients settle after a debridement and 1st stage and do not return for a 2nd stage procedure.

VI. Future Directions

- **Additive manufacturing** for custom solutions.
- **Distraction osteogenesis** for length and correction.
- **PEKK** - potential antibacterial and mechanical advantages.

Summary

Failed MTPJ Fusion

- Common causes: poor position, biological insufficiency, mechanical instability.
- Revision requires careful diagnosis and correction of factors leading to original failure.
- Bone graft may be required to maintain length
- Rigid fixation is important for successful outcome
- About 10% of revisions may remain problematic due to non-union or malalignment.

MTPJ Arthroplasty

- Appropriate in patients without major deformity and with retained ROM.
- Failure usually due to loosening, implant degradation, or misalignment.
- Fusion remains the most reliable salvage procedure.

General Principles

- Optimize patient factors and biological environment.
- Use imaging to guide correction.
- Set realistic expectations: revisions are complex and carry higher complication rates.
- Innovation in materials and imaging may offer additional options in future.

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4.2. The Floating Toe

Hans-Jörg Trnka

Introduction

Floating toe is a well-known complication following metatarsal forefoot surgery, particularly associated with Weil osteotomy. It refers to the inability of a toe (typically the second) to make contact with the ground during weight-bearing.

Incidence in Literature

- **2004 Study:** 28.5% (n=26) occurrence in 70 patients after metatarsal surgery.[1] Increased risk with associated PIPJ fusion - 50% occurrence.
- **Large Retrospective Series:** 36% floating toes after 1,100 Weil osteotomies.[2]
- **Retrospective study of 89 osteotomies -** 33% occurrence of floating toes.[3]

Aetiology of Floating Toe

Biomechanical Factors

1. **Alteration in metatarsal length and mechanics.**
    - Weil's osteotomy alters both the location and orientation of the affected metatarsal bones, particularly the first and second metatarsals disrupting the initial "Maestro parabola."
    - Focusing on the "Maestro parabola" during osteotomy, and the relationship of the metatarsal heads to each other can minimise the occurrence of Post-operative complications.[4]
2. **Change in the centre of rotation of the MTP joint.**
    - After Weil osteotomy, the metatarsophalangeal joint's centre of rotation was proximally and plantarly displaced by 3.5mm compared to the control group, and by 3.7mm in comparison to the triple Weil osteotomy group.
    - In the latter, the centre of rotation was displaced by 0.817mm, the position of the interossei tendon was above the metatarsal longitudinal axis.[5]
    - Displacing the rotation centre of the MTP joint in a downward direction, induces a collapse of the foot arch.
    - This collapse results in elevation of the proximal phalanx due to the levering effect.[6]
3. **Dorsal and plantar tendon imbalances due to lengthening.**
    - Depression of the plantar fragment always occurs after a Weil osteotomy.
    - This depression changes the centre of rotation of the MTP joint, and the interosseous muscles then act more as dorsiflexors than as plantarflexors
    - The flexor tendon has the potential to undergo displacement towards the dorsal side of the MTP joint, assuming the role of the extensor tendon, further contributing to the upward pulling of the toe.[7]

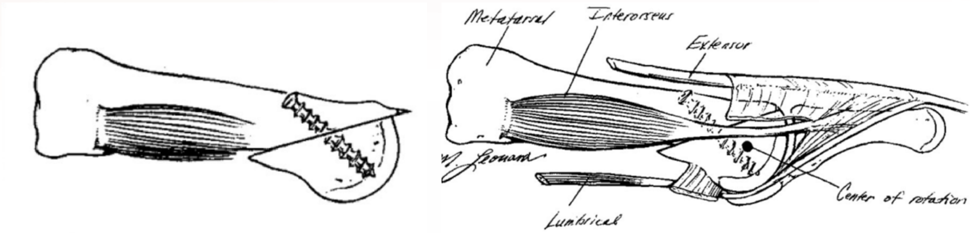
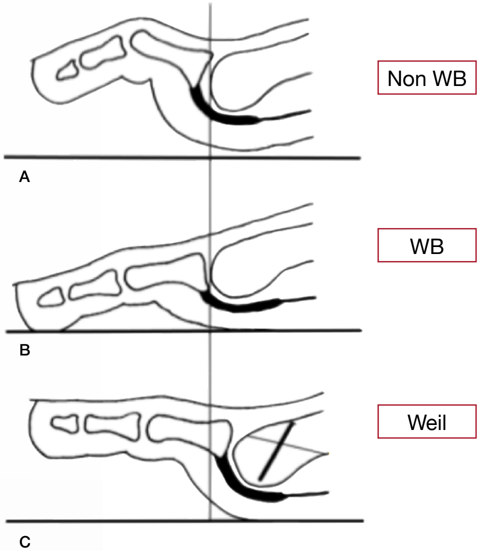


Figure: Weil osteotomy anatomic positions.
The shortening of the metatarsal bone causes a relative lengthening of the tendon and ligaments.[7]

4. Metatarsal Plate Relaxation, Change in the Windlass Mechanism

- Loss of plantar stability from relaxed plantar plate.
- Plantar force is reduced due to loss of windlass mechanism.
- Leads to increased risk of toe dorsiflexion.[8]



Dampening of Windlass Mechanism may contribute to floating toe.

Surgical Technique Factors

- Incorrect angulation or execution of Weil osteotomy.
- Excess shortening of the metatarsal (>5mm).
- Excess scar tissue formation dorsally causing a contracture, elevating the toe.

Preventive Techniques

1. Modified Weil Osteotomy

- Resection of a dorsal bony slice to avoid excessive plantar flexion of the metatarsal head.
- Triple Weil osteotomy may help maintain central rotation of the joint, has been found to provide significant benefits in the enhancement of plantar fascia laxity and elevates the metatarsal head in response to metatarsal displacement resulting from a shortening exceeding 3mm.
- A comparative study showed better Post-operative AOFAS scores and few occurrences of Post-operative floating toes with triple Weil's compared to standard in cases performed for metatarsalgia.[9]

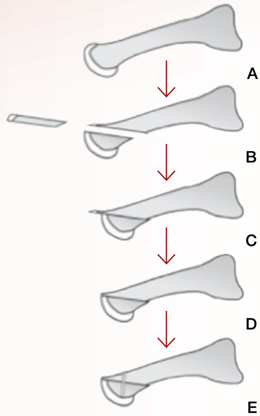
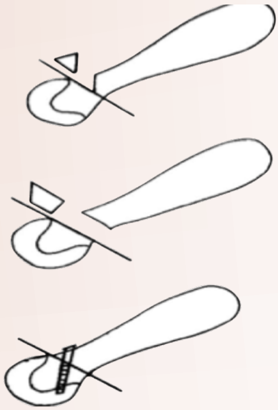


Figure: Wedge excision helps avoid plantarflexion of the head.

Triple Weil's osteotomy[6]



2. Soft Tissue Management

- **Extensor Tendon Lengthening:** To reduce dorsal pull.
- **Dorsal Capsule Release:** Prevents joint stiffness and contracture.
- **Flexor to Extensor Tendon Transfer:** Balances forces, may reduce floating.
- **Temporary K-wire Fixation:** Offers support, though has risks of loosening osteotomy and can break. Has been shown to be superior to post-op strapping.[10]
- **Plantar Plate Repair**: Shown in some studies to significantly reduce floating toe (e.g., only 3 of 34 toes affected in one series).[11]

3. Post-operative Support

- Unverified reports of plastic orthotic splints for 12 weeks preventing recurrence (limited to podiatry journals).

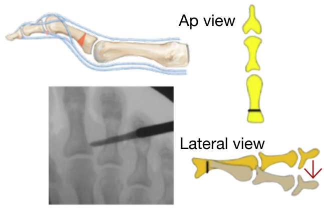
Management of Established Floating Toe

1. Soft Tissue Procedures

- **Extensor Tendon Lengthening** (again, to rebalance forces).
- **Capsulotomy:** To improve joint alignment and release contracture.
- **Tendon Transfers:** Including flexor to extensor transfers, though not always effective (37% residual deformity in one study).[12]

2. Minimally Invasive Surgery (MIS)

- **Plantarflexion Osteotomy of the Proximal Phalanx:**
  - Quick, effective, minimally invasive.
  - Involves controlled breaking and repositioning of the phalanx.
  - Preferred solution by the speaker.



Conclusion

Floating toe is a prevalent and challenging complication in forefoot surgery, particularly after metatarsal osteotomies like the Weil procedure. Understanding its biomechanical underpinnings and surgical factors is key to prevention. When it does occur, both soft tissue and bony procedures exist for correction, with minimally invasive techniques emerging as a promising, efficient solution.

Summary Points

- **Floating toe** occurs in up to 36% of cases post-metatarsal osteotomy.
- **Key causes** include altered tendon dynamics, metatarsal shortening, and loss of plantar plate integrity.
- **Prevention strategies** include:
  - Modified osteotomy techniques (e.g., triple Weil).
  - Tendon lengthening and capsulotomy.
  - Plantar plate repair.
- **Treatment options** for established deformity:
  - Soft tissue release.
  - Flexor to extensor transfers.
  - **Preferred method:** MIS plantarflexion osteotomy of the proximal phalanx.
- Success depends on **identifying the correct anatomical cause** and using the **least invasive effective method.**

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4.3. Non-union/Mal-union lesser metatarsals *Claire Topliss*

1. Causes of Non-union/Mal-union

A. Traumatic Causes

- Most common reason.
- Can occur at:
  - Metatarsal **base**
  - **Midshaft**
  - **Neck**
- Can be **simple fractures** or part of **complex injuries.**
- Associated soft tissue injury may be significant in major trauma.

B. Traumatic Causes

- May appear minor but can progress to complications.

C. Pathological or Secondary Causes

- **Rheumatoid arthritis**
- **Infection**
- **Tumors**
- **Charcot neuroarthropathy**
- **Iatrogenic** (surgical/post-operative)

2. Patient Presentation & Clinical Signs

- **Pain on weight-bearing**
- **Callus formation** due to altered load or deformity
- **Dorsal or plantar skin compromise** (e.g., ulcers)
- **Nerve irritation or compression**
- **Swelling, visible deformity**
- **Walking difficulties**

3. Diagnostic Considerations

- Assess **bone alignment**
- Evaluate **angulation and displacement**
- **Identify non-union vs. mal-union:**
  - Is it **symptomatic?**
  - Is it **atrophic or hypertrophic?**
- Check for **toe deformities, metatarsalgia,** or **pressure symptoms**

4. Treatment Guidelines

A. Indications for Fixation

- >10° angulation.
- Significant displacement or instability - >3-4mm.
- To restore anatomic alignment.

B. Fixation Methods

- **Percutaneous wires.**
- **External fixation.**
- **Plating** (medial/lateral column).
- **Intramedullary fixation.**

C. Fracture-Specific Considerations

- **2nd - 4th metatarsals** (central unit): tend to displace as one. Inherent stability from ligamentous attachments normally. Managment goals are primarily to restore length in the sagittal plane.
- **5th metatarsal shaft:** often managed conservatively, unless athletic or symptomatic.
- **5th metatarsal base:** can allow early weight-bearing unless complications arise.

5. Bone Health & Healing Support

- Emphasis on **optimizing bone health** to prevent poor healing outcomes
- **Immobilisation protocols** may influence healing outcomes (though debated)

6. Management of Non-union/Mal-union

A. Non-operative

- Orthotics
- Custom footwear

B. Surgical Options

- **Osteotomies** (e.g., DMMO - Distal Metatarsal Metaphyseal Osteotomy) to realign, shorten or lengthen.
- **Toe correction surgeries** - tendon releases.
- **Soft tissue procedures.**

DMMOs can allow **early weight-bearing**, enabling bones to find their optimal alignment during healing.

Summary

- **Most lesser metatarsal non-unions/mal-unions** stem from trauma, stress fractures, or systemic diseases.
- **Symptoms** include pain, deformity, calluses, and altered gait.
- **>10° angulation** or significant displacement can indicate the need for **surgical fixation.**
- Consider **bone health optimisation** and tailored **immobilisation** strategies.
- Management depends on **symptoms**, not just radiology: many patients manage well without intervention.
- Options include **osteotomies, tendon balancing**, and **custom orthotics**.
- Decision-making must balance **radiological alignment, functional outcome**, and **patient preferences**.

Consensus Questions

1. In the case of a failed 1st MTPJ Fusion with shortening of the 1st Ray - which option do you prefer to preserve/restore length?

Cancellous Autograft	0
Bone block autograft (eg iliac crest)	16 (84.2%)
Bone block allograft	1 (5.25%)
Synthetic bone block	1 (5.25%)
Metal Cage	1 (5.25%)

2. In the case of revision arthrodesis for non-union without significant bone loss, which fixation technique would you prefer?

Screws only	0
Standard Primary Plate	10 (52.5%)
Revision Plate	8 (42.2%)
Staples	0
Other	1 (Removal of metalwork) (5.25%)

3. In the management of symptomatic IPJ hypermobility after a 1st MTPJ Fusion, which surgical option would you choose after failed conservative management?

IPJ fusion	17 (73.9%)
Joint preserving realignment procedure	5 (21.7%)
Fusion of IPJ and take down of MTPJ	1 (4.3%)
Terminalisation	0

4. How would you manage a symptomatic worn out silastic 1st MTPJ arthroplasty (WITHOUT significant bone loss)?

Removal of implant only	1 (4.2%)
Revision with another implant	3 (12.5%)
Convert to fusion (WITHOUT bone block)	2 (8.3%)
Convert to fusion (WITH bone block)	17 (70.8%)
Convert to fusion (With CAGE)	1 (4.2%)

5. How many people consider MTPJ Arthroplasty in the appropriate patient?

Would consider it	8 (42.1%)
Would not consider it	11 (57.9%)

6. What is your preferred management of floating toe following a Weil's or DMMO osteotomy?

Don't operate - insoles, taping, stretches	0
Dorsal/Extensor release	0
Plantar plate repair	7
Flexor Transfer	6
PIPJ Fusion	12
Elevating revision metatarsal osteotomy	2
Other	13 (Plantarflexion osteotomy)

7. What is your preferred method of preventing floating toe during Weil's osteotomy?

Do nothing	0
Post-operative splinting only	0
Combine with extensor release	0
Elevating Weil's/Triple Cut Weils	6
Plantar Plate repair at the same time	1
Do DMMO Instead	5
Prophylactic flexor tenodesis +/- PIPJ Fusion	1
Other/Combination	19

There is a general consensus that no one technique is better, but a combination of techniques is required.

8. Does DMMO reduce the incidence of floating toes compared to open Weil osteotomies?

Yes	4 (21.1%)
No	0
It Depends	15 (78.9%)

9. Do you tape the toe post-operatively after Weil/DMMO osteotomies?

Yes, both for both procedures	8 (42.1%)
Weil osteotomy only	3 (15.8%)
DMMO only	8 (42.1%)

10. If you are taping - how long for Post-operatively?

2 weeks	5 (33.3%)
Up to 4 Weeks	3 (20%)
Up to 6 Weeks	4 (26.7%)
Beyond 6 Weeks	3 (20%)

11. In the case of a symptomatic non-union of a Weil's osteotomy, with metalwork failure. If operating, what would be the surgical procedure of choice?

Revision without bone graft	5 (31.3%)
Revision with bone graft + Screw	6 (37.5%)
Revision with bone graft + plate	3 (18.8%)
Excision of MT head	1 (6.3%)
Plate fixation without graft	1 (6.3%)

12. How do you manage recurrence of Morton's Neuroma (New Neuroma after surgical excision)?

Injection of Steroid as needed	0
Injection of other substance	2 (Cryo) (9.1%)
Revision neurectomy	15 (68.2%)
Nerve Transposition (into muscle)	3 (13.6%)
Refer to Nerve specialist	0
Other	2 (osteotomy, plantar plate repair, gastrocnemius release) (9.1%)

13. Do you routinely refer patients for Post-operative physiotherapy after lesser MT osteotomy?

Yes	3 (15.8%)
No	15 (78.9%)
It Depends	1 (5.3%)

14. Should you consider alternative causes of pathology in all causes of symptomatic Morton's neuroma

Yes	19 (100%)
No	0

15. Do you believe that Morton’s neuroma is usually associated with another biomechanical abnormality within the foot?

Yes	19 (100%)
No	0

16. Do you usually consider alternative surgical procedures (eg PMGR) prior to excising a Morton's neuroma to treat their symptoms?

Yes	9 (47.4%)
No	10 (52.6%)

Session 5: Achilles Tendon

Chaired by Lyndon Mason

5.1. Re-Rupture of the Achilles Tendon

Jitendra Mangwani

Introduction and Initial Thoughts

- Achilles tendon rupture is an increasingly common injury.
- The injury has several associated risk factors.
- With increasing changes in management, re-ruptures have become a surrogate marker of effectiveness of treatment.

Achilles Tendon Rupture

- **Incidence:** 40/100,000 person-years; increasing in men >30 years.
- **Demographics:**
  - Male predominance (5:1).[1]
  - Peaks in 3rd - 5th decades of life and after 50.
  - Higher incidence in Afro-Caribbeans.
- **Risk factors:**
  - Fluoroquinolones, local corticosteroid injections, tendinopathy.
  - High BMI, excess alcohol, diabetes, PVD, chronic steriod use.[1]
- **Mechanism:** Forced dorsiflexion, lunging, blunt trauma.[1]
- **Presentation:** Sudden "kicked in calf" sensation, loss of plantarflexion strength.
- **Diagnosis:**
  - Primarily clinical.
  - Dynamic Ultrasound Scan: measures gap, rupture location. Ideally in plantarflexion of the foot.
  - MRI: Usually reserved for chronic/degenerative or pre-operative planning.[2]
  - Ultrasound tissue characterisation: research tool.
  - Clinical exam more sensitive than MRI, the commissioning of MRI scanning locally may result in treatment delays.[3]

Treatment of Acute Rupture

- **Non-surgical:** Cast immobilisation, functional bracing.
- **Surgical:** Open, mini-open, percutaneous.
- **Institutional protocols:**
  - SMART (US-guided, equinus immobilisation).[4]
  - LAMP (Vacoped boot, staged functional rehab, no routine US).[5]
  - Many variations of the 2 basic protocos in individual institutions.

- **Evidence:**
  - Historically, surgery thought superior (lower re-rupture rates).[6]
  - Modern studies: With functional rehab, non-operative and operative options have similar re-rupture rates and functional outcome.[7]
  - Non-operation choices avoid the risk surgical complications (infection, nerve injury).

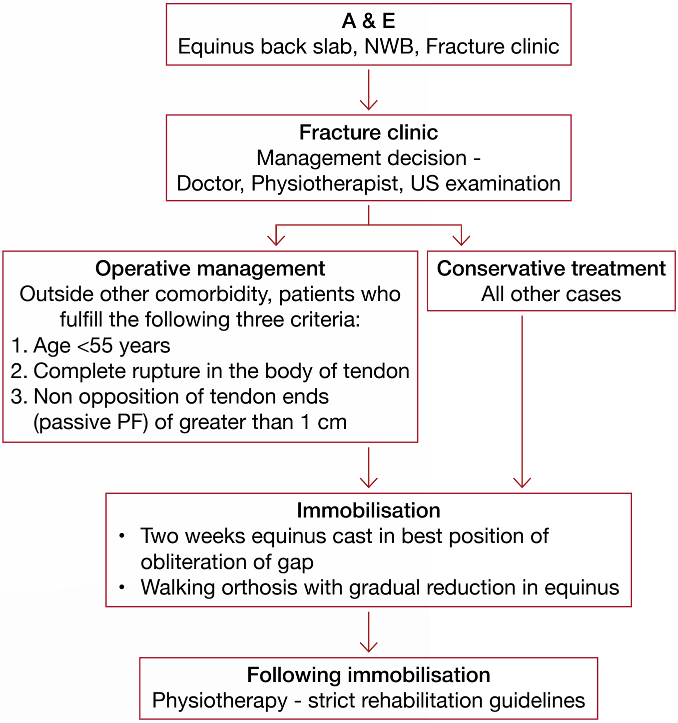

Figure - SMART Protocol for Achilles Tendon Injuries[4]

0 - 2 Weeks Post Injury	Clinical Assessment, No Routine Ultrasound Scan VacoPed™ Boot in 30 Degrees Equinus
4 Weeks Post Injury	Change of Liner of boot Dynamisation of VacoPed™ boot between 15-30 Degrees
6 Weeks Post Injury	Further Dynamisation from 0-30 Degrees
8 Weeks Post Injury	Re-assessment clinically Physiotherapy input for Achilles Tendon Rehabilitation protocol
12 Weeks Post Injury	Further assessment by physiotherapist Discharge

Figure - Leicester Achilles Management Protocol (LAMP)[5]

Achilles Tendon Re-rupture

- **Incidence:** Less common but significant complication.
- **Risk groups:** Men, especially <45 years.
- **Timing:** Typically, 3-6 months post-injury; median 98 days.[8, 9]
- **Late cases:** Documented up to 50 years later.
- **Risk factors:** Cast immobilisation, premature orthosis removal.[8, 9]
- **Patterns:**
  - True re-rupture (second discrete rupture).
  - Tendon elongation/stretching resulting in functional loss.
- **Diagnosis:** Primarily clinical; US/MRI for confirmation & planning.

Management of Re-rupture

- **Surgical treatment:**
  - Mini-open technique favoured: lower re-rupture and sural nerve injury rates.[10]
  - Open vs. percutaneous: similar re-rupture, fewer complications with open.[10]
- **Conservative treatment:**
  - Selected cases (good tendon apposition, subacute rupture).
  - Structured rehabilitation can be effective.
- **Evidence:**
  - Surgery lowers re-rupture risk but has higher infection risk.[11]
  - Non-op with functional rehab shows comparable outcomes in some cases.[12]
- **Adjuncts:**
  - Protein Rich Plasma (PRP): no proven benefit, in medium to long term outcomes.[13]
  - Early weight-bearing/controlled motion supported.[12]
  - Early orthosis removal can be a risk factor for increased re-rupture risk.[9, 12]

Summary

- Re-rupture outcomes **inferior** according to evidence compared to primary rupture.
- Lower patient outcome scores and persistent deficits are apparent, compared with initial rupture.
- Non-operative management of some subacute re-ruptures could lead to comparable outcomes, but overall long-term results poorer.

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5.2. Assessing the Gap and Psychology of Achilles Rupture

Lyndon Mason

Assessing the Tendon Gap

- The reliability of imaging in assessing the tendon gap after an Achilles rupture remains controversial.
- Ultrasound (US) is widely used and has good sensitivity for detecting ruptures, but its value in accurately measuring the tendon gap is questionable.
- Studies report that the sensitivity of ultrasound ranges from 79.6% to 100%, yet the reproducibility of gap measurements is poor due to technical factors such as probe positioning, gain settings, and whether the ankle is imaged in plantarflexion or dorsiflexion.[1]
- Posterior acoustic shadowing and transducer misalignment can easily lead to under-or overestimation of the gap.

Evidence

- Importantly, multiple clinical trials and systematic reviews have shown no consistent correlation between the measured tendon gap and patient outcomes.[2]
- Protocols such as the Copenhagen Achilles Rupture Treatment Algorithm (CARTA) have failed to demonstrate a meaningful link between gap size and treatment success.[3]
- Inter-operator variability is high, with differences of up to 3 cm in measurement reported, even in normal tendons.[4]
- As a result, the consensus is that tendon gap measurements should not dictate management decisions between surgical and non-surgical pathways, unless more standardised methods are established.

Psychology and Return to Sport

- The psychological impact of an Achilles rupture plays a major role in recovery and the likelihood of returning to sport.
- While elite athletes show return-to-sport rates of around 60-65%, they often perform at a lower-level post-injury, with measurable declines in metrics such as tackles or scoring ability in professional leagues.[5]
- In non-elite athletes, return rates are even lower, with one large cohort showing only 41% resuming their sport, typically after 7-12 months.[6]

Psychological Readiness

- Psychological readiness is a critical factor in determining return to play.[7]
- Tools borrowed from anterior cruciate ligament (ACL) rehabilitation research show that motivation, confidence, and mental preparedness strongly influence outcomes.[7]
- Local data displayed fear of re-rupture is the most significant psychological barrier, and many patients who never return to sport have functional scores like those who do. In other words, psychological factors often outweigh physical limitations.

Positive Influencing Factors

- Younger age and strong athletic identity are associated with a greater likelihood of return to sport.
- Conversely, individuals with lower psychological readiness or high kinesiophobia (fear of movement) often avoid resuming activity despite being functionally capable.

Summary

- **Ultrasound gap measurement is inconsistent and not a reliable guide** for surgical versus conservative treatment decisions.
- **Clinical examination remains central** in assessment, with imaging mainly used to rule out other injuries.
- **Psychological readiness and fear of re-injury are central determinants** of whether patients return to sport, sometimes more than functional recovery itself.
- Incorporating **psychological assessment and support into rehabilitation pathways** may improve outcomes, much as is now standard in ACL injury management.
- Return to sport expectations should be individualised rather than based on generic percentages.

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5.3. Wound Dehiscence and infection after Achilles Tendon Repair

Krishna Vemulapalli

Introduction

- Achilles tendon surgery is widely offered to patients in the UK.
- Current trends have moved toward more viable non-surgical options.
- Despite this, there is a role for surgical management of Achilles ruptures.
- Risk and complication management should be addressed in patients prior to undergoing surgery.

Analysis of Wound Dehiscence Causes and Surgical Literature

Incidence and Techniques

- Wound dehiscence in orthopaedics is relatively uncommon but **higher in Achilles tendon repairs**, especially with **open techniques**.[1]
- **Mini-open and percutaneous methods** have lower rates (2-4%) compared to **direct posterior** incisions (up to 10.5%).[1, 2]

Risk Factors

These are classified into:

1. **Non-modifiable:** age, diabetes, vascular disease, steroid use, gender (female > male), etc.
2. **Medical:** electrolyte imbalances, cardiac issues, renal/liver disease.[3]
3. **Modifiable (surgical):**
   - **Operating time:** Longer surgeries and tourniquet time (>60 minutes) increase risk.[4]
   - **Surgical approach:** Open vs mini-open vs percutaneous; longitudinal vs transverse incision.[2]
   - **Suture material:** Non-absorbable braided sutures (e.g., Ethibond) are linked to higher infection rates.[5]
   - **Immobilisation:** The degree of **plantar flexion** post-op influences healing.[4]

Surgical Recommendations Based on Literature

- **Mini-open technique** is superior in terms of healing and functional outcomes.[6]
- A **midline longitudinal incision** is preferable to minimise vascular disruption.[7]
- **Avoid braided non-absorbable sutures**, which may provoke foreign body reactions and infection.[8]
- **Immobilise in 20° plantar flexion:** Studies show this angle allows optimal tissue perfusion; more extreme positions reduce oxygen delivery.[9]

Anatomical Considerations

- Knowledge of **angiosomes** (vascular territories) is crucial. The posterior Achilles area is supplied by **peroneal and posterior tibial arteries.**[10]
- Direct posterior approaches are more reliable for flap planning, and **lazy-S incisions** are useful when extending into the calcaneal region.[11]

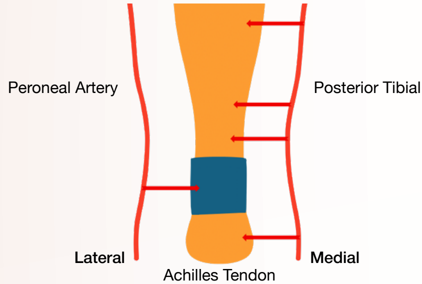

Figure - displaying the supply around the Achilles tendon.[10]

Summary

- Even in young, healthy patients, surgical complications can be devastating.
- Surgeons must:
  - **Minimise modifiable risks,**
  - Use **mini-open, midline longitudinal incisions,**
  - Avoid high-risk suture materials,
  - Keep **operative and tourniquet times short,**
  - **Immobilise appropriately** post-op to support perfusion and healing.

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Consensus Questions

1. Should USS routinely be used in all Acute Achilles Tendon Ruptures?

Yes	10/19
No	9/19

2. Is the gap measures on USS in Achilles tendon ruptures reliable?

Yes	0/19
No	19/19

3. What position should the foot and knee be in to measure the gap?

Knee Flexed, Ankle Plantarflexed:	0/19
Knee Extended, Ankle Plantarflexed:	14/19
Knee Extended, Ankle in Neutral:	0/19

4. Should the foot be put in dorsiflexion during gap measurement?

Yes	0/19
No	19/19

5. What size gap would change your management from non-surgical to surgical?

5.0mm	0
1.0cm	6/19
1.5cm	7/19
2.0cm	6/19

6. When would you expect a return to high impact activity after Achilles tendon treatment (Operative or Non-operative)?

3 Months	0/19
3 Months	8/19
9 Months	7/19
12 Months	4/19

7. Are the rates of re-rupture equivalent between conservative functional treatment and surgery?

Yes	11/19
No	8/19

8. Should all re-ruptures undergo surgical reconstruction?

Yes	0/19
No	19/19

9. What imaging is routinely required for re-rupture?

None	0/19
Ultrasound Scan	7/24
MRI Scan	14/24
Multiple Modalities	3/24

10. What suture material do you use for Achilles Tendon Repair?

Monofilament	8/19
Braided	11/19
Absorbable	15/19
Non-Absorbable	4/19

11. What incision do you use for Achilles tendon repair?

Midline	11/19
Paracentral	4/19
Other (Mini-open, Transverse)	4/19

12. What position do you put your foot post-surgery?

Full Plantarflexion	1/19
Mid-Equinus	18/19
Neutral	0/19

Session 6: Midfoot Hindfoot and Ankle

Chaired by Rod Hammett

6.1. Failed Flat Foot Correction

Rod Hammett

Introduction & Initial Thoughts

- Initial thoughts were that a failed flat foot correction would simply result in fusion.
- The topic however is more complex, involving understanding why failures occur and how to avoid or manage them.
- Surgical approaches have evolved from a "fixed menu" for all patients to tailored, patient-specific strategies.

What Does Failure Mean?

- **Radiographic failure:** Poor correction of measured angles.
- **Clinical failure:** Patient still experiences symptoms like pain or functional limitation.
- Clinical relevance is key: no symptoms = no intervention needed.

Common Modes of Failure

- **Under-correction:** Most frequent cause.[1]
- **Failure to recognise components of deformity** (e.g., rigid deformities, coalitions).
- **Over-correction:** Rare but documented.[2]
- **Non-union/Mal-union:** Previously discussed complications.
- **Soft tissue failure:** tendon transfers or persistent equinus contracture putting stress on repairs.
- **Degenerative joint disease:** Leads to ongoing pain and dysfunction.

Strategies for Avoiding Failure

- Identify **rigid deformities** and **coalitions** early.
- Beware of **deltoid ligament insufficiency** which can cause ankle failure post foot surgery.
- Monitor **medial column stability;** failure here often requires extended fusion and has poorer outcomes.
- Always assess and correct **equinus contractures** (tight Achilles/gastrocnemius).

Approach to Failed Flat Foot Reconstruction

A. Non-Operative Management

- Orthoses and appropriate footwear.
- Physiotherapy targeting dynamic stabilizers.
- Achilles and gastrocnemius stretching.
- Pain control (analgesics, steroid injections for degenerative joint disease).
- Ongoing follow-up for progressive conditions.

B. Clinical Assessment

- Understand the patient's primary complaint (pain, deformity, footwear problems, bony prominences).
- Review past treatments and deformity evolution.
- Investigate for infection, soft tissue quality, inflammatory disease, or hypermobility.
- Assess alignment and leg length to look for any abnormalities utilising imaging as necessary and available. (MRI helpful; CT if available).
- CT scan for non-union.
- Weightbearing CT for alignment, dynamic deformities and sub-fibular impingement.[3]
- MRI for arthrosis and medial soft tissue restraints.
- Correct modifiable risk factors.
- Evaluate skin and scar quality for surgical approach planning.
- Plan which structures may need releasing and tightening.
- Consider implant removal if prior hardware complicates surgery.
- Decide on implants and bone grafting needs.
- Assess arthritis severity to determine joint-preserving surgery vs. arthrodesis.
- Identify and correct residual deformity components ideally at the CORA: hindfoot valgus, midfoot abduction, forefoot position.

Correcting Specific Deformities

A. Hindfoot Valgus

- Even slight heel valgus reduces functional outcomes (>5mm).[4]
- Causes: tibio-talar joint collapse, deltoid ligament failure (assessed by talar tilt and Meary’s angle).
- Treatments: deltoid reconstruction, heel shift osteotomy may avoid need for fusion.[5]
- Beware malunions from previous subtalar fusions.

B. Midfoot Abduction

- Corrected effectively with **lateral column lengthening**, an underused but powerful technique.[6]
- Normally indicated if talar head uncoverage of >40%.

- Potentially high complication rates with concerns regarding overstuffing of the CCJ and lateral column.[7]
- If previous fusion leads to abnormal foot orientation an osteotomy may be required.
- Consider closing wedge osteotomy medially through fusion sites (TNJ).

C. Forefoot Position
- Can be addressed via TMT fusion, Cotton osteotomy (proximal and powerful), or navicular-cuneiform arthrodesis (powerful de-rotation).[8]
- Unrecognized unstable medial columns often lead to poor outcomes after extended medial column fusions.[9]

When to Fuse?

- Multiple failed attempts at joint preserving surgery.
- Significant degenerative joint disease.
- The decision is case-specific and often debated.

Final Thoughts

- Failed flat foot surgery requires nuanced understanding of deformities, patient symptoms, and surgical options.
- Avoid repeating failed procedures blindly; strive for individualized, joint-preserving strategies when possible.

Summary

- **Failure in flat foot correction is mostly due to under-correction and missed deformity components.**
- Clinical failure (symptoms) matters more than radiographic appearance.
- Key causes of failure: persistent Achilles contracture, deltoid insufficiency, medial column instability, and degenerative arthritis.
- Non-operative management remains important, and follow-up is essential for progressive conditions.
- Surgical planning must consider deformity correction, soft tissue quality, implant management, and arthritis severity.
- Hindfoot valgus, midfoot abduction, and forefoot alignment are critical deformity components to correct.
- Joint-preserving surgery is preferable when feasible; fusion reserved for salvage.
- Individualized patient assessment and careful surgical planning optimize outcomes.

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6.2. Recurrence after Pes Cavus Correction *Karan Malhotra*

Introduction

- Recurrence after pes cavus surgery is a complex and challenging issue.
- Current literature lacks high-quality evidence (mostly level 5 or "expert opinion").

The 4 Key Goals in correcting pes cavus;

1. **Put the hindfoot under the body.**
2. **Get the foot flat on the floor.**
3. **Restore the tripod foot support.**
4. **Balance the muscles around the foot.**

How to Achieve This

Prepare tendon transfers and release all necessary soft tissues.

- Correct bony deformities in the hindfoot, midfoot, and forefoot.
- Fix and tension the tendon transfers properly.

Why are Cavus Feet Difficult?

- Cavus deformities are **complex 3D deformities**, they are dynamic, and they progress over time.
- They appear differently depending on imaging, angle, and timing.
- Often, the foot is stiff (unlike flexible flat feet).
- Bone anatomy is abnormal, with variations in shape, curvature, and hypoplasia. Soft tissue and muscle imbalances contribute to deformity and recurrence.
- No two cavovarus feet are the same.

Reasons for Recurrence in Adults

Static:

- Inadequate soft tissue releases.
- Insufficient or improperly located bony correction - correction not at the CORA.

Dynamic or time-based:

- Unbalanced muscles or loss of muscle tension over time.
- Failure to address dynamic and time-progressive aspects of deformity.[1]

Anatomy and Deformity Patterns

Key Points

- Pes cavus involves hindfoot varus, forefoot pronation, toe deformities, and foot drop.
- Tibialis anterior, Peroneus brevis and the extensors are weak in CMT.
- Mechanical axis misalignment leads to abnormal ground reaction forces.

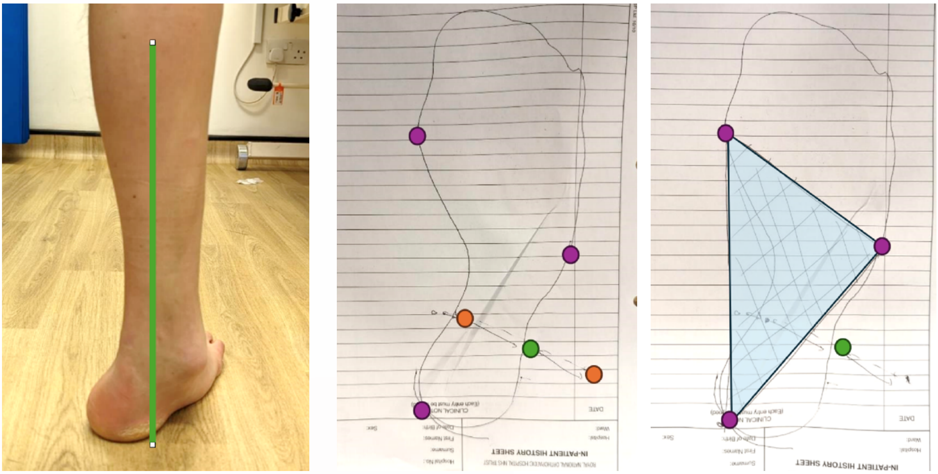

Figure - Green line represents mechanical axis of the limb. Ground reaction force will be at the centre of the patient's stable base. Central green dot represents centre of the talus. When green dot is outside stable base it needs correcting when performing surgery.

- Bone shapes differ due to neuromuscular causes (Wolf's law effect). Calcaneus is curved compared to normal anatomy. Hypoplasia present around talar head and navicular.[2]
- The **Center of Rotation of Angulation (CORA)** often lies near the navicular-cuneiform joint, not where we traditionally cut.
- The first ray pronation is often due to problems with the shape of the medial cuneiform itself, not the joint.[3,4]
- Forefoot deformities also important and different abnormalities are underappreciated.

Forefoot Morphotypes (Types)[5]

- **Type 1 (60%):** First ray planatarflexed, rest of foot normal.
- **Type 2 (20%):** Multiple rays planatarflexed (2nd and 3rd in addition to the 1st ray).
- **Type 3 (10%):** Foot adducted.
- **Type 4 (10%):** No deformity.

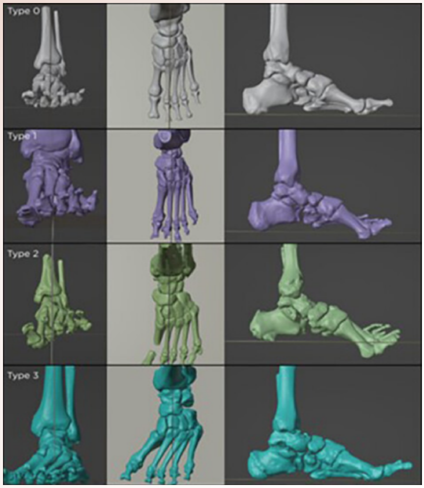

Figure - Different forefoot morphotypes identified using WBCT.[5]

Preventing Recurrence: Setting Up for Success

- Assess stiffness: fusion is preferable if goals can't be met with flexible corrections.
- Soft tissue: Aim is to reduce the TNJ.
- Release tibialis posterior and spring ligament if necessary (except certain types like CMT type 2).
- CMT type 2 patients develop problems later in life and tend not to have same degree of deformity, therefore at risk of overcorrection if spring ligament is released.
- Plantar fascia release has no bearing on TNJ reduction.
- Bony correction: take a wedge (lateral closing) in calcaneal osteotomy due to bone curvature to restore normal axis.
- Midfoot: treat deformities appropriately; avoid anterior ankle impingement from improper corrections.
- Forefoot: address morphotype-specific deformities with osteotomies or fusions (e.g., dorsiflexion osteotomy, TMT joint fusion).

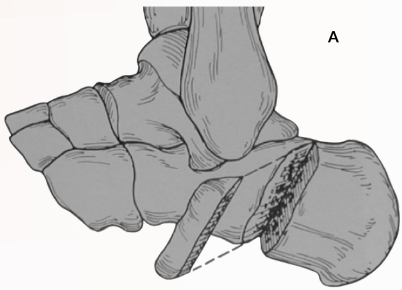

Figure - Schematic of wedge calcaneal osteotomy to restore normal axis of calcaneum.

-Type I: Treat with 1st ray dorsiflexion osteotomy.

-Type II: May require multiple dorsiflexion osteotomies (look for callosities under associated plantarflexed rays). Options include BRTs or TMTJ fusions.

-Type III: Minimal TNJ overcoverage. Remain adducted when TNJ is reduced. Often a multiplanar deformity which required a proximal de-rotation osteotomy. Performing at NCJ spares Chopart's.

- Tendon transfers: balance between dorsiflexion (more medial transfers) and eversion (more lateral transfers); use split tendon transfers; secure tendon to bone or tendon with appropriate tensioning.
- Tendon to bone - easy to perform but may pull out in soft bone.
- Tendon to tendon - harder to perform but potentially more durable and natural. Needs proper tensioning.
- Be aware patient may currently have preserved dorsiflexion, but this may reduce over time.

Managing Recurrence

- Thorough assessment including clinical exam, weight-bearing CT, and MRI.
- Identify root cause of failure: soft tissue, bony correction, or muscle imbalance. Was the correction ever right?
- Be prepared for challenges: scar tissue, altered neurovascular anatomy, stiff joints.
- Reoperate by correcting previous errors: revise osteotomies with wedges, consider fusion if needed.
- Tendon transfers in revision may require bridle configurations due to scarring, weakness and loss of length. Need for tendon-to-tendon transfer may increase.
- Use the same principles as primary surgery but with increased caution and planning.

Take-Home Messages

- The goal is a **foot under the body**, flat on the floor, with a **stable tripod** and **balanced tendons.**
- Don't hesitate to perform fusions if flexible corrections cannot achieve goals.
- Surgical management is complex; proper deformity assessment is essential.
- When recurrence occurs, the same fundamental principles apply to revision surgery.
- Surgical success depends on addressing both static and dynamic aspects of deformity.

Summary

- Recurrence after pes cavus surgery is due to inadequate soft tissue release, bony correction, or muscle balancing.
- The 4 fundamental goals: position hindfoot correctly, flatten foot, restore tripod, balance muscles.
- Pes cavus deformity is 3D, dynamic, and often stiff with abnormal bone shapes.
- Forefoot deformities vary; proper classification helps tailor treatment.
- Fusion is better than flexible correction if surgical goals aren't met.
- Tendon transfers should be balanced, considering dorsiflexion and eversion needs.
- Revision surgery is more challenging but follows the same principles; plan carefully.

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6.3. Ankle Cysts after TAR

Andy Goldberg

Introduction

- Osteolysis is a major problem after ankle replacement.
- The immune response to wear particles leads to bone cysts and osteolysis.
- High joint fluid pressure (comparable to a car tyre) contributes to cyst formation.

Pre-Existing Bone Cysts

- Many patients (around 78%) have cysts visible on preoperative CT scans before ankle replacement. 30% of these are >5mm in size.
- Standard X-rays often miss these cysts (up to 60%), so 3D imaging like CT is crucial.[1]
- Pre-existing cysts may be part of osteoarthritis and relate to fluid pressure under cartilage breaks.

Types and Timing of Osteolysis

- **Mechanical Osteolysis:** Often caused by stress shielding, tends to be non-progressive and cysts relatievly small.
- **Biological Osteolysis (Particle Disease):** Occurs later, progressive, caused by immune response to implant wear particles, and cysts tend to be larger.[2]
- Early cysts are usually stable; late-stage cysts tend to worsen.
- Around 40% of patients show osteolysis within 4 years post-op, though definitions vary across studies.[3]

Role of Joint Pressure and Capsule

- Fluid pressure inside the ankle joint can cause fluid to penetrate exposed bone areas, like the Geyser effect.
- Intact joint capsule post-surgery may result in higher joint pressures, thus contributing to cyst formation.
- Implant type and capsule response (e.g., thickening) may influence failure risk.

Particle Disease and Biomaterials

- Wear particles cause inflammation mediated by RANKL pathways, affecting bone resorption.[4]
- Although earlier studies suggested ankles behave differently, newer research shows ankles do experience particle disease similarly to hips and knees.[5]
- Advances in polyethylene materials (highly cross-linked, vitamin E stabilized) may reduce wear.
- Joint size and load (ankle experiences higher loads than knee/hip) may influence wear and osteolysis timing.[6]

Malalignment and Instability

- Malalignment strongly correlates with worse cyst formation and implant failure.[7]
- Rotational and mechanical instability (due to ligament damage) increases wear and cyst development.
- Mobile bearing implants can “pump” polyethylene debris into bone cracks, worsening cysts.
- Early detection and correction of malalignment/instability are critical to prevent progression.

Diagnosis

- CT scans are the gold standard for detecting cysts and osteolysis.
- Routine 3D imaging pre- and post-op is essential to differentiate new cysts from old.
- SPECT CT has limited utility due to cost and radiation.

Treatment and Management

- Bone grafting cysts shows limited success; ~40% fail by 4 years if underlying causes are not addressed.[8]
- Malalignment must be corrected before or along with grafting; grafting alone is often insufficient.
- Bone graft options include fresh femoral head allograft (preferred for large osteolytic cysts) over synthetic materials.
- Grafting at the time of ankle replacement for existing non-osteolytic cysts is advisable and fresh allograft is not necessarily required for these.

- Emerging research is investigating medical therapies (e.g., bone metabolism drugs) but evidence is not conclusive.

Genetic and Other Factors

- Genetic predispositions (e.g., pseudoxanthoma elasticum, hemochromatosis) may influence cyst formation.
- Understanding patient-specific risk factors remains an area for further research.

Summary and Recommendations

- Always perform preoperative 3D imaging (CT) to identify cysts and plan accordingly.
- Early cysts likely due to mechanical stress shielding; late cysts related to fluid pressure and malalignment.
- Avoid leaving exposed bone surfaces during surgery to minimize fluid ingress and cyst formation.
- Correct malalignment and instability early - don't delay intervention.
- Grafting without addressing biomechanical issues often leads to failure.
- Regular monitoring with CT scans is necessary to detect progression if there are concerns.
- New biomaterials and medical treatments hold promise but require further study.

Summary

- Osteolysis and bone cysts after ankle replacement are common and multifactorial.
- Pre-operative 3D imaging is essential to detect pre-existing cysts often missed on X-rays.
- Mechanical stress shielding causes early, often stable cysts; late cysts are driven by fluid pressure and implant wear.
- Malalignment and instability significantly worsen outcomes and must be corrected early.
- Polyethylene wear particles trigger immune responses causing bone resorption (particle disease).
- Grafting cysts alone is not effective if biomechanical issues persist; combined treatment is necessary.
- Early intervention improves long-term outcomes; delaying treatment risks implant failure.

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6.4. Loosening and Suspected Loosening of Total Ankle Replacements

Hiisham Shalaby

Rising Incidence of Total Ankle Replacement Loosening

- Ankle replacements are on the rise globally.
- UK data: TAR numbers doubled in the last 10 years.[1]
- Italy data: numbers increased tenfold in the last 20 years.[2]
- The trend suggests these numbers will continue to increase.
- With more primary replacement, revisions and complications are becoming more common.

Complications and Outcomes

- Multiple studies map out complication rates and types.
- Data from the Infinity study shows 2-5 year complication rates with slight improvement attributed to the learning curve, not necessarily fewer complications.
- PJI rates range from 0.4-2.2%.[3, 4]
- Common complications include:
  - Malalignment
  - Instability
  - Intra-operative and Post-operative fractures
  - Wound problems
  - Post-operative pain
  - Superficial and deep infection
  - Pathology in adjacent joints

Assessment of Painful Total Ankle Replacements

1. Clinical Assessment:
   a. Stability and alignment are critical.
   b. Look for signs of septic vs. aseptic loosening (infection or no infection).
   c. Infection can be obvious but often is subtle.

2. Imaging:
   a. X-rays
      i. Radiolucency (signs of loosening)
      ii. Cysts
      iii. Subsidence of the implant
      iv. Heterotopic ossification

v. Changes over time via serial x-rays

3. Blood Tests:
   a. C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR) are commonly used.
   b. CRP shown to have 84.9% sensitivity for PJI when >9.6 mg/L and ESR 75.1% sensitivity when > 29mm/h.[5]
   c. Debate over the value of other blood markers.
   d. Synovial fluid CRP and white blood cell counts can aid diagnosis.

4. Joint Aspiration:
   a. Often debated:
      i. Should it be done under ultrasound guidance?
      ii. Should lavage and aspiration be combined?
      iii. Volume of aspirate is crucial for culture sensitivity but often clinical practice yields insufficient volume (drops rather than mL).[6]
   b. Synovial CRP may help identify infection in ambiguous cases.[7]

5. CT Scan:

Useful in:
- Confirming loosening.
- Assessing size of cysts.
- Evaluating bone stock.
- Pre-operative planning including use of Prophesy/Inbone implants.

Diagnosing Infection

- Many patients fall into a “not sure” category for infection where there is a degree of clinical uncertainty.
- If clinical suspicion is low, bloods normal, mechanical symptoms dominate, and aspirate is negative or dry, infection is unlikely.
- Otherwise, infection must be seriously considered.

Treatment Strategies

1. Clear Non-infected Cases:
   a. Single-stage revision surgery can be performed safely.
   b. Studies report very low infection rates following single-stage revision where there was a low index of suspicion for infection.[8]

2. Uncertain or Infected Cases:
   a. Two-stage revision is often preferred.
   b. Pooled eradication rates of 1 and 2 stage revision 92-95%.[9]
   c. Treatment options include:

i. Revision to another ankle prosthesis
ii. Fusion (arthrodesis)
iii. Amputation (in severe, unmanageable infections or tissue loss)

3. Debridement Antibiotic and Implant Retention (DAIR):
   a. More common in the USA.
   b. Suitable primarily for acute infections (within 28 days).
   c. Not recommended for chronic infections.
   d. Data comparing DAIR with single-and two-stage revisions is heterogeneous and inconclusive.[9]

Fusion after Failed Ankle Replacement

- Fusion rates after failed primary ankle arthroplasty:
  - 96% survival at 1 year
  - 77.5% survival at 3 years (survival means no further revision or amputation)[10]
- Fusion is considered a salvage procedure with moderate success and complication rates.
- PROMS in the fusion groups are like those in the revision TAR patients.[11]
- TTC (tibiotalocalcaneal) fusion subgroup has a lower success rate (50%) and is a challenging group, especially with large bone defects.[12]

Managing Large Bone Defects

- Increasingly common with complex revisions.
- Emerging technologies like custom 3D-printed implants show promise.
- Survival rates at 12 years around 67% in early studies.[13]
- These implants may help manage large cavitary defects and osteonecrosis.

Infection Eradication Outcomes

- Definitions vary with some defining eradication as no further surgery needed.
- Common infecting organisms: methicillin-sensitive Staph aureus and coagulase-negative Staph.
- Eradication success rates[14]:
  - 84.4% with two-stage revision
  - 79.4% after revision to arthrodesis
  - 58% after DAIR

Amputation

- Reserved for patients with:
  - Diabetes
  - Soft tissue loss
  - Severe microbial infections
  - Failed multiple revisions or late-presenting infections
  - Unable to tolerate complex revision surgery
- Around 7.2% of patients with deep infection after TAR may require amputation.[9]

Controversies and Challenges

- Diagnosing infection remains controversial.
- Optimal management strategies vary widely.
- Increasing complexity of cases with multiple revisions and bone loss complicates treatment decisions.
- More research and consensus are needed.

Summary:

- **Increasing Rates:** Total ankle replacement revisions for loosening are rising worldwide.
- **Complex Complications:** More revisions mean more frequent and complex complications.
- **Assessment:** Careful clinical, imaging, blood tests, and aspiration are essential, though each has limitations.
- **Infection Diagnosis:** Often unclear, with many cases falling into an uncertain category.
- **Treatment:**
  - Non-infected cases may undergo single-stage revision.
  - Uncertain or infected cases generally require two-stage revision or fusion.
  - DAIR has limited but defined indications.
  - Amputation is a last resort.
- **Fusion:** Salvage fusion is moderately successful but has risks of failure and reoperation.
- **Large Bone Defects:** Custom 3D implants offer new hope for managing severe bone loss. This is controversial in cases of infection.

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Consensus Statements

1. Should motion preservation surgery should be performed where possible in failed flatfoot correction surgery?

Yes	16/16 (100%)
No	0/16

2. Should WB CT Scan be considered for surgical planning in the context of failed surgical reconstruction?

Yes	13/16 (81.25%)
No	3/16 (18.75%)

3. Do you have access to WB CT Scanning facilities?

Yes	1/16 (6.25%)
No	15/16 (93.75%)

4. Is heel position is the most important factor to correct in revision for failed flat foot surgery?

Yes	11/16 (68.75%)
No	5/16 (31.25%)

5. Is Meary's Angle the most important factor to correct in revision for failed flat foot surgery?

Yes	3/16 (18.75%)
No	13/16 (81.25%)

6. Is the tripod is the most important factor to correct in revision for failed flat foot surgery?

Yes	16/16 (100%)
No	0/16

7. In the case of recurrence after in a presumed idiopathic cavus recurrence - should further attempt to neurological diagnosis be considered?

Yes	13/16 (81.25%)
No	3/16 (18.75%)

8. In the case of recurrence after in a presumed idiopathic cavus recurrence, should motion preserving surgery be performed where possible?

Yes	16/16 (100%)
No	0/16

9. In the case of recurrence after a presumed idiopathic cavus recurrence - WB CT would be desirable for surgical planning in the context of a failed reconstruction?

Yes	14/16 (87.5%)
No	2/16 (12.5%)

10. PSI Guides should be considered for complex primary and revision cases?
    Yes 15/16 (93.75%)
    No 1/16 (6.25%)

11. Should complex multiplanar foot deformities be discussed in regional MDTs?
    Yes 15/16 (93.75%)
    No 1/16 (6.25%)

12. In the case of recurrence after in a presumed idiopathic cavus recurrence - The preferred calcaneal osteotomy technique is a closing wedge or pure translation?
    Closing wedge 16/16 (100%)
    Pure translation 0/16

13. In the absence of sufficient tendon strength (according to traditional rules of tendon transfer) is it still acceptable to still use a tendon transfer as a tenodesis?
    Yes 15/16 (93.75%)
    No 1/16 (6.25%)

Ankle cysts after TAR

14. Pre-operative CT Scanning for primary TAR patients should be advisable.
    Yes 15/16 (93.75%)
    No 1/16 (6.25%)

15. If an Ankle replacement presents 3 years post-op with progressive osteolysis in an asymptomatic patient with 10-degree malalignment of tibial component on radiographs, do you:
    A) continue to observe until they become symptomatic 0/16
    B) recommend early bone grafting 0/16
    C) recommend revision surgery to correct malalignment) 6/16 (37.5%)
    D) (A) then (C) 10/16 (62.5%)

16. Should an aspiration of the joint always be performed in the investigation of painful TAR?
    Yes 15/16 (93.75%)
    No 1/16 (6.25%)

17. Single stage revision should be considered in the case of proven infection in TAR

Yes	0/16
No	16/16 (100%)

18. 2-stage revision to another TAR should be considered in the case of proven infection in TAR

Yes	16/16 (100%)
No	0/16

19. In an infected TAR - How long would advisable between the two stages?

2 Months	0/16
3 Months	9/16 (56.25%)
>3 Months	7/16 (43.75%)

Notes

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Notes

Convened participants of the 2025 Round Table Meeting

Aamir	Junaid	Countess of Chester NHS Trust
Brown	Rick	Nuffield Orthopaedic Centre, Oxford
Chadwick	Carolyn	Sheffield Teaching Hospitals NHS Trust
Clayton	Rob	NHS Fife
Davies	Mark	Sheffield Orthopaedics Ltd
Duncan	Nick	Burton NHS Foundation Trust
Flatt	Ellie	Sheffield Teaching Hospitals NHS Trust
Goldberg	Andy	The Wellington Hospital
Hammett	Rod	Musgrove Park Hospital, Taunton
Madeley	Jane	Glasgow Royal Infirmary
Mahadevan	Dev	Royal Berkshire NHS Foundation Trust
Malhotra	Karan	Royal National Orthopaedic Hospital
Mangwani	Jitendra	University Hospitals of Leicester NHS Trust
Mason	Lyndon	Liverpool University Hospital NHS Foundation Trust
Nolan	Ciaran	Sheffield Teaching Hospitals NHS Trust
Prem	Hari	Royal Orthopaedic Hospital, Birmingham
Ritchie	James	Maidstone and Tunbridge Wells NHS Trust
Shalaby	Hisham	Edinburgh Royal Infirmary
Dishan	Singh	Course facilitator
Topliss	Claire	Morriston Hospital, Swansea
Trnka	Hans-Jörg	Foot Centre Vienna
Vemulapalli	Krishna	Barking, Havering & Redbridge Hospitals NHS Trust
Walker	Roland	Guys and St Thomas' NHS Foundation Trust
Williams	Tim	East Suffolk & North Essex Foundation NHS Trust