

**Methods:** This prospective study recruited 24 surgeons equally divided between plastic and orthopaedic surgery at different grades. Knowledge, training, confidence, speed and accuracy in posterior tibial artery perforator location were assessed on five healthy subjects using an 8-MHz hand-held Doppler. These five subjects also underwent colour duplex imaging to definitively locate these perforators. Data were compared between the specialities and the surgical grades.

**Results:** Knowledge of the location of posterior tibial artery perforators was correct in 63% of candidates. Twenty-nine percent had received training in this skill, and all trained surgeons felt competent in assessment. All participants perceived this to be a skill relevant to both plastics and orthopaedic surgeons.

At SHO, registrar and consultant grade, early data show the average time for assessment was 4 min 30 s, 4 min 26 s, and 4 min 45 s, respectively. Sensitivity for perforator assessment was 20%, 36% and 40%, with positive predictive values of 20%, 29% and 34%. There was no significant difference between orthopaedic and plastic surgeons. Training had no significant influence on perforator location.

**Discussion:** Preservation of arterial perforators is important for potential future soft tissue reconstruction. The hand-held Doppler is an operator-dependent tool, and our study suggests that it is unreliable at locating lower limb arterial perforators. We found training in the use of a hand-held Doppler did not improve accuracy. We suggest colour duplex imaging should be considered as a first line assessment tool when localising arterial perforators in lower limb trauma.

**Keywords:** Doppler; Lower limb trauma; Open fracture; Accuracy

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## 2A.4

### Management of gunshot injuries of the humerus

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Gunshot injuries of the humerus usually present with neurovascular injuries that require urgent attention as well as complex fracture patterns which are difficult to reduce and stabilise using internal fixation methods. This study looks at the fixation methods used for patients presenting with these injuries over the last 3 years. Implants used include broad dynamic compression plate (locking plates), condylar buttress plate and Y-plate (for more distal humeral intra-articular fractures), semitubular plates and intramedullary (IM) nails.

A total of 22 patients with a mean age of 27 years are included in this study, of which there were 18 males and 4 females. The range of presentation varied from 30 min to a few patients presenting several weeks after injury. Patients presenting late with heavily contaminated wounds were initially treated with surgical debridement and temporary splintage until wounds healed before final definitive fixation was carried out.

Most of the patients required autologous iliac bone graft, and two patients (9%) required tricortical bone graft. Twenty patients (91%) with humeral shaft injuries had wrist drop on presentation. Five of these made a full recovery without repair, whereas 6 patients (27%) required primary repair and 2 (9%) underwent tendon transfer for wrist drop.

20 patients (91%) went on to full bony union and achieved good post-operative ranges of movement. The average time to achieve union was 7 weeks, except for two patients (9%) who had their IM humeral nail removed and required sequestrectomy and delayed

tained intra-articular distal end humeral fractures (they had limited extension and flexion post-operatively).

**Keywords:** Gunshot; Humerus; Radial nerve injury; Y-plate

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## 2A.5

### The presence and pattern of vascular insufficiency in the older patient suffering an unstable ankle fracture: The relationship to skin and wound complications

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**Hypothesis:** Impaired vascularity of the skin in elderly ankle fracture patients causes the skin and wound complications.

**Materials and methods:** This is part of a RCT comparing ORIF and close contact casting (CCC) for isolated unstable ankle fractures in patients >60 years. Assessments over 6 months (i) transcutaneous O<sub>2</sub> saturation (TcPO<sub>2</sub>) of medial and lateral ankle skin; (ii) Ankle-Brachial Pressure Index (ABPI); (iii) three-vessel arterial duplex scan; (iv) distal calf perforator artery patency. The uninjured limb was the control.

**Results:** 89 patients eligible; 59 participated (76% female). 30 randomised to ORIF; 29 to CCC. Each had one death and one withdrawal. Vascular data available on 55. Two patients had delays in wound healing (>25% for >6 weeks). Two further developed wound infections. No skin breakdowns in CCC group. There was a reduced TcPO<sub>2</sub> on day 3 in the injured limb. The TcPO<sub>2</sub> rose at 6 weeks compared to day 3 (medial 58 mmHg; lateral 53 mmHg,  $p=0.002$ ) in the injured leg. At 6 months the TcPO<sub>2</sub> measurements were not different to uninjured leg. A critical TcPO<sub>2</sub> (<20 mmHg) found in four, correlated with skin problems ( $p=0.003$ ). Two of these had the only major delays in wound healing and one of the two wound infections.

94% of participants had normal ABPIs (>1.0). There was no difference between patients with or without an impaired ABPI (<0.7 mmHg) and wound problems ( $p=0.20$ ).

There was no difference in patent perforators between the injured and uninjured ( $p=0.39$ ).

**Conclusions:** Occult vascular insufficiency is present but at low incidence. ABPI and Duplex-US are insensitive for predicting infection or delayed healing. The ankle fracture injury does not disrupt the local perforators. TcPO<sub>2</sub> is sensitive and specific for predicting skin problems. Impairment of skin oxygenation is transient. Current TcPO<sub>2</sub> technology however is impractical as a clinical tool.

**Keywords:** Vascularity; Ankle fracture; Older people; Wound complications

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## 2A.9

### Is tibial pilon fracture primarily a soft tissue injury?

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**Introduction:** Management of tibial pilon fracture is controversial. Recently interest has been generated in minimally invasive techniques for fixation. Soft tissue damage seems to be the main concern in the treatment of these injuries. Should the management of tibial

pilon fractures be based primarily on soft tissue injury rather than bony injury? was the basis of our current study.

**Methods:** We analysed 41 isolated closed tibial pilon fractures that underwent surgical fixation with minimal invasive techniques over three years at a level 1 trauma centre. Fractures were classified using Rüedi-Allgöwer systems. Soft tissue injuries were classified as per Oestern and Tscherné classification system. Minimally invasive techniques utilised included percutaneous screw fixation, minimally invasive plate osteosynthesis and external fixation. Post-operative outcome including fracture healing, mobilisation and complications were correlated with the fracture type and soft tissue injury type. SPSS version 13 was used for statistical analysis.

**Results:** There was no statistically significant difference between the three Rüedi-Allgöwer groups for the method of fixation, fracture healing, complications and post-operative mobilisation. But there was a statistically significant difference between the soft tissue injury groups for the method of fixation, post-operative mobilisation, fracture healing and complications. Overall, extensive soft tissue damage resulted in poor functional outcome and delayed fracture healing. Fracture type did not affect these outcomes significantly. Minimally invasive techniques have provided good post-operative mobility and fracture union.

**Conclusion:** Soft tissue condition, rather than the fracture pattern, determined post-operative recovery in our cohort. Hence, management of these complex injuries should rely primarily on the soft tissue condition, rather than the bony injury. Therefore tibial pilon fracture should be considered as a soft tissue injury with a secondary bony injury.

**Keywords:** Tibial pilon fracture; Soft tissue injury; Minimally invasive techniques; Post-operative outcome

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## 2A.10

### The predictive value of the mangled extremity severity score for the severely traumatized upper extremity

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**Objective:** To identify if there is a value that can predict the ultimate viability of mangled upper extremity by using the MESS system.

**Methods:** 18 patients (16 male and two female, with mean age of 33 years old [range, 16–58 y/o]) with severely injured upper extremity met the inclusion criteria of this retrospective investigation. Inclusion criteria were the presence of associated high-energy skeletal and/or large calibre vascular lesions (defined as a mangled segment) requiring immediate intervention after hospital admission. The salvageability of the mangled upper limb was determined by the physicians who initially treated the patient based on their own decision-making. Fractures occurred in 77.8% ( $n = 14$ ) of the patients, arterial injuries in 88.9% ( $n = 16$ ), with nine combined arteriovenous injuries (50%), and major peripheral nerve damage in 72.2% ( $n = 13$ ). Five patients required primary amputation and two delayed amputation. Upper extremity injuries were retrospectively scored with the MESS system by reviewing medical charts and a comparison of our approach to limb salvage or amputation was compared to the MESS system for every score equal or superior to 7. Sensitivity and specificity of the MESS score were calculated.

**Results:** The MESS equal or greater than 10 accurately predicted successful salvage in 91% of the patients and agreed with amputation in

63%. The sensitivity was 0.7 and the specificity was 0.3. Of the eight patients with a MESS  $\geq 10$ , five had to be amputated. Of the three patients with a MESS  $\geq 10$  that did not require an amputation, there was a mean of four operative procedures during hospitalization. One of those patients died from septic complications and another had a non-functional upper extremity. The MESS  $< 10$  could predict 10 of the 11 limbs salvaged.

**Conclusion:** We recommend a high MESS cutoff score when approaching a mangled upper extremity. A MESS greater than or equal to 10 predicted amputation with a 70% specificity in this study.

**Keywords:** Amputation; MESS; Mangled extremity; Upper limb

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## 2B.1

2B: General Trauma—Soft Tissue Reconstruction

### Peroneal tendons plasty for lateral instability of the ankle: A new surgical technique

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**Introduction:** The pronation and supination of the ankle gives the human a very unique weight bear. This is shown in the ability for walking on uneven surfaces, climbing and dexterity for performing sports.

The stability of the ankle is not only provided by the anatomical configuration of the tibia, fibula and talus within the mortise but by the combined function of ligaments and muscles, too.

The chronic instability of the ankle precedes chronic pain, disability for daily living activities and leisure sports. This is a direct consequence of ligamentous injury as well as elongation and dysfunction of the peroneal tendons.

**Surgical procedure:** Skin longitudinal incision of about 7 cm. starting 4 cm above the tip of the lateral malleolus. The peroneus brevis and longus tendons are identified. A transverse incision over the tendinous part of both tendons is performed at the same level and 1 cm is excised from the substance of both tendons. The tendons are sutured together again with a Bunnel type suture. The surgical wound is sutured by layers. A Robert-Jones bandage is applied.

**Materials and methods:** We operated with this new technique in 83 patients, 15 patients were not included because they were lost to follow-up. We included 67 patients in this study (47 males, 20 females); 44 on the right side and 23 on the left. The average age was 24 years old ranging from 14–39. The average time of follow-up was 3 years ranging from 7 months to 10 years.

**Results:** We found excellent results in 88% of the patients, good in 12% and 0% bad results.<sup>1</sup> We had only one superficial infection and painful nodules over the surgical area of the tendons in 25% of the patients after surgery. These nodules disappear after 6 months.

**Discussion:** The peroneus tendons plasty, a technique not yet described in the literature, highlights the concept of dynamic and static stabilizers acting in the ankle joint. The technique is easy to perform and provides good results when compared with other surgical techniques described in the literature.

**Keywords:** Ankle; Instability; Treatment; Surgery