Message

The 4th issue of UOHJ is now ready. UOHJ continues to receive wide support from the residents who have contributed several articles. The journal has become an important arm of the UOHC Resident Training Programme with its popular “Residency Teaching Section”. The journal has also received good feedback from medical students on clinical attachment to the department for its “Examination on …” series.

In addition to its teaching section, the journal has now more articles and features in its social section to reflect the work-life balance of our residents.

I am confident that UOHJ 2015 will continue to receive good feedback from all its readers.

Associate Professor Aziz Nather
Editor
University Orthopaedics & Hand Journal
Editorial Board

EDITOR
Aziz Nather

DEPUTY EDITOR
Francis Wong Keng Lin

MEMBERS
Bernard Lau Pung Huh
Andrew Hong Choon Chiet

MEMBERS
Low Siew Leng
Eunice Mok
Joseph Thambiah
David Tan Meng Kiat

ASSISTANT MEMBERS
Tan Ting Fang
Nur Amalina Binte Anwar
Rachel Teo
Ma QianHui
Julia Cheong Ling-Yu

BUSINESS MANAGER
Sharona Chang

ADVISOR
Wong Hee Kit
Content

Message by Editor, UOHJ

Editorial Board

Content Page

List of Staff, UOHC

RESIDENCY TEACHING SECTION

• Clinical Orthopaedics Update

  Negative Pressure Wound Therapy – Muhammed Yaser Hasan, Rachel Teo, Aziz Nather, Division of Foot & Ankle

• Basic Science Update

  Biomechanics of Intramedullary Nailing – Khor Yuet Peng, Chee Yu Han, Division of Musculoskeletal Trauma

• Clinical Examination

  Examination of the Ankle & Foot – Andrew Hong Choon Chiet, Lee Wei Ting, Division of Foot & Ankle

  Examination of the Hand: A Systematic Approach – Jas Lee Chiat Tan, Amitabha Lahiri, Department of Hand & Reconstructive Microsurgery

• Operative Approach

  Anterior Approach to the Lumbar Spine – Bernard Lau Puang Huh, Dennis Hey Hwee Weng, University Spine Centre

  Kocher-Langenbeck Approach: for the Acetabulum – Ng Yau Hong, Diarmuid Murphy, Division of Musculoskeletal Trauma

• Operative Technical Note

  Pirogoff Amputation – Francis Wong Keng Lin, Ma Qian Hui, Aziz Nather, Division of Foot & Ankle

  Arthroscopic Flexor Hallucis Longus Transfer: For Chronic Achilles Tendon Rupture – Andrew Hong Choon Chiet, Lee Wei Ting, Tan Ken Jin, Division of Foot & Ankle

• Trauma Case Discussion

  Management of Posterior Hip Dislocation & Acetabular Fracture – Amritpal Singh, Gavin Kane O’Neill, Division of Musculoskeletal Trauma
• Orthopaedic Case Discussion

  Approach to Management of Cervical Spondylotic Myelopathy – Jonathan Tan
  Jiong Hao, Gabriel Liu Ka Po, University Spine Centre

• Clinico-Pathological Case Discussion: Cartilaginous Tumours – Sumon Salman Huq,
  Gurpal Singh, Division of Musculoskeletal Oncology

• Hand Case Discussion

  Carpal Tunnel Release: Beware the Anatomy – Rishi Malhotra, Mark Puhaindran,
  Department of Hand & Reconstructive Microsurgery

• Writing Research

  Choosing the Right Journal – Wee Lin, Aziz Nather , Division of Foot & Ankle

  Uncovering the Review Article – Ang Yi Yen Zest, Aziz Nather , Division of Foot
  & Ankle

Professorial Lectures

• V K Pillay Lecturer: Mr Colin R Howie, Edinburgh, United Kingdom

• R W H Pho Lecturer: Dr Richard A Berger, Mayo Clinic, USA

• N Balachandran Professorial Lecturer in Paediatric Orthopaedics: Dr In Ho Choi,
  Seoul, Korea

• Pesi B. Chacha Lecturer: Dr Todd J Albert, Thomas Jefferson University, USA

Research Awards

• Young Investigator Award: Hong Choon Chiet Andrew

• Oral Presentation Award: Tao Hu

Residents of UOHC

Residency Programme Awards 2015

List of Publications (January to December 2014)

Academic Medicine Department Award, NUHS

Lai Kah Weng, Division of Sports Medicine

Reports by UOHC Clinical Fellows 2014

UOHC Events

• Annual Giving Tree Event

• UOHC Cluster Retreat

Instructions to Residents
LIST OF STAFF, UOHC
LIST OF STAFF, UOHC

CHAIRMAN, UOHC: Professor Wong Hee Kit

DEPARTMENT OF ORTHOPAEDIC SURGERY

Head: Professor Wong Hee Kit

University Spine Centre
- Prof Wong Hee Kit
- A/Prof Gabriel Liu Ka Po
- A/Prof Naresh Kumar
- Dr Lim Jeong Hoon
- Dr Lau Leok Lim
- Dr Dennis Hey Hwee Weng
- Dr John Nathaniel Ruiz

Division of Hip & Knee
- A/Prof Wilson Wang Ee Jen
- Prof Satkunanantham Kandiah
- Asst Prof Lingaraj Krishna
- Dr Mark Chong Seng Ye

Division of Paediatric Orthopaedics
- Prof James Hui Hoi Po
- Emeritus Professor Lee Eng Hin
- Dr Andrew Lim Kean Seng
- Dr Peter Lee Yew Chung (Visiting Consultant)

Division of Shoulder & Elbow
- Prof V Prem Kumar
- Dr Bryan Tan Hsi Ming
- Dr Dennis Ng Zhao Wen

Division of Musculoskeletal Trauma
- A/Prof Joseph Thambiah
- Asst Prof Diarmuid Murphy
- Asst Prof Chee Yu Han
- Dr Gavin O’ Neill
- Dr Vinod Kumar Pannirselvam

Division of Musculoskeletal Oncology
- Dr Mark E Puhaindran
- Emeritus Professor Robert Pho Wan Heng
- Dr Gurpal Singh

Division of Foot & Ankle
- Prof Das De Shamal
- A/Prof Aziz Nather
- Adj A/Prof Christopher Pearce (Visiting Consultant)
- Dr Ajay Purushothaman Nambiar

Division of Sports Medicine
- Asst Prof Lingaraj Krishna
- Dr Lai Kah Weng
- Dr Priathashini Krishnasamy (Visiting Consultant)
- Dr Jimmy Chin (Visiting Consultant)
LIST OF STAFF, UOHC

CHAIRMAN, UOHC: Professor Wong Hee Kit

DEPARTMENT OF HAND & RECONSTRUCTIVE MICRO SURGERY

Head: Asst Prof Alphonsus Chong Khin Sze

Emeritus Professor Robert Pho Wan Heng
A/Prof Aymeric Lim Yu Tang
Dr Mark Edward Puhaindran
Dr David Tan Meng Kiat
Dr Amitabha Lahiri
Dr Sandeep Joseph Sebastin
Dr Andre Cheah Eu Jin
Dr Anthony Foo Tun Lin
Dr Peng Yeong Pin (Visiting Consultant)
Dr Tan Ter Chyan (Visiting Consultant)
Dr Lim Beng Hai (Visiting Consultant)
Dr Aaron Gan Wei Tat (Visiting Consultant)
**Negative Pressure Wound Therapy**

Muhammed Yaser Hasan  
Rachel Teo  
Aziz Nather  
Division of Foot & Ankle

**Introduction**

Negative-pressure-wound-therapy (NPWT) is a crucial technique used in the management of wounds today. It was first described by Charikar (1989) as an experimental technique for treating subcutaneous fistulas. However, it was clinical work by Argenta and Morykwas a decade later that allowed NPWT to gain recognition as a useful clinical tool for managing wounds.

Today, NPWT is well established for treating trauma wounds, general surgical wounds and diabetic foot wounds. Supporting evidence for NPWT for the treatment of diabetic foot wounds includes prospective and multi-centered randomised controlled trials. Yet, NPWT’s mechanism of action remains unclear.

This review focuses on the role of NPWT in the management of diabetic foot wounds—its basic science, application, clinical evidence and future developments.

**Basic Science**

Much of the understanding of basic science is built upon the work of Morykwas on animal models. NPWT is thought to facilitate an ‘ideal’ wound healing environment through the following mechanisms (Figure 1):
Improve local blood flow

NPWT is thought to improve dermal blood flow through vasomotor mediators. Morykwas showed that negative pressures of up to 125 mm Hg resulted in an increased blood flow in swine wound models. Similarly, Zoch found an increase in blood flow in diabetic foot wounds based on perfusionography measurements. Despite this, the ideal pressure level remains controversial. Some studies indicate that high pressure (>200 mm Hg) decreases blood flow. However, others contend that high levels of negative pressure will in the long term increase blood flow.

Induce macro-deformation

Direct macro-deformation induced by NPWT leads to wound contraction and size reduction. This is an important mechanism that reduces large defects in diabetic wounds after radical debridement.

Induce granulation and angiogenesis

Granulation is an important clinical sign that indicates wound healing. Laboratory experiments on swine and rabbit wound models showed increased granulation tissues after treatment with NPWT. Clinical trials in diabetic wounds have also demonstrated NPWT’s superiority in producing granulation as compared to conventional dressings. NPWT also induces angiogenesis and vascular proliferation. Micro-deformation at the wound interface is thought to activate vasculogenic growth factors. Furthermore, NPWT mobilises the endothelial progenitor cell (EPC). Seo and colleagues noted significant increase in systemic EPC numbers in patients treated with NPWT. This reflects underlying angiogenesis and repair.

Reduce edema

Infective wounds generally produce higher levels of exudate. This leads to local soakage and edema. NPWT removes excess wound fluid, thereby reducing edema. This improves wound healing by enhancing local blood and nutrient flow. It also prevents the build-up of anti-inflammatory mediators like metalloproteinase, which degrade adhesion proteins necessary for wound repair.

Reduce bacterial colonization

Studies involving swine wounds demonstrated that wounds treated with NPWT showed a more rapid reduction in bacterial colonization. While the mode of bacterial clearance is unclear, NPWT is thought to provide a safety barrier that shields the wound from environmental contaminants. In clinical practice, the relationship between bacterial load reduction and NPWT requires further research. In diabetic wounds, there is evidence that NPWT aids bacteria clearance. However, a recent systemic review on bacterial load and vacuum therapy recommends that further studies are done to draw definitive conclusions.

Clinical Application

NPWT can give good results when it is used by a multi-disciplinary diabetic foot team in the management of diabetic foot wounds.

Factors contributing to a successful outcome include:

Careful selection of cases

All wounds selected for application must be assessed meticulously. Is there ischaemia?

Wounds selected must have at least one palpable foot pulse and a good pulp capillary return (<2 sec).
Is there sensory neuropathy?

Foot must be assessed with Semmes-Weinstein Monofilament Testing (SWMT) 10-point monofilament and new aesthesiometer. Patients with sensory neuropathy have a higher risk for failed debridement and amputation.

Is there underlying deep infection?

Wounds must be assessed for deep tenderness. One must exclude underlying osteomyelitis or septic arthritis. The markers of infection must also be studied – White Blood Cell (WBC), C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR). Underlying osteomyelitis or septic arthritis must be surgically excised before the debridement will heal.

Indications include: post-debridement wounds for Necrotising Fasciitis, infective wounds dorsum foot, infective wounds sole of foot, infective heel ulcers and exposed bone, capsule and tendon.

- **Radical debridement before application**

  NPWT can only give results when adequate and proper debridement has been performed to remove all decentralized, necrotic and infected tissue and slough.

- **Good glycemic control**

  No wound will heal if endocrine control is poor.

- **Good markers of healing**

  - Haemoglobin level must be adequate — 10Gm/dL. Wounds will not heal if haemoglobin is low and is unable to provide enough oxygen for the healing tissue bed.
  - Albumin level must also be adequate — >38Gm/L to provide enough proteins for the budding of tissues.
  - Vitamin C and zinc should be provided — 1 tablet daily.
  - No renal impairment. Renal failure impairs wound healing.

- **Appropriate antibiotics**

  The antibiotic sensitive to the organism cultured must be administered to help clear the infection and achieve a reduction in bacterial load.

- **Regular monitoring of wound**

  During each change of dressing, the wound must be carefully inspected and managed. Small slough must be subjected to bedside debridement and all wounds scraped to remove biofilm before the application of a new vacuum device. If there is more slough, surgical debridement under a general anaesthetic is performed.
Application of Device

- Once dressing is applied, a standard negative pressure of -125 mm Hg is applied to the wound intermittently (5 minutes “on” and 2 minutes “off”). However, if the patient experiences pain or too much blood is seen in the canister despite haemostasis, use a lower negative pressure of about 80 mm Hg.

- Assess the wound carefully at each dressing change. This is to determine if the wound is healthy (clean and granulating). If infection or slough appears in the wound, additional surgical debridement needs to be performed in the operating theatre before a new dressing is applied.

- Once the bed is filled with granulation tissue, wound bed preparation has been achieved. Vacuum dressing may be stopped if the culture and sensitivity of the wound bed is negative for micro-organisms.

- Either allow the wound to close with secondary intention or perform split skin grafting instead of waiting for further reduction in wound size. This will significantly reduce the healing time.
Technical Considerations for Device Application

**Wound filler type: Foam or gauze?**

Wound filler characteristics determine most of the effects of NPWT on the wound bed. Commonly used fillers in diabetic wounds are polyurethane (PU) foam and saline-moistened gauze. PU foam results in thick and rapid granulation and is ideal for wounds with large defects after radical debridement. Foam induced scarring and fibres aid in wound contracture and size reduction. Antimicrobial (i.e. Silver) impregnated foam is also available to provide antibacterial cover during NPWT.

Gauze is an alternate filler and is useful for irregular wounds because of its conformability and ease of application. It is also useful in diabetic wounds where post-debridement soft tissue structures such as tendons and bone are exposed. Although underlying wound deformation by foam and gauze are different, studies show no differences in the time to complete healing between the two filler types.

**Pressure Setting: Continuous, intermittent or variable?**

The vacuum pump delivers the desired negative pressure to the entire system. In vitro studies show that at sub-atmospheric pressures of 125mmHg, there is a fourfold increase in blood flow. In clinical practice, continuous delivery of pressures from -50mmHg to -150mmHg is common. Higher pressures can be used when there is high exudate and wound fluids. However, it is recommended that we avoid using higher negative pressures in wounds with compromised vascularity or risk of ischemia.

Pressure modes can be changed between continuous, intermittent and variable delivery. Though preclinical studies show higher granulation under intermittent and variable pressures, continuous delivery is the established norm in clinical practice. In clinical application, the intermittent mode has shown an increased potential for pain due to repeated wound filler contraction and expansion. Additionally, using the intermittent mode with PU foam can result in granulation ingrowth in the wound. Variable mode, on the other hand, is a recent introduction. It involves cycling between two negative pressure levels. There is currently limited evidence of its use in clinical practice.

**Case Study 1**

A 62 year old female with diabetes presented with a dorsal forefoot abscess involving the 2nd toe. There was tracking towards the sole. Risk factors associated with healing included a 10-year history of type 2 diabetes and hyperlipidemia. The patient’s dorsalis pedis and posterior tibial pulses were palpable. Markers of infection on arrival were as follows: WBC count of 16x10⁹/L, ESR of 80 mm/hr and CRP of 102 mg/L. The markers of wound healing included 12.5% for HbA1c, 12 g/dL for Hb and 30 g/L for albumin. A microbiology test for culture and sensitivity indicated that the following micro-organisms were present: *Pseudomonas Aeruginosa* and *Enterococcus Faecalis*. She underwent a 2nd toe ray amputation and radical debridement (Figure 3).

Post debridement, she was placed on KCI VAC® NPWT for 4 weeks. During this period, she also underwent aggressive systemic optimisation (i.e. glycaemic control, nutritional support and antibiotic therapy). At the last follow-up 8 weeks after surgery, the wound was noted to have completely healed and the patient was ambulant with minimal assistance.
Since the experimental work by Morykwas and Argenta in 1997, several publications have reported the use of NPWT in the treatment of wounds. With regard to diabetic foot treatment, NPWT’s efficacy has been demonstrated in several randomised clinical trials (Table 1). The early randomised controlled trials (McCallon et al, 2000; Eginton et al, 2003) were primarily single center work with limited sample sizes. In 2005, Armstrong et al conducted the landmark multi-center controlled study comparing NPWT with standard dressings. They demonstrated a statistically significant reduction in healing time, higher percentage of healed wounds and reduction in the number of re-amputations in the NPWT treated group.

In 2008, Blume and colleagues conducted a larger trial. They noted that a greater proportion of diabetic foot ulcers achieved complete closure with NPWT than with standard wound therapy (43.2% vs. 28.9%). A trial by Paola et al (2010) further showed that NPWT reduced the need for subsequent amputations in a six month follow-up period. In a parallel trial, this group also showed a higher uptake of skin-graft in wounds assigned to NPWT when compared to standard dressings (80% vs. 68%). In two published systematic analysis of randomized trials, NPWT was concluded to be more effective in treating diabetic foot wounds and ulcers than standard dressings. Wounds treated with NPWT showed increased granulation, faster healing and reduced amputation rate.

Besides the aforementioned trials, there are numerous other studies ranging from evidence level 1 to 5 that demonstrate NPWT’s efficacy and safety in diabetic foot management.
<table>
<thead>
<tr>
<th>Publication</th>
<th>Design</th>
<th>Sample</th>
<th>Methods</th>
<th>Results and Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumville, et al, 2013&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Meta-analysis</td>
<td>605</td>
<td>Systematic review of 5 RCTs examining NPWT effectiveness</td>
<td>NPWT is more effective in healing diabetic postoperative foot wounds and ulcers compared with moist wound dressings.</td>
</tr>
<tr>
<td>Paola et al, 2010&lt;sup&gt;33&lt;/sup&gt;</td>
<td>RCT (Study 1)</td>
<td>70 (NPWT=35, moist dressing= 35)</td>
<td>Skin-graft wounds assigned to NPWT or moist dressings</td>
<td>Greater proportion of complete skin graft uptake in NPWT group (80%) compared to moist dressings (68%) p=0.05</td>
</tr>
<tr>
<td>Paola et al, 2010&lt;sup&gt;33&lt;/sup&gt;</td>
<td>RCT (Study II)</td>
<td>130 (NPWT=35, moist dressing=35)</td>
<td>After debridement patients assigned to NPWT or moist dressings</td>
<td>NPWT group had faster granulation (65 days vs. 98 days) p=0.005 and more rapid infection clearance (10 days vs. 19 days) p=0.05.</td>
</tr>
<tr>
<td>Noble-Bell et al, 2008&lt;sup&gt;14&lt;/sup&gt;</td>
<td>Meta-analysis</td>
<td></td>
<td>Systematic review of 4 randomized controlled trial examining NPWT effectiveness</td>
<td>NPWT therapy more effective than conventional dressings with increased granulation and healing rates</td>
</tr>
<tr>
<td>Blume et al, 2008&lt;sup&gt;32&lt;/sup&gt;</td>
<td>RCT</td>
<td>335 (NPWT=169, moist dressing=166)</td>
<td>Assigned to either NPWT or moist dressings (predominately hydrogels and alginates).</td>
<td>NPWT group achieved higher wound closure rates (43.2% vs. 28.9%) with fewer secondary amputations, p=0.035</td>
</tr>
<tr>
<td>Armstrong et al., 2005&lt;sup&gt;34&lt;/sup&gt;</td>
<td>RCT</td>
<td>162 (NPWT=77, moist dressings=85)</td>
<td>Partial foot amputation wounds assigned to NPWT or moist dressings</td>
<td>NPWT group had increased healing (56% vs. 39%, p=0.040. The rate of healing was also faster in the NPWT group, p=0.005. Adverse effects were similar in both groups</td>
</tr>
<tr>
<td>Eginton et al, 2003&lt;sup&gt;8&lt;/sup&gt;</td>
<td>RCT–crossover after 2 weeks</td>
<td>6</td>
<td>Assigned to receive moist gauze dressings or NPWT treatments for 2 weeks, after which subjects crossed over</td>
<td>NPWT resulted in a greater wound size reduction compared to moist dressings</td>
</tr>
<tr>
<td>McCallon et al, 2000&lt;sup&gt;5&lt;/sup&gt;</td>
<td>RCT</td>
<td>10 (NPWT=5, moist dressings=5)</td>
<td>Wound healing faster in NPWT group (22.8±17.4 days versus 42.8±32.5 days for the control group)</td>
<td></td>
</tr>
<tr>
<td>Nather et al, 2010</td>
<td>Prospective</td>
<td>11</td>
<td>Diabetic foot ulcers treated with NPWT were prospectively studied</td>
<td>100% granulation and bacterial clearance at the end of therapy. Healing was achieved in all wounds (9 closed by SSG, 2 by secondary closure)</td>
</tr>
</tbody>
</table>

<sup>Table 1: Clinical Evidence on Negative Pressure Wound Therapy and Diabetic Foot</sup>
Future Developments

The first device for NPWT was cleared by the Food and Drug Administration (FDA) in 1997. Since then, the system for NPWT has evolved considerably, with new devices and upgrades. The original V.A.C.™ system (KCI Inc., San Antonio, TX, USA), however, is still the most widely used clinically. Majority of clinical evidence on the use of NPWT in wound management (including diabetic wounds) pertains to the use of V.A.C.™ system. Renasys-GO™ (Smith & Nephew GmbH) is an alternate option. A recently published randomised controlled trial showed no difference in clinical efficacy between the two devices in treatment of acute and chronic wounds. Prospective clinical data has also shown the effectiveness of Renasys-GO™ (Smith & Nephew GmbH) in treating diabetic foot wounds.

In diabetic wound management, NPWT is still an evolving technology. New devices and dressing features are being added to make the system more effective for infective wounds. At the same time, this would offer more portability to provide care in non-hospital settings (including rehabilitation centers and homes).

**NPWT and silver antimicrobials**

Silver has long been recognised as a powerful antimicrobial for infective wounds. It binds to DNA of bacteria and spores and reduces their ability to replicate. It also binds to cell membranes, causing irreversible damage to microbial architecture. Silver-resistant organisms are extremely rare. Nanocrystalline silver has further enhanced silver’s antimicrobial effect. It utilises nanotechnology to release clusters of extremely small and highly reactive silver cation particles. When incorporated into wound dressings, nanosilver can provide a continuous flow of charged silver cations to the wound bed. This creates a sustained and effective antimicrobial environment. Existing clinical data suggests that nanosilver dressings are cost effective, lessen wound exudate, reduce microbial level and promote healing in chronic wounds. Various commercial silver products compatible with NPWT are available for clinic use. They are either combined with the polyurethane foam or used as a wound contact dressing under the NPWT foam.

a. Silver foam products

The silver impregnated foam structure has a dual role of stimulating granulation tissue formation and providing antimicrobial cover. When in contact with fluids, the silver of the foam dressing oxidises to ionic silver. V.A.C. GranuFoam™ (KCI, San Antonio, TX) is a reticulated, silver coated, polyurethane foam, compatible with the V.A.C. NPWT system. In-vitro efficacy of this foam dressing has been demonstrated against various microbes, which commonly colonise diabetic foot wounds. CuraVAC™ Ag (Daewoong Pharm Co, LTD, Seoul, Korea) is another product that delivers NPWT through a foam dressing which contains silver nanoparticles. The latter has been employed for treating diabetic foot wounds.

b. Silver dressing products

Unlike silver foam products, NPWT compatible silver dressings are applied as wound contact layer under the foam. Acticoat™ Flex (Smith & Nephew, Inc., St. Petersburg, FL) dressing is an NPWT compatible nanocrystalline silver dressing. The dressing’s porous architecture enables it to be placed under the negative pressure foam, allowing passage of exudate through the pores. The dressing is used in infective wounds, including diabetic foot wounds. There is currently limited data on the clinical efficacy and cost effectiveness of this new product.

**NPWT and instillation (NPWTi)**

Instillation is new in NPWT. In NPWTi, topical solutions are cyclically fed to the wound through the foam dressing. They are held for a selected period before removal via NPWT. Cyclic irrigation of the wound optimises wound healing by removing devitalised tissue, debris, infectious agents and preparing the wound bed for closure. Solutions used for instillation include topical cleansers, antibiotics, antifungals and antiseptics. V.A.C. Ultra™ Therapy System (KCI) is one of the commercial NPWTi devices that combines conventional V.A.C.™ Therapy (KCI) with controlled delivery of topical instillation solutions to the wound bed using V.A.C. VeraFlo™ Therapy (KCI).
In-vitro evidence favouring NPWTi shows increased granulation in wound models treated with NPWTi\textsuperscript{45}. Gabriel et al demonstrated that instilling silver nitrate helped to reduce bio-burden, decreased time to wound closure and allowed early hospital discharge\textsuperscript{46}. Instillation of polyhexanide (PHMB) solution resulted in effective treatment of soft tissue necrotising fasciitis and osteomyelitis, when used in combination with other treatments\textsuperscript{47,48}. In a diabetic wound cohort, Bernstein and colleagues used NPWTi with bacitracin-polymyxin B solution and showed successful outcomes with complete healing and no amputations\textsuperscript{49}. Current evidence suggests that NPWTi may potentially improve overall outcome in diabetic foot wounds.

**Portable devices and home-care protocols**

A major disadvantage of conventional NPWT systems is the bulky nature of device. However, more portable new devices have been developed. PICO® (Smith & Nephew, Hull, United Kingdom) is one of the available commercial portable NPWT systems. It is a single-use canister free device that can be placed in a pocket or attached to a belt-loop. Published data on mixed etiology wounds (including diabetic foot ulcers) shows efficacy comparable to that of conventional NPWT\textsuperscript{50}.

Smart Negative Pressure [SNaP] Wound Care System® (Spiracur, Inc., Sunnyvale, CA, USA) is another portable device that uses specialised springs to deliver NPWT. The system consists of a cartridge, a hydrocolloid dressing layer with integrated nozzle and tubing, and a foam interface. The cartridge doubles as a storage canister and can deliver negative pressures of up to 125 mm Hg\textsuperscript{51}. Efficacy comparable to that of conventional NPWT has been demonstrated in a recent multi-centered trial\textsuperscript{52}.

However, portable NPWT devices are only suited for wounds with low to moderate exudate levels\textsuperscript{53,54}.

Another recent development is the delivery of NPWT in non-hospital settings i.e. step-down units, nursing facilities and even patient homes. Device companies, working together with medical teams, have introduced various home-care NPWT packages facilitating therapy in non-hospital settings. These provide arrangements for regular dressing change at patient residences. Such protocols at diabetic foot centers aid early discharge and reduce overall cost.

**Conclusion**

Negative pressure wound therapy has been a major breakthrough in wound care over the last decade. Its significant impact on limb-salvage in diabetic foot wound management is evident from existing literature. The science of NPWT is still evolving and new additions such as instillation and silver antimicrobials may further improve outcomes in infected wounds. Portable devices and home-care protocols also are expanding NPWT’s usage beyond hospital setting. It is however important to emphasize that diabetic foot management requires a multidisciplinary effort. NPWT is only one of the essential tools in the overall management. Successful NPWT outcome in these wounds is therefore heavily dependent on concomitant treatment modalities. Careful surgical debridements, appropriate antibiotic therapy, good glycemic control and regular wound monitoring are all essential to achieve good results.

**References**


Biomechanics of Intramedullary Nailing

Khor Yuet Peng
Chee Yu Han
Division of Musculoskeletal Trauma

Introduction

The late 19th century and early 20th century saw the development of intramedullary nailing devices and techniques. The early attempts using ivory pegs, bones and solid metallic rods showed promise but were fraught with high rates of infection and failure. An important milestone in the development of intramedullary nailing was the work of Gerhard Kuntscher (Figure 1), a German surgeon, during the Second World War. Intramedullary nail has the advantage of being a ‘load-sharing’ device that allows early weight bearing and limited soft tissue and periosteal disruption. Currently, nails are the standard treatment for most long bone diaphyseal fractures.

Figure 1: Gerhard Kuntscher (Figure from Vescei V, Hajdu S, Negrin LL. Intramedullary nailing in fracture treatment: History. Science and Kuntscher’s revolutionary influence in Vienna, Austria. Injury. 2011. S4. S1-5)

Biology of intramedullary nailing and effects of reaming

The inner two thirds of the cortex is supplied by the medullary arteries while the outer one third is supplied by periosteal arterioles (Figure 2). With intramedullary nailing, there is a predictable local vascular response. Blood flow is temporarily disrupted by direct vessel injury followed by vasoconstriction. Subsequent vascular recruitment leads to increased local flow. Neovascularisation occurs, modulated by local growth factors. Remodeling generates a new vascular system.

Figure 2: Illustration of endosteal and periosteal blood supply. (Figure from Bong et al, Intramedullar Nailing of the Lower Extremity: Biomechanics and Biology, J Am Acad Orthop Surg 2007; 15: 97-106)
Reaming increases the contact area between the nail and cortical bone. This allows the insertion of a nail with a larger diameter, providing more rigidity to bending and torsion. Reaming can result in an 80% reduction in cortical blood flow, which returns to normal by 3 months. However, reaming does not appear to have a deleterious effect on the vascularity of the fracture callus, unlike unreamed nails. In fact, reaming aids in depositing osteoinductive factors from medullary contents at the fracture site, which may help healing. Reaming has not been shown to cause an increase in intracompartmental pressure or to result in an increased infection rate in the treatment of open fractures. Clinical trials have shown that there is a greater risk of delayed union and nonunion in cases where unreamed nails are used.

**Biomechanics**

Intramedullary nails act as internal splints. The stability of the construct is generally determined by its size, number of locking screws and distance of contact point to fracture site. The nails bear most of the load initially, which is gradually transferred to the bone as the fracture heals (Figure 3).

![Figure 3](image_url)

**Nail characteristics**

The nail’s material properties, cross-sectional shape, diameter and degree of anterior bow contribute to its structural stiffness. Titanium alloy has a modulus elasticity that is half that of 316L stainless steel, but closely approximates that of the cortical bone. The ultimate tensile strength of titanium is higher than that of stainless steel. Early designs of a slotted hollow nail allowed increased radial compression of the nail. However, this was found to significantly decrease its torsional stability. As a result, the slotted nail has largely been abandoned.

Larger diameter nails are stiffer and stronger than smaller diameter ones with the same cross-sectional shape (Figure 4). Stiffness is proportional to the 4th power of the radius of the nail (Figure 5). A well fitted nail can reduce movement between nail and bone and maintain fracture reduction. The bending rigidity of a solid circular nail is proportional to the third power of its diameter.
Nails with interlocking screws can withstand greater load before failure. However, in the absence of cortical contact with the nail postoperatively, compressive loads are transferred to the screws. This results in four-point bending of the screws (Figure 6).

The anterior bow of femoral nails affects the frictional fit within the medullary canal (Figures 7 and 8). Nails with a smaller mismatch are easier to insert but have less frictional fixation. Frictional fixation is increased in nails with a larger radius curvature mismatch. However, insertion is difficult and there is a risk of intraoperative fracture.
Interlocking screws or bolts increase the stability of the nail construct. Proximal and distal screws restrict translation and rotation at the fracture site.

**Summary**

The intramedullary nail provides a strong and stable construct with minimal soft tissue and periosteal disruption, allowing early weight bearing. Recent attention is focused on the implications of reamed intramedullary nailing, especially those involving the pulmonary system, which are beyond the scope of this article.

**References**


**Examination of the Ankle & Foot**

**Andrew Hong Choon Chiet**  
**Lee Wei Ting**  
**Division of Foot & Ankle**

**Introduction**

The ankle and foot are commonly injured from activities such as jumping and running. A thorough clinical examination of the ankle and foot requires assessment of the gait pattern, inspection, palpation and range of motion. Special tests and vascular and neurological assessments are also required.

The clinical examination usually begins with an introduction between the doctor and the patient. Verbal consent should be obtained as well. The patient’s footwear should be removed and lower limbs exposed from above the knee to the foot. The examination technique can vary depending on the nature of the ankle and foot condition. Assessment can progress from proximal to distal or vice versa.

**Assessment of Posture and Gait**

Observe the ankle and foot during the standing posture. Start proximally by looking at the hindfoot alignment for any varus or valgus misalignment. Then examine the foot arches for pes cavus or pes planus and the toes for any deformity.

Instruct the patient to walk normally while paying attention to his/her gait. Look for:

- Antalgic gait – a shortened stance phase on the affected limb, usually to minimize pain on that limb
- Calcaneus gait – increased ankle dorsiflexion during heel strike, caused by plantar flexor weakness such as Achilles tendon rupture or triceps surae weakness
- High steppage gait – increased knee and hip flexion to allow toes to clear the ground during swing phase, seen with foot drop, usually due to neurological causes
- Tip toe gait – an equinus deformity causing abnormal weight bearing on the toes, with inadvertent fixed plantarflexion of the ankle or limb length discrepancy, resulting in an intentional tip toeing to compensate for the shorter limb

**Inspection**

Allow patient to lie down on a couch. Inspect the ankle and foot carefully.

Look out for:

- Symmetry of both ankle and foot
- Atrophy of calf muscles
- Skin changes (i.e. cellulitis, hyperkeratosis and growth)
- Swelling – symmetric (due to systemic causes), asymmetric (usually due to trauma), edema (i.e. pitting edema due to heart failure or chronic venous insufficiency), inflammation (i.e. cellulitis)

- Ulcer (site, size, floor, content, adjacent skin)

- Bruising (due to trauma)

- Deformity

- Any scar that indicates previous surgery

### Palpation

Palpate for increased warmth that could indicate inflammatory or infective process. Palpate and feel for tenderness proximally from ankle joint at bony prominences (i.e. malleoli and walls of calcaneus (calcaneal squeeze)), Achilles tendon attachment site and surrounding soft tissue (i.e. Achilles tendon continuity).

Continue to palpate medially from deltoid ligament, posterior tibial tendon attachment at navicular bone, anteromedial and part of ankle joint. On the lateral side palpate anterolateral part of ankle joint, anterior talofibular ligament (ATFL), sinus tarsi, calcaneofibular ligament (CFL), peroneal tendons at retromalleolar space down to peroneal brevis attachment at the base of the fifth metatarsal.

Proceed to the midfoot. Palpate the Lisfranc joint dorsally. Move laterally to the entire tarsometatarsal joints (TMTJ). Then palpate the metatarsal head starting from the first metatarsophalangeal joint (MTPJ) to the fifth. Continue with interphalangeal joints (IPJ).

Tenderness at these sites could mean injury and can present with specific clinical symptoms and examination findings. For example:

- Peroneal tendon tear can present with pain over the lateral aspect of the ankle, tenderness elicited via direct pressure, and swelling along the tendon sheath. There may be pain and weakness on evertng the foot as well.

- A Lisfranc ligamental/bony injury can present with pain over the midfoot after a traumatic sprain and tenderness over the dorsal aspect of first and second TMTJ. This is coupled with occasional ecchymosis at the plantar aspect of the midfoot.

- A fifth metatarsal base avulsion fracture or Jones fracture can present with pain and swelling over the fifth metatarsal base, tenderness elicited on direct pressure, and pain on evertng the foot.

### Range of motion

Assess all active movements of the ankle and foot. Start with ankle dorsiflexion and plantarflexion, then proceed with subtalar inversion and eversion. Observe active foot and toe dorsiflexion and plantarflexion movements.

- Test passive movements. Stabilize the tibia by holding the calf with one hand and moving the ankle in dorsiflexion and plantarflexion.

- Lock the ankle joint in neutral or slight dorsiflexion and fix the talonavicular joint. Passively invert or evert the subtalar joint.

- Test MTPJ flexion and extension. Pay special attention to the first MTPJ as hallux rigidus often causes pain and restricted motion.
There are multiple special tests to examine conditions specific to the ankle and foot.

**Anterior drawer test**

This test is used to examine the integrity of the ATFL, which is frequently injured during an inversion ankle sprain.

Seat the patient with his affected limb hanging freely off the edge. Assure him that the examination is painless and observe for visual cues of pain. Keep the patient’s knee flexed and ankle in slight plantarflexion. Using your non-dominant hand, stabilize the distal tibia. Cup the heel with your dominant hand and apply an anterior force to the heel. (Figure 1) If the ankle can be translated > 10 mm anteriorly, the test is positive. It is prudent to test both ankles to ensure that global laxity does not contribute to anterior translation.

![Figure 1: Anterior drawer test of the ankle](image1.png)

**Talar tilt test**

This test is used to examine the integrity of the CFL, the second most commonly injured ligament after the ATFL, in an ankle sprain.

Seat the patient with his affected limb hanging freely off the edge. Assure him that the examination is painless and observe for visual cues of pain. Keep the knee flexed and ankle in neutral or slight dorsiflexion. Using your non-dominant hand, stabilize the distal tibia. Cup the heel with your dominant hand and apply an inversion force. (Figure 2) This test is positive if there is pain over the CFL and increased joint laxity.

![Figure 2: Talar tilt test of the ankle](image2.png)
Syndesmosis squeeze

This test is used to examine the integrity of syndesmosis for high ankle sprain. The patient can be seated or lying supine. Use both hands to apply a mediolateral compressive force at the mid-calf to compress the tibia and fibula together. (Figure 3) Pain elicited in the ankle joint may be indicative of syndesmosis joint disruption or ankle fracture.

Figure 3: Syndesmotic squeeze

Thompson’s test

This test is used to examine the integrity of the Achilles tendon.

Position the patient prone with both feet extended and hanging off the edge. Squeeze the calf muscle at the mid-calf portion and observe for plantarflexion movement. (Figure 4) A positive test occurs when no plantarflexion movement is observed or the plantarflexion movement is weaker compared to the contralateral limb.

Figure 4: Thompson’s test looking at passive plantarflexion with squeezing of the calf

Coleman Block

This test is used to examine whether the hindfoot deformity is forefoot driven.

Ask the patient to stand on a block on the lateral half of the foot, leaving the first ray hanging. If the first ray plantarflexes and the hindfoot are corrected, the hindfoot varus is flexible and is not the primary deformity (Figure 5).

Figure 5: Coleman block test for assessment of hindfoot varus deformity
**Mulder’s test**

This test is used to examine the presence of Morton’s neuroma (interdigital plantar neuroma).

The patient can be seated or lying supine. Use your dominant hand to grasp the forefoot from the plantar aspect, squeezing the first and fifth MTPJ. A positive test will elicit pain or a burning sensation that radiates to the toes. An audible click indicates a fibrotic neuroma (Figure 6).

![Mulder’s test](image)

**Vascular assessment**

Vascular assessment is vital for ankle and foot surgeries, especially in patients with vasculopathy. Conduct a detailed assessment to determine whether vascular intervention is needed prior to any orthopaedic reconstructive surgery. Palpate the dorsalis pedis and posterior tibial artery pulses for every foot examination. Perform capillary refill of the toe pulps. A normal capillary refill should take < 2 seconds. Use adjunctive tools such as ankle brachial index (ABI) and toe brachial index (TBI) to measure distal perfusion. ABI of 0.8 to 1.2 is considered normal while values < 0.8 indicates ischaemia and those > 1.2 are considered inaccurate due to calcified vessels. TBI > 0.7 is normal while any value < 0.7 indicates ischaemia. Toe pressure of > 30 mmHg is required for good healing. Any abnormality in the vascular assessment should warrant a referral to the vascular surgeon for intervention.

![Vascular assessment](image)
Neurological assessment

This includes the assessment of motor and sensory functions of the ankle and foot. Sensory assessment includes examination of five cutaneous nerves that supply the foot:

- Deep peroneal nerve – dorsal first webspace
- Superficial peroneal nerve
  - medial dorsal cutaneous nerve – dorsomedial foot
  - intermediate dorsal cutaneous nerve – dorsolateral foot
- Saphenous nerve – medial ankle and hindfoot
- Sural nerve – posterolateral ankle and foot
- Posterior tibial nerve – medial calcaneal, medial and lateral plantar nerve all supplying the plantar aspect of the foot

![Figure 8: Five cutaneous nerves that supply the foot](image)

The motor power examination of the ankle and foot usually includes strength testing of dorsiflexors, plantarflexors, evertors and invertors. This is vital to determine the deforming force that affects tendon balance in the foot:

- Dorsiflexor – tibialis anterior
- Plantarflexor – triceps surae complex
- Evertor – peroneus longus and brevis
- Invertor – posterior tibialis

Conclusion

It is important to obtain an accurate history and perform a systematic and meticulous clinical examination to diagnose the ankle and foot condition.
Introduction

The hand is a complex structure comprising of multiple structural and functional elements. The general approach is to focus clinical examination on relevant structures as indicated by a precise and well-taken history.

The hand can be divided into five broad systems: peripheral nervous system, muscular system, vascular system and skeletal system, which are functionally linked.

This article provides a systematic approach to the clinical examination of the hand.

<table>
<thead>
<tr>
<th>Spectrum of Presenting Symptoms</th>
<th>Involved Anatomical System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbness</td>
<td>Peripheral nervous system (sensory)</td>
</tr>
<tr>
<td>Paraesthesia</td>
<td>Peripheral nervous system (motor)</td>
</tr>
<tr>
<td>Weakness</td>
<td>Paralysis or disruption of musculo-tendinous units</td>
</tr>
<tr>
<td>Clumsiness</td>
<td></td>
</tr>
<tr>
<td>Complete Loss of motor function</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>Skeletal system:</td>
</tr>
<tr>
<td>Stiffness</td>
<td>Bone</td>
</tr>
<tr>
<td>Limitation of motion or function</td>
<td>Joints</td>
</tr>
<tr>
<td></td>
<td>Ligaments</td>
</tr>
<tr>
<td>Ulceration</td>
<td>Vascular System</td>
</tr>
<tr>
<td>Discolouration</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td></td>
</tr>
<tr>
<td>A lump or lesion in the hand</td>
<td>Soft tissues and skeletal tumors/ tumor like conditions</td>
</tr>
</tbody>
</table>

Basic Principles

Systemic conditions such as diabetes, peripheral vascular disease and central nervous conditions such as stroke or polio can manifest as conditions of the hand. Other important factors include the patient’s occupation or functional demands such as smoking habits.

Localise the anatomical system or the structure that is the source of the symptoms.

Trouble manifesting in the hands may relate to problems proximally such as brachial plexus, cervical spine or brain pathology. Expose the upper limb, neck and chest to complete the examination. A comparison should always be made with an unaffected contralateral hand.
Use the approach of "Look (Inspection), Feel (Palpation), Move (Joint motion)" for the examination of the hand.

First, take time to carefully look at the hand. The natural relaxed posture of the hand at rest forms the "cascade" of the digits, which describes the characteristic flow of increasing flexion from the index to little finger (Figure 1). With experience, the clinician will be able to correlate a deviation from this natural, normal posture with possible pathologies (Figure 2). Any scars, often subtle, should be carefully noted as they may hint at the cause of problems or suggest previous surgery.

![Figure 1 and 2: Normal cascade. Note the natural progressive flexion at each joint from index to little fingers.](image)

Next, assess the range of motion. A quick screening assessment can be done by asking the patient to flex, extend, pronate and supinate the wrist. Ask the patient to make a fist, extend, abduct and adduct all digits and to perform key pinch, tripod and chuck grips. Evaluate active and passive range of movement at each affected joint using a goniometer. Consider functional assessments such as doing up a shirt button or writing to ascertain the patient's general level of function.

![Figure 3: The figure on the left shows the normal posture of the hand resulting from normal basal tone in intrinsic and extrinsic muscles. In comparison, the middle figure indicates abnormal posture in clawing, characterised by hyperextension of MCP joints and flexion of PIP joints due to paralysis of intrinsic muscles. They are contrasted with the intrinsic plus posture of the hand on the right with actively flexed MCP joints and extended interphalangeal joints. This posture requires normal function of intrinsic muscles.](image)
System Specific Examination

1. Neuromuscular Examination:

General Approach

Localise the peripheral nerve and find out the level at which the nerve is involved. A neuromuscular examination is indicated when the patient reports paraesthesia, pain, loss of sensation, numbness, weakness, clumsiness or complete paralysis. A slow progressive history indicates compression or neuropathy. A sudden functional loss may indicate acute trauma.

Nerve injuries can often produce changes visible on careful initial inspection. Look for any abnormal postures such as clawing, resulting from paralysis of certain muscle groups. The presence of areas of smooth, dry skin within anatomical boundaries of a given nerve on an otherwise sweaty palm is a subtle sign of nerve dysfunction.

Palpation and movement evaluation combines sensory and motor testing, all of which should be geared towards identifying the level of nerve injury. Dry smooth skin on an otherwise sticky palm hints at denervated skin that can be tested with tactile adherence\(^1\). This involves the running of the side of a pen along a digit. The pen encounters less gliding resistance on anhydrotic denervated skin compared to normal sweating skin.

Gross evaluation of sensation can be achieved with the “Ten Test”\(^2\), where the patient is asked to rate sensation in an affected area on a scale of 1 to 10, with 10 being a normal comparative area, usually the contralateral side. Detailed evaluation can be undertaken with the use of static or dynamic 2-point discrimination and light touch testing using Semmes Weinstein filament mapping. One should differentiate sensory loss in a particular nerve-territory from that of dermatomal distribution sensory loss, as seen in injuries involving nerve roots and the central nervous system. Provocative testing using Tinel’s test and various compressive or stretch tests for nerve dysfunction is mandatory to recreate the offending mechanism of injury and symptoms of nerve irritation.

Motor power and movement of the neurologically impaired hand is then assessed and graded from 1 to 5 using the Medical Research Council (MRC) scale\(^3\). It is important not only to observe, but also to palpate for muscle contraction.

Nerve conduction tests, electromyography and further imaging should be considered to complete the examination.

A basic examination for the three main nerves in the hand is outlined below:

The Median Nerve

Atrophy of the thenar eminence on inspection indicates median nerve dysfunction (Figure 4). Sensory testing on the thumb, index, middle fingers and the radial side of the ring finger classically evaluates the median nerve. Sensation of the thenar eminence is supplied by the palmar cutaneous branch of the median nerve, which lies outside the carpal tunnel and should be spared in carpal tunnel syndrome.

---

Figure 4: Ulceration due to sensory loss (left) and thenar wasting in severe carpal tunnel syndrome (right).
Testing of the median nerve motor component involves evaluating the thenar eminence musculature by way of active and resisted thumb abduction as well as the action of the extrinsic flexor pollicis longus (FPL) and flexor digitorum profundus (FDP) to the index and middle fingers. Although abduction and opposition are complex movements involving muscles of the thenar eminence, the abductor pollicis brevis supplied by the median nerve is the main contributor to abduction. Higher median nerve lesions additionally cause weakness of thumb interphalangeal joint flexion and impaired flexion at the distal interphalangeal joint (DIPJ) of the index and middle fingers due to weakness of FPL and FDPs respectively.

Provocative testing in the form of the Tinel’s test and compressive or stretch tests such as Phalen’s or Durkan’s for the median nerve at the carpal tunnel level must be performed. In Tinel’s test, the paraesthesia upon percussion experienced by patients in a given nerve territory or at a specific site, implies nerve injury and regenerating nerve fibres. Tinel’s test is performed from distal to proximal and the site or level at which percussion elicits paraesthesia should be clearly documented to allow future comparison. An advancing Tinel’s sign from proximal to distal over a period of time denotes a regenerating nerve front.

**Ulnar Nerve**

Visible wasting of the hypothenar eminence, first web space and the interosseus muscles with characteristic "guttering" on the dorsum of the hand suggests ulnar nerve dysfunction.

Classical clawing of the ring and little fingers with flexion at the IPJs and hyperextension at the MCPJs are seen in ulnar nerve injuries (Figure 5). This clawing is more severe with lower ulnar nerve lesions than higher ulnar nerve lesions, a condition named the “ulnar paradox”. This occurs because intact ring and little FDP muscles of a low ulnar nerve lesion results in greater flexion and hence clawing of the digits.

![Figure 5: Ulnar nerve paralysis with ulnar nerve clawing, abducted posture of the little finger and guttering seen in the interosseous spaces](image)

Sensory testing of the little finger and ulnar border of the ring finger evaluates the ulnar nerve. The dorsal branch of the ulnar nerve arises 5cm from the wrist crease and winds around the ulnar border of the wrist to supply the dorso-ulnar border of the hand. The dorsal branch of the ulnar nerve is spared in low level ulnar pathology such as in Guyon’s canal. Tinel’s testing is performed along the course of the ulnar nerve. Sustained elbow flexion for the ulnar nerve in the cubital tunnel is also performed to illicit symptoms of nerve irritability.

Muscles tested in the assessment of the ulnar nerve are dorsal interossei involved in abduction of digits from the midline in the axis of the middle finger, palmar interossei in adduction, abductor digiti minimi of the hypothenar eminence, adductor pollicis in adduction of the thumb and FDP to the little and ring fingers. The action of dorsal interossei and abductor digiti minimi of the hypothenar eminence are tested by asking the patient to abduct the index and little fingers against resistance. The patient is then asked to cross the fingers as a test for palmar interossei.

Adductor pollicis is assessed with the classically described Froment’s test where the patient grips a piece of paper between the thumb and radial border of the index finger whilst the examiner pulls the paper away. Paralysis of the ulnar nerve innervated adductor pollicis results in an inability to grip the paper by adduction of the thumb alone, requiring compensatory flexion of the thumb at the interphalangeal joint by the median nerve innervated flexor pollicis longus. This is said to be Froment’s positive. High ulnar nerve injuries additionally cause weakness of the little and ring finger FDP.
Radial Nerve

The radial nerve sensory supply is less well defined with the dorsum of the first web being the only relatively consistent area supplied.

The radial nerve supplies no intrinsic muscles in the hand, and presents as wrist or finger drop. Motor testing involves that of the extrinsic muscles of finger metacarpophalangeal joints, thumb and wrist extension. Care must be taken to differentiate interphalangeal joint extension, which is a function of intrinsic muscles and will be present in pure radial nerve paralysis.

2. Skeletal System

Inspection of a hand affected by a skeletal problem usually reveals obvious visible problems in the form of swelling, inflammation, contractures, malalignments of a digit, rotation of digits, deviations from the normal “cascade” and deformities of the hand. Certain deformities are hallmarks of particular pathologies such as the ulnar deviation at the MCPJs of rheumatoid arthritis or the Boutonniere deformity of an extensor central slip injury. It is essential to note the quality of the overlying skin, as tight scars can limit the movement of joints. The quality of skin also affects the subsequent management because any surgery planned must include the management of the lack of skin, which can be associated with chronic joint contractures or injuries.

Ligament damage usually results in pain in the acute phase of injury or with inflammatory disorders. Careful palpation is performed to localise this pain to a specific anatomic site or named structure. Synovitis associated with inflammation such as that of rheumatoid arthritis, manifests as pain, tenderness, swelling and palpable crepitus. Clunks, clicks, crepitus and grinding are usually a result of problems with joint articulation, either from diseased joint surfaces or unstable joints during movement. Joint instability is present in significant ligamentous injury and can be identified by applying stress to a joint in antero-posterior, rotational, varus and valgus directions while palpating for clunks, clicks, crepitus and grinding. The nature of swelling should be noted and may indicate the underlying pathology. This can either be from the soft tissues (e.g. inflammation, synovitis, effusions, ganglions), or from bony causes (e.g. deformity, osteophytes).

Active and passive range of movement of each individual joint should be accurately measured and documented as per basic principles. A crucial aspect of palpation and movement of a joint is to try and identify the underlying cause of any joint contracture, movement block or stiffness. Bony or articular blocks to movement are typically rock solid with unyielding end points. Soft tissue limitations of movement, such as skin contractures or tendon adhesions, generally have more “give” when passively stressed and have softer end points.

The consolidation of information obtained from the history, inspection, palpation, assessment of range of movement and imaging investigations should allow the clinician to ultimately determine the mostly likely cause of stiffness and guide treatment. However, problems with bone, joints, ligaments, tendons or skin contractures seldom occur in isolation.
3. Vascular System

Causes of vascular insufficiency of the hand can be broadly classified as arterial, venous or lymphatic. All these can result in varying degrees of swelling.

On inspection, arterial insufficiency in the hand is suggested if the hand appears less well perfused and pale. Acute pain as well as paraesthesia due to nerve ischaemia are more indicative features compared to venous or lymphatic causes, especially if the insufficiency occurs suddenly. Acute disruption of arterial supply results in particularly obvious pain, pallor and paraesthesia, and should be raised as an emergency to the physician. A chronically ischaemic hand has wounds that do not heal or present with frank ulcers at the fingertips, and also a lack of hair growth.

Venous insufficiency usually results in a greater degree of swelling compared to that of arterial problems and is characterised by a purplish, cyanotic and congested limb. Superficial veins on the limb may be very prominent. Pain is usually described as a dull ache and less acute than that of arterial compromise. Venous ulcers are more uncommon in the upper limb compared to the legs.

Lymphoedema can be differentiated from arterial and venous insufficiency by its chronic nature, less pronounced colour changes and significant swelling that varies much less with posture. Pain is not usually an issue but a history of repeated infections can be a feature. The skin in lymphoedema can exhibit peau d’orange pitting changes caused by dermal oedema.

An ischaemic hand feels relatively cooler than a venously congested or lymphoedematous upper limb. Pulses should always be examined and are absent or weak in an ischaemic scenario. An Allen’s test, where the radial and ulnar arteries are simultaneously occluded manually and released alternately, should be performed to assess the pattern of arterial inflow into the hand. Capillary refill time should be checked. It is prolonged in arterial insufficiency, brisk in cases of venous congestion (under 2 seconds) and usually normal in lymphoedema. Venous congestion is posture dependant and may improve visibly with simple elevation of the limb. In situations where a vascular anomaly is suspected, an arterio-venous or high flow lesion may exhibit a palpable thrill whilst a venous malformation may be compressible and soft. In contrast, lymphoedema tends to give a firm and woody feel. A portable Doppler ultrasound is a useful bedside adjunct in the assessment of flow through vessels.

![Figure 7: Infected gangrene of the middle finger resulting from peripheral ischemia in a diabetic patient.](image)

Movements are assessed according to basic principles. Although no limitation is expected, in situations of acute arterial ischaemia, pain and impending compartment syndrome limit movement. The swelling of the limb is also sufficient to mechanically inhibit the full range of movement.

4. Soft Tissues and Skeletal Tumors

Important points to note on the initial visual inspection of the lump are its anatomical location and relationship to surrounding structures, size, shape and skin appearance (includes ulceration, inflammation or visible skin tethering). Certain tumours are more common in a particular anatomical location (e.g. dorsal wrist ganglion). Proximity to major arteries or nerves may relate to the cause of the lump or at the very least, complicate excisional surgery if it is required. Slow growing, symmetrically shaped lumps not involving the skin suggest benign pathology whereas ulceration, skin tethering and inflammation allude to greater concern.
Palpation of the lump will allow the clinician to further assess the points as mentioned above, as well as derive more information on other characteristics of the lump including tenderness, fixity to skin and deeper tissues, texture of the lump and margins. Vascular lesions may pulsate or exhibit a palpable thrill. Some tumours in the hand are painful whilst others are not typically so. A Tinel’s test should also be gently performed for tender lumps to detect a lesion associated with a nerve either directly (e.g. neuroma) or indirectly by pressure effect. Benign tumours such as inclusion cysts or lipomas are less likely to be tender and are mobile under the skin or over deeper tissues. They are well circumscribed, regular in shape and relatively soft. Fluid filled ganglions transluminate brightly. Hard, craggy, irregular and fixed lumps are of greater concern and signal potential malignancy. The examination of the upper limb lymph node basins in the epitrochlear, axillary and supraclavicular regions should also be undertaken, to detect any lymphadenopathy which may be due to either metastatic or inflammatory causes.

Tumours of the hand may cause either a mechanical block to movement or a functional impairment if nerves are involved. Active and passive ranges of movement are again assessed according to the basic principles outlined. Plain radiograph as well as the other modalities of ultrasound or magnetic resonance imaging are often indicated as necessary.

Figure 8: Firm, mobile, multilobulated lump over the flexor aspect of the tendon, with the common condition being a giant cell tumour of the tendon sheath of the left thumb.

Figure 9: Lump over the metacarpophalangeal joint crease of the thumb overlying the proximal annular pulley, usually representing a ganglion of the flexor tendon sheath.

Summary

Basic understanding and knowledge of the complex anatomy of the hand and a system of examination are required to diagnose the many pathologies arising in the hand. We have presented some basic principles and applied the system of “Look, Feel and Move” to each of the anatomical systems above, with the aim of providing the reader a basic and structured approach when faced with a particular reported symptom.


Anterior Approach to the Lumbar Spine

Bernard Lau Puang Huh
Dennis Hey Hwee Weng
University Spine Centre

Introduction

Anterior approaches to the lumbar spine can be transperitoneal or retroperitoneal. Depending on the need to access the abdominal cavity and the planned surgical procedure, most spine surgeons prefer the retroperitoneal approach as it minimizes the risks of handling and injury to intraperitoneal structures, which may lead to unnecessary complications including postoperative ileus. At the L5 and S1 levels, retroperitoneal access is also popular from the anterior abdominal wall due to the orientation of the major blood vessels in relation to the anterior spine.

Indications

The common indications for anterior approaches include the need for debridement, decompression, instrumentation, correction of deformity and fusion of the anterior spine. These may be secondary to degenerative spine conditions with compression of neural elements (e.g. spinal stenosis), traumatic instability of the spine (e.g. fracture dislocation), symptomatic deformity of the spine (e.g. degenerative scoliosis), an infected collection (e.g. psoas abscess), or an underlying tumour (e.g. neurofibroma).

<table>
<thead>
<tr>
<th>Indication</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degenerative</td>
<td>Anterior discectomy for interbody fusion</td>
</tr>
<tr>
<td></td>
<td>Total disc replacement</td>
</tr>
<tr>
<td>Fracture</td>
<td>Reduction and stabilization of fracture dislocation</td>
</tr>
<tr>
<td>Deformity</td>
<td>Radical discectomy for scoliosis correction</td>
</tr>
<tr>
<td>Infection</td>
<td>Psoas abscess</td>
</tr>
<tr>
<td></td>
<td>Discitis</td>
</tr>
<tr>
<td></td>
<td>Vertebral osteomyelitis</td>
</tr>
<tr>
<td>Tumour</td>
<td>Enbloc corpectomy</td>
</tr>
</tbody>
</table>

Table 1: Indications for anterior approaches to the lumbar spine

Position

Careful positioning of the patient is essential to avoid any unnecessary pressure on important tissues/organ such as the eyes, nose, ears and groin. Ensure that the patient is always lying on bony prominences to minimize soft tissue injury. As far as possible, make sure the limbs are not overly stretched to prevent neuropraxia either during the process of positioning, or in the final surgical position.

For the purpose of anterior approach to the lumbar spine, 2 common positions are adopted. They are the lateral position and the supine position. The lateral position often requires breaking of the surgical table to separate
the lower ribs and the iliac crest allowing a wider surgical corridor. The supine position may be modified to a reverse trendelenburg with lithotomy position to allow easier access of the L4 to S1 levels from the anterior abdominal wall. The patient may be further supported by the use of stirrups, leg/ side supports and beanbags in these positions.

Lighting is important during surgery and the table should be placed in the center of theatre light. Adjustment of light positions should also be done before the surgery. It is crucial to ensure the diathermy pads are placed on adequate soft tissue, staying far from any conductive device. Intra-operative radiographic imaging is often required and precautionary measures must be done to remove any possible obstacles that may interfere with imaging.

**Landmarks & incision**

The landmarks for the anterior abdominal wall approaches include the pubis symphysis, umbilicus and the palpable midline which is the confluence of the left and right rectus abdominis muscles. The planned incision may be a longitudinal midline approach that is extensile, or a Pfannenstiel incision, to gain access to the lower lumbar spine (Figures 1, 2).

The midline longitudinal approach may be advantageous for multilevel exposures, whilst the Pfannestial approach may be more cosmetic for a limited exposure to the lower lumbar vertebrae.

The landmarks for the lateral approach include the palpable lower ribs, the iliac crest and the umbilicus. The incision is usually oblique, starting from the ribs inferomedially towards the midline below the umbilicus.

Further planning of all incisions can be guided by intra-operative radioimaging. This allows the planned incision to be placed centre on the intended field of surgery, considering the trajectory of the approach.

**Exposure**

For anterior abdominal wall approaches, the skin incision is taken down to the underlying anterior rectus sheath, via separation of the subcutaneous tissue. This sheath is then incised centered over the disc of interest and then retracted laterally together with the rectus abdominis muscles, exposing the underlying transversalis fascia. If the exposure of L4-S is required, the arcuate line is identified and a small, 1-inch incision is created proximally on the posterior rectus sheath to widen the surgical corridor for access to the spine. The peritoneum is encountered and would be mobilized and retracted together with the ureter towards the midline.

At the spine, the bifurcation of the great vessels is studied. For a L5-S1 approach, direct access to often possible following careful haemostasis of the traversing presacral and ililumbar vessels. Palpation of the sacral promontory helps guide the blunt dissection (Figure 3).
However, for a L4-5 approach, the aortic bifurcation should be mobilized and retracted to allow adequate visualization and access (Figure 4).

For lateral approaches, the skin incision is deepened through the abdominal musculature via muscle-splitting or muscle-cutting techniques. The layers of muscles encountered include the external oblique, the internal oblique and the transversus abdominis muscles. Using the 12th rib as a landmark, the peritoneum deep to the transversus abdominis is identified and retracted anteriorly. This exposes the quadratus lumborum and the psoas muscles lateral to the lumbar spine.

The spine can then be approached either anterior to or through the psoas muscles. The major vessels anterior to the lumbar spine should be protected at all times. Ligation and division of the segmental branches should be performed to gain access to each individual lumbar vertebra.

**Complications & outcomes**

The incidence of major vein lacerations and left iliac artery thrombosis is said to be 1.4% and 0.45% respectively. Urethral and nerve injuries (lumbosacral nerve root or sympathetics) occur less frequently than major vascular injuries. Patient must also be counselled regarding retrograde ejaculation for anterior approaches to the spine, where the incidence is said to be between 0.1% to 13.3%. The mortality rate after anterior lumbar exposures is less than 1%. Horton et al. analysed patient based outcomes and complications following anterior exposure for spinal deformity. Analysis has shown that anterior approaches to the spine will likely result in reduced patient satisfaction in terms of self-image and appearance.
References


Kocher-Langenbeck Approach
For the Acetabulum

Ng Yau Hong
Diarmuid Murphy
Division of Musculoskeletal Trauma

Introduction

The Kocher-Langenbeck approach was first described by the prominent German surgeon Bernhard von Langenbeck in 1867. It was subsequently modified by his protégé Theodor Kocher. It is one of the 3 key approaches to the acetabulum, other two being the extended iliofemoral approach and the ilioinguinal approach.

Indications

The key indications of this approach are:

- Fixation of acetabular fractures involving the posterior wall and posterior column
- Fixation of simple transverse acetabular fractures of the transtectal or infratectal types

Other indications include:

- Biopsy of lesions involving the posterior column or posterior wall of the acetabulum
- Total hip arthroplasty, particularly in revision cases
- Drainage of septic hips.

Internervous planes

There are no internervous planes.

General Anaesthesia

Use general anaesthesia with adequate muscle relaxation.

Positioning

The patient can be positioned prone or lateral on a traction table. Traction should be applied using the traction table, femoral distractor or by hand. Adequate joint distraction is essential for adequate assessment of the entire hip joint, removal of any loose fragments and reduction of any marginal impaction fractures.
Spontaneous electromyography (EMG) monitoring allows for real-time monitoring of the sciatic nerve function. EMG needles are placed in the tibialis anterior and peroneal longus to assess the common peroneal nerve. They are also placed in the abductor hallucis and flexor hallucis longus to assess the tibial nerve.

Lateral positioning may allow for easier access to posterior wall fractures and prone positioning for posterior column and transverse fractures.

Lateral positioning allows for the buttock fat to fall away from the surgical field and the femoral head to dislocate, which would be preferable for hip arthroplasty. Prone positioning eliminates the tendency for the femoral head to translate medially and allowing it to lie in a reduced position.

The hip should be extended and the knee flexed to avoid traction injury to the sciatic nerve.

**Skin Incision**

The longitudinal skin incision is centered over the greater trochanter, extending proximally just lateral to the posterior superior iliac spine (PSIS) and distally 10cm below the tip of the greater trochanter, in line with the femoral shaft.
Superficial Dissection

Dissection should be made through the subcutaneous fat until the fascia lata is encountered. The fascia lata should then be incised sharply and inferiorly while the fibres of the gluteus maximus should be split proximally.

The insertions of the short external rotators should be tagged and released approximately 1.5cm from the greater trochanter to avoid compromising the blood supply to the femoral head. Care should be taken not to dissect around the quadratus femoris to avoid injury to the medial femoral circumflex artery, which could cause profuse bleeding. The short external rotators can then be reflected posteriorly to protect the sciatic nerve. The tendon of the piriformis can be traced proximally to identify the greater sciatic notch while the tendon of the obturator internus can similarly be traced to identify the lesser sciatic notch.
The posterior wall and posterior capsule should be adequately cleared of abductors and other soft tissues for good visualization.

**Deep Dissection**

Elevation of the obturator internus can be done to adequately expose the quadrilateral plate and assess the adequacy of posterior column fracture reduction. Marginal capsulotomy can be done if the hip joint needs to be exposed, being careful not to detach capsular attachments to the posterior wall. Doing this can devascularize the posterior column fracture fragments. Intra-articular assessment of the hip joint can be aided by femoral traction.

Greater trochanteric osteotomy has been described to help enhance the lateral and posterior exposures of the acetabulum and retro-acetabular space, but this may increase the risk of post-operative heterotopic ossification.6, 5

Osteotomy of the ischial spine at its base provides an unobstructed view of the quadrilateral plate, as previously described.7
Caution

Sciatic nerve injury can be avoided by reflecting the released short external rotators over themselves to protect the nerve, refraining from excessive soft tissue retraction and keeping the hip extended and knee flexed during the surgery.

The inferior gluteal artery emerges just beneath the piriformis muscle. Inadvertent transection of the artery may cause it to retract into the pelvis, requiring a formal open laparotomy and ligature of the internal iliac artery.

Femoral vessels can be damaged due to inadequate protection of the anterior aspect of the acetabulum or excessive retraction anterior to the iliopsoas muscle.

Quadratus femoris injury can be caused by excessive retraction or dissection around the muscle. Injury to the muscle risks injury to the Medial Femoral Circumflex Artery (MFCA), which can cause profuse bleeding.

Heterotopic ossification (HO) is more commonly seen in the extended iliofemoral approach. The incidence of HO with this approach can be reduced by adequate debridement of necrotic gluteus minimus muscle.

References

Pirogoff Amputation

Francis Wong Keng Lin
Ma Qian Hui
Aziz Nather
Division of Foot & Ankle

Introduction

The Pirogoff amputation involves the removal of the forefoot and talus, without dissection of the calcaneum. A smaller flap will suffice for arthrodesis, thus allowing a minimum loss of length that is capable of bearing full weight. There is also minimal devascularization of the flap because the calcaneum is not dissected. It is easier for the patient who has undergone amputation to walk without prosthesis because this surgery allows for a full weight-bearing stump with limb length discrepancy minimized. As part of the medial and lateral malleolus is preserved, prosthesis may be worn with less friction and will be more rotationally stable compared to the prostheses used following a standard transtibial amputation.

Modifications have been made to the original Pirogoff amputation to improve outcome and reduce risk of complications.

Indications

- Wet or dry gangrene of forefoot
- Infection of forefoot
- Palpable dorsalis pedis and posterior tibial pulses
- Ankle Brachial Index ≥ 0.8
- Toe Brachial Index ≥ 0.7

Pre-operative Preparation

- Full Blood Count (FBC), Erythrocyte Sedimentation Rate (ESR), C-Reactive Protein (CRP)
- Urea and electrolytes
- HbA1C
- Chest X-ray (CXR), Electrocardiogram (ECG)
- Haemoglobin > 10 g/dL to provide sufficient oxygen for wound healing.
- Total proteins: Albumin level > 38 g/L to provide nutrition for wound healing.
- Stop all Blood Thinners (Plavix, Aspirin) at least 3 days pre-op.
- Cardiac Assessment: For Acute Myocardial Infarction (AMI) or Ischaemic Heart Disease (IHD), ejection fraction > 35%.
Anaesthesia

Use General or Regional (spinal or femoral nerve block) Anaesthesia for ‘high risk’ cases.

Positioning

Place patient in supine position. Place sandbag beneath buttock on side of amputation. Apply pneumatic tourniquet on the thigh. Inflate before surgery begins.

Operative Technique

- Mark anterior and posterior skin flaps. Incise skin flaps down to deep fascia.

- Anteriorly, on the medial side, divide and ligate the long saphenous vein.

- Clamp, divide and ligate the dorsalis pedis artery.
- Cut extensor tendons (hallucis longus, digitorum longus and digitorum brevis) along the line of incision. On the lateral side of the foot, cut peroneus brevis and longus tendons.

- Place foot in equinus position. Incise the anterior capsule to expose the articular surfaces of the tibia and talus. On the medial side, section the deltoid ligament. Take care not to damage the posterior tibial artery. On the lateral side, incise the calcaneo-fibular ligament.

- Pull the talus outward and downward using a bone hook and dissect the talus from the calcaneum.

- Excise the talus.

- Identify the calcaneo-cuboid joint. Incise its capsule on the lateral side of the foot. Expose the articular surface of the calcaneum for the cuboid.
- Deepen the incision on the sole. Cut the flexor tendons.

- Excise the distal part of the foot, leaving the calcaneum in the plantar flap.

- Expose the anterior, middle and posterior talar articular surface of the calcaneum.

- Using an oscillating saw, osteotomise the calcaneum, just behind the anterior talar articular surface (line CD). The distal one-quarter of the calcaneum is excised.

- Perform an oblique osteotomy from Point D to Point E (posterior border of upper end of remaining calcaneum). Remove the wedge of bone osteotomised (CDE). This osteotomy gives a 60-degree cut of the calcaneum to be apposed to the tibia.
- Expose the lower articular surface of the tibia using Hohmann retractors. Using an oscillating saw, osteotomise the distal end of the tibia perpendicular to the bony surface (FG). Cut the medial malleolus (Point F) and the lower part of the fibula (Point G).

- Remove the articular surface of the tibia to prepare a smooth bony surface (cortico-cancellous) for apposition to the osteotomised calcaneum.

- Make two small incisions in the calcaneal flap. Insert two 2mm Kirschner wires in criss-cross fashion from the calcaneum to engage the tibial cortical surface. Confirm satisfactory position of both wires using image intensifier.

- Drill the track of the Kirschner wires and tap with a 7.0mm cancellous tap.

- Place washers and insert two 7.0 mm partially threaded cannulated hip screws over the Kirschner wires with compression. Confirm satisfactory position and length of screws using image intensifier.

- Release tourniquet and secure hemostasis. Use jet lavage to flush the wound and bone surfaces with normal saline.

- Appose the calcaneum to the tibia. Position the calcaneum slightly posteriorly to avoid tension.
Close the flaps using a single layer of 3-0 prolene sutures.

Apply Tulle-Gras dressing over wound. Put gauze and cotton wool. Wrap the stump with crepe bandage in figure-of-8 fashion. Apply stockinette over stump.

---

**Post-operative Care**

- Monitor high-risk patient in high-dependency ward.
- Monitor 4-hourly parameters (BP, PR, RR) for 24 hours.
- Check post-op Hb on POD 1. Give blood transfusion if Hb < 10 g/dL.
- Inspect wound on POD 3.
- Monitor endocrine control.
- Continue IV antibiotics until wound heals.
- Ambulatory status – non-weight bearing.

---

**Conclusion**

There is currently limited literature regarding the results of Modified Pirogoff Amputation for diabetic foot infections. Nather A. et al. reported good results in six cases of diabetic foot infections (2014)\(^5\). The emphasis for a good outcome is careful patient selection.
References


Arthroscopic Flexor Hallucis Longus Transfer
For Chronic Achilles Tendon Rupture

Andrew Hong Choon Chiet
Lee Wei Ting
Tan Ken Jin
Division of Foot & Ankle

Introduction

Tendon Achilles (TA) rupture is a common sports injury\(^1\). Often, delays in treatment or misdiagnosis result in neglected chronic TA rupture\(^1,2\). Chronic TA rupture leads to weak plantarflexion of the foot. Its management differs from acute ruptures\(^1,3\). Flexor hallucis longus (FHL) transfer for chronic TA ruptures has been shown to yield good results. It is able to bridge the TA gap and complements the triceps surae in plantarflexion\(^4,5\). However, there are associated wound complications with the open technique, especially in patients with risk factors. The latter includes steroids, smoking, diabetes, obesity and old age\(^6\).

This article describes the arthroscopic FHL Transfer Technique. It is less invasive and avoids possible risks of wound complications associated with the open technique. It also allows for earlier rehabilitation. It is now recommended for all chronic TA ruptures.

Anaesthesia

Use General Anaesthesia.

Positioning

Place patient in prone position with the affected lower limb supported on a pillow. Apply a pneumatic tourniquet on the thigh. Inflate before surgery begins.

Operative Procedure

- Use two standard posterior portals for ankle arthroscopy (Figure 1).

Figure 1: Patient in prone position with the standard hindfoot arthroscopy portals.
Perform an initial posterior diagnostic ankle scope and identify FHL at the entrance to its fibro-osseous tunnel. Passively plantarflex the hallux to visualize the movement of the FHL tendon (Figure 2).

Once the tendon has been identified, place the ankle and hallux in full plantarflexion to allow maximal length harvesting of the FHL tendon.

Subsequently, under direct vision, use arthroscopic scissors or a curved blade to harvest the FHL tendon (Figure 3A). Avoid the neurovascular bundle medial to the tendon.

After procuring the tendon, deliver the proximal stump of the FHL tendon through the posteromedial portal and apply a whip-stitch using 2-0 Ethibond suture. (Figure 3B). The assistant should hold the tendon in tension to allow for the stretching of the muscle.

Create a bone tunnel using a bone drill in the os calcis via the posteromedial portal (Figure 4A and 4B).
Attach the proximal stump of the FHL tendon to the guidewire. Deliver the former into the bone tunnel via the posteromedial portal. Pull the FHL tendon through the tunnel slowly (Figure 5A).

With the ankle in maximum plantarflexion, the assistant should provide tension to the FHL tendon and apply traction over several minutes.

Insert the interference screw to anchor the FHL tendon in tension (Figure 5B).

Wash portal wounds and close in layers. Place the affected lower limb in a below knee front splint with the ankle in plantarflexion.

**Rehabilitation**

- Keep the front splint on the affected limb for 2 weeks until wound inspection and change of dressing. Keep the patient non-weight bearing for 2 weeks.
- For the next 4 weeks, use a walking boot (XP Walker) with 3 heel wedges to maintain equinus position.
- At the end of the 4th week, allow the patient toe-touch weight bearing using the walking boot with 1 heel wedge removed.
- In the 6th week, remove all heel wedges and allow the patient full weight bearing in covered shoes.
- Commence a structured rehabilitation programme consisting of a range of motion exercises from the second week. Start strengthening exercises once the patient is fully weight bearing.

**Conclusion**

The arthroscopic FHL transfer for chronic TA rupture is a reliable method. It is less invasive, avoids possible risks of wound complications associated with the open technique and potentially allows for earlier rehabilitation.

Note: This technique and its clinical outcomes were presented at the International Federation of Foot and Ankle Societies (IFFAS) and American Orthopaedic Foot and Ankle Society (AOFAS) Annual Meeting in Chicago 2014 and will be published in the Journal Techniques in Foot and Ankle Surgery 2015.
References


Management of Posterior Hip Dislocation & Acetabular Fracture

Amritpal Singh
Gavin Kane O’Neill
Division of Musculoskeletal Trauma

Introduction

A traumatic hip dislocation is an orthopaedic emergency, which usually occurs in young adults as a result of high energy trauma. If not treated appropriately it can have significant consequences for long term function. The frequency of traumatic hip dislocations has increased. They currently represent 5% of all dislocations1.

This is a case-study of a 22 year old Chinese lady who was involved in a road traffic accident. The principles of assessment and management of such injuries will be discussed.

Case Presentation

A 22-year-old lady was admitted to the Emergency Department after being involved in a road traffic accident. She was previously healthy with no medical problems and had no prior history of previous trauma. She had lost control of her car while turning and hit a tree. She was driving between 90 to 100km/h and had her seatbelt on. Both airbags at the front of her car were deployed during the accident.

On arrival, her Glasgow Coma Scale was 15 (E4V5M6). She did not remember the exact time of the accident but had no amnesia otherwise. Her vital signs were normal with a blood pressure of 112/74 mmHg and heart rate of 88/min. She complained of pain in the lip, generalised facial pain and bilateral knee pain.

On examination, she had 2 lacerations on her face, one approximately 1 cm and the other located 2 cm above her lip. There was no cervical tenderness. Examination of cardiovascular and respiratory system was normal. Tenderness was noted over both knees but there was no limitation in their range of motion. There was no neurovascular deficit in both knees.

Radiographs of the face, chest and bilateral knees were done (Figure 1). No abnormality was found. The patient was admitted to the Plastics and Reconstructive Department for treatment. She underwent debridement and suture of her facial features in the operating theatre under general anaesthesia.

Figure 1: Initial radiograph of both knees
Following her surgery, the patient complained of pain over her left anterior thigh and left groin. Her left hip was noted to be adducted, internally rotated and shortened.

Radiographs of the pelvis and left hip performed in the ward showed a left hip posterior dislocation and an acetabular fracture (Figure 2).

![Figure 2: X-rays of the pelvis and left hip showing a posterior fracture/dislocation of the left hip](image)

**Investigations & Treatment**

The patient underwent a closed reduction of the left hip under general anaesthesia. This was performed 18 hours after presentation.

The hip was stable following reduction and examination under anaesthesia of the left knee was performed. The latter showed no abnormality.

A Computed Tomography (CT) scan of the pelvis performed showed a comminuted fracture of the acetabulum with an intra-articular bony fragment (Figure 3).

![Figure 3: CT scan of the pelvis](image)
Magnetic Resonance Imaging (MRI) of both the knees and pelvis was done as well. The MRI findings of the pelvis were consistent with the CT findings. There was a lateral tibial plateau subchondral microfracture noted in the left knee. The MRI of the right knee was normal.

The patient underwent an open reduction and internal fixation of the acetabular fracture using a Kocher-Langenbeck approach. The intraoperative findings showed that there were approximately 7 to 10 fragments with 5 main fragments reduced. The intra-articular fragment was an acetabular fragment, not a femoral head fragment, which was retrieved but not viable. There was no significant marginal impaction or significant femoral head articular cartilage damage.

Outcome & Follow-Up

Post-operative X-rays and a CT scan of the pelvis were performed (Figure 4).

![Figure 4: Post-operative X-rays and CT scan of pelvis AP and left hip lateral of the pelvis](image)

The patient was placed on non-weight bearing status on the left lower limb and allowed to ambulate with crutches over the next 6 weeks. The patient did well clinically on the last follow-up and was ambulating well without crutches.

Discussion

The hip joint is a ball and socket joint with a rather stable articulation of its anatomical structure, strong ligaments and muscles\(^2\). The hip joint contains a strong fibrous capsule that attaches proximally to the acetabulum and transverse acetabular ligament, and distally to the neck of the femur anteriorly at the greater trochanter. This capsule is composed of 3 ligaments: iliofemoral ligament, ischiofemoral ligament and pubofemoral ligament. All these ligaments prevent hyperextension and overabduction of the hip and help to hold the femur in the acetabulum deeply.

Dislocations of the hip joint are usually caused by high-energy trauma such as road traffic accidents. In this case, there was a significant trauma with airbags being deployed secondary to the road traffic accident. Traumatic hip dislocations make up 5% of all dislocations and up to 50 to 60% of them are secondary to motor vehicle accidents. Job related injuries account for 17% to 20% of traumatic hip dislocations\(^1\).

This case represents an unusual presentation of hip dislocation. As she complained only of knee pain in the Emergency Department, the hip dislocation was not identified then. She may also have been distracted as she complained mostly about her lip laceration in the Emergency Department. She may have also been worried about the cosmetic results due to that injury. Referred knee pain from a hip dislocation is rare among adults and thus, we could not find any literature on this. However, such cases have been well described in the paediatric age group\(^4\).
The hip position during trauma determines the direction of dislocation. If the leg is adducted (flexed and internally rotated), a posterior dislocation occurs. If the leg is abducted (flexed and externally rotated), anterior dislocation usually occurs\textsuperscript{5-7}. Posterior hip dislocations comprise 80\% of all hip dislocations, with motor vehicle accidents being the most common cause. An anterior dislocation is most commonly caused by a hyperextension force against an abducted leg that levers the femoral head out of the acetabulum. Less commonly, an anterior force against the posterior femoral neck or head can also produce this dislocation pattern\textsuperscript{5}.

The most important prognostic factor is the time taken to reduction of the hip joint to prevent complications such as avascular necrosis\textsuperscript{8,9}. The rates of avascular necrosis for cases with early and delayed reduction were reported as 6\% to 27\% and 48\% respectively\textsuperscript{8,9}. The timing of reduction is also crucial to prevent the risk of AVN. It has been shown that if reduction is performed within 6 hours, incidence of AVN will be less than 10\%. In the study by McKeever et al. (1998), the occurrence of AVN was 26\% with a mean time to reduction of 15.3 hours\textsuperscript{10}. In the case presented, the patient had a delayed reduction of the hip and was counselled regarding the risk of avascular necrosis prior to her operation. Another prognostic factor is the presence of associated femoral or acetabular fractures. Both would worsen the prognosis and increase the risk of avascular necrosis\textsuperscript{11,12}.

Acetabular fractures are severe injuries and they can be a complex surgical problem. The greatest contributions towards a better understanding of acetabular fractures, their classification, the mechanism of the fracture, and surgical treatment as made by Judet and Letournel\textsuperscript{13,14}. They clearly defined the indications for surgical treatment of these features.

Acetabular fractures with a dislocation of bone fragments from 3 mm and above require surgical reduction and a stable internal fixation. These in turn enable the early mobilisation of patients. For younger patients with good bone structure and overall good health, surgical treatment is an option. Dislocated fractures of the acetabulum, unstable hips and incongruence are also indications for surgical treatment. Acetabular fractures can be serious medical problems and should therefore be handled by an experienced team of surgeons.

Judet and Letournel’s classification of acetabular fractures has been widely accepted. Fractures of the posterior wall of the acetabulum are the most common, occurring in around 23.6\% of cases, based on the meta-analysis of 34 publications, which included 3670 patients\textsuperscript{15}.

The standard procedure for preoperative evaluation of the patient includes a clinical examination, radiographs of the pelvis including anteroposterior pelvic view, 45-degree iliac view, 45-degree obturator view according to Judet as well as CT scan.

The reduction of the fracture is regarded as satisfactory if the dislocation has a gap that is less than or equal to 2 mm or a 1 mm step\textsuperscript{15}. Anatomical reduction depends on the type of fracture and the interval between the injury and the surgical intervention. Mears et al. (2003) showed in their study of 424 fractures treated by operation, that simple fractures were reduced anatomically in 87\% of patients, whereas associated fractures could be reduced anatomically in only 59\% of patients\textsuperscript{16}.

Long term complications of acetabular fractures include heterotopic ossification in up to 25.6\% of cases and degenerative osteoarthritis in 9.2\% of patients with associated posterior dislocation of the hip\textsuperscript{14}. Another major complication is avascular necrosis of the hip. The incidence of avascular necrosis has been reported to occur in up to 5.6\% of patients treated within 24 hours and 27.8\% of those treated after 24 hours\textsuperscript{17}. Despite a perfect reduction of the hip dislocation with anatomic reduction of acetabular fracture, a significant degenerative process of the hip can still occur in the long-term follow-up. All patients should be counselled regarding this possible late complication.

**Conclusion**

Traumatic hip dislocation is an orthopaedic emergency. Proper diagnosis and early closed or open reduction is important for a good outcome. With regard to acetabular fractures, surgical treatment of displaced acetabular fractures allows for early mobilisation. Good to excellent results are achieved only if anatomical reduction and stable internal fixation are completed.
References


Approach to Management of Cervical Spondylotic Myelopathy

Jonathan Tan Jiong Hao
Gabriel Liu Ka Po
University Spine Centre

Introduction

A 74-year-old female presented with increasing clumsiness of her hands as well as inability to use chopsticks and button her clothes over the period of 8 months. This was associated with an increasingly unsteady gait and frequent falls. She also complained of neck pain with no radiation to the upper limbs. Physical examination revealed an inability to perform tandem gait, positive Hoffman’s sign and generalized hyperreflexia. Magnetic resonance imaging (MRI) of her cervical spine revealed cervical disc degenerative disease with severe exit and central canal stenosis from the level of C3/C4 to the level of C5/C6. There was associated change in T2 signal intensity/myelomalacia at C4/C5.

In view of the above findings, the patient was offered surgery. She underwent an open door left sided laminoplasty from C4 to C6 and a dome osteotomy of C3.

Post-operative recovery was uneventful. At follow-up one year post-operation, her neck pain had resolved and she was able to use chopsticks and wear her clothes independently. She was also able to ambulate without aid.

Discussion

Cervical spondylotic myelopathy (CSM) is a degenerative condition that results in progressive, chronic compression of the cervical spinal cord¹. It is the most common cause of cervical spinal cord dysfunction worldwide. Disc degeneration, facet hypertrophy, formation of syndesmophytes/osteophytes as well as buckling of the ligamentum flavum are some of the static changes that may lead to narrowing of the spinal canal. Other causes of cervical myelopathy include congenital canal stenosis, ossification of the posterior longitudinal ligament (OPLL), trauma, tumor, infection and kyphosis of the cervical spine.
Natural History and Presentation

CSM is a clinical syndrome characterized by loss of dexterity, weakness of the hands and gait imbalance. It is progressive and characterized by long periods of stable symptoms with occasional stepwise deterioration. Rapid deterioration occurs in the minority of cases. Chronic compression of the spinal cord results in progressive neural cell loss. This is a result of direct compression and secondary mechanisms such as apoptosis, inflammation and vascular disruption. In asymptomatic patients with no clinical evidence of myelopathy but with radiographic evidence of cord compression and central canal stenosis, approximately 8% and 23% develop clinical evidence of myelopathy at 1 year and 4 years of follow up respectively. It is associated with lumbar spinal stenosis and up to 20% of patients have tandem stenosis.

Genetics and Heritability

At present, existing family studies suggest that CSM has an inherited predisposition. However, there is no evidence of any specific single nucleotide polymorphisms (SNPs) or haplotypes associated with CSM.

Patient assessment

Clinical assessment of patients with suspected cervical myelopathy includes a full neurological examination of the patient. Possible findings include motor weakness, changes in proprioception and decreased pain sensation, upper motor neuron signs such as hyperreflexia, an inverted radial reflex, a positive Hoffman’s sign and Babinski’s reflex, an abnormal grip and release test and an inability to perform a tandem gait.

In a retrospective review of 120 patients undergoing surgery for cervical myelopathy, hyperreflexia demonstrated the highest sensitivity for detecting cervical myelopathy followed by a positive Hoffman sign, Babinski sign and ankle clonus. These signs also correlated with the severity of myelopathy. However these signs were not as sensitive in patients with mild disability due to myelopathy. These findings were similar to that of a prospective study comparing 39 patients with CSM and 37 patients without CSM (control). The study showed that myelopathic signs were not sensitive in detecting CSM in 21% of the cases. The absence of myelopathic signs in the presence of myelopathic symptoms and correlative imaging findings does not preclude the diagnosis. The successful diagnosis and surgical treatment of CSM necessitates correlation with imaging studies such as radiographs, magnetic resonance imaging and in some cases electrodiagnostic studies.
A cervical radiograph may demonstrate general degenerative changes and decreased sagittal diameter of the central canal. Flexion and extension views may demonstrate angular or translational instability. The cervical sagittal alignment in terms of the sagittal vertical axis (SVA) has been found to be correlated with regional disability, general health scores and myelopathy severity. It is measured by the distance between a plumb line dropped from the centroid of C2 or odontoid and the posterior superior aspect of C7. Cervical sagittal alignment is correlated with global spinal alignment. In cases where significant deformity is suspected global spinal and spino-pelvic alignment must be assessed with full-length scoliosis films.

MRI is routinely used to diagnose cervical myelopathy and assess the degree of stenosis and cord compression as well as to identify intramedullary signal changes. A high intensity signal change on T2 does not appear to be prognostic of progression post-surgery. However, high T2 intensity in combination with low signal intensity on T1 weighted imaging or in comparison to other non-affected segments appears to be prognostic of outcome post-surgery. Nerve conduction studies may be useful in distinguishing cervical myelopathy from other central processes such as amyotrophic lateral sclerosis (ALS) or multiple sclerosis (MS).

Outcome measures

At present, there is no single-outcome measure that adequately quantifies the range of neurological deficits seen in these patients. One of the commonly used outcome measures would be the Modified Japanese Orthopedic Association Scale (mJOA) which scores patients from 0-18 based on upper extremity, lower extremity, bladder and sensory function and the Nurick classification. The latter was developed to assess gait impairment in patients with CSM. Other outcome measures including the Myelopathy Disability Index, Neck Disability Index, and 30-Meter Walk Test could also be used.

Conservative Management

CSM is known to be a progressive condition. 20-60% of symptomatic patients will have neurological deterioration if there is no surgical intervention. As such, conservative treatment is not recommended in patients with moderate to severe cervical myelopathy. There is also little evidence to suggest a specific form of conservative treatment which will benefit patients with mild myelopathy.

Surgical management

The goals of surgical treatment of cervical myelopathy include surgical decompression of the affected segments, surgical stabilization and restoration of normal cervical lordosis. Surgical considerations before choosing the method of surgical treatment include the number of levels affected, the overall sagittal alignment of the spine, the degree of existing motion and motion needed post-operatively and finally the presence of any co-morbidity which would be relative contraindications to the chosen approach.

Anterior surgery typically takes the form of either an anterior cervical discectomy or fusion (ACDF) or corpectomy. Posterior surgery typically involves a laminoplasty or laminectomy and fusion. ACDF is usually performed in patients with 1-2 levels of disease, anterior pathology (disc-osteophyte complex, OPLL) and fixed cervical kyphosis of more than 10 degrees. Posterior approaches such as laminectomy with posterior fusion or laminoplasty are usually performed in patients with multilevel compression and cervical kyphosis less than 10 degrees. In patients with cervical kyphosis, anterior surgery is able to address and treat the underlying kyphosis and compression. Posterior procedures may not be able to decompress the spinal cord due to anterior “bowstringing” of the spinal cord. In contrast, for patients with multiple levels of stenosis with rigid kyphosis, patients requiring multiple corpectomies or patients with post-operative kyphosis after posterior surgery, combined anterior and posterior surgeries may be performed.
The choice of surgical treatment for patients with multilevel CSM remains controversial. In a systemic review by Lawrence et al\textsuperscript{10}, there was no clear advantage in effectiveness in terms of improvement in mJOA scores between anterior and surgical approaches. When comparing complication rates, there was no difference in post-operative C5 palsy rates. Anterior approaches were associated with higher dysphagia rates, while posterior approaches were associated with higher post-operative infection rates\textsuperscript{10}. This suggests that in patients with multi-level CSM, an individualized approach based on patient factors, underlying pathology and surgeon preference should be used as both approaches seem to be equally effective.

**Conclusion**

Cervical spondylotic myelopathy is the most common cause of cervical spine dysfunction. It is marked by fine motor dysfunction and decreased hand dexterity, as well as worsening gait and balance. Diagnosis is made based on clinical findings and correlative radiological imaging. In view of the progressive nature of this condition, conservative management is usually not indicated. Surgical decompression is usually the treatment of choice. It can be performed via an anterior or posterior approach based on underlying pathology, patient factors and surgical preference.

**References**


Background

Chondrosarcomas are a diverse range of malignant bone lesions that account for 9% of all primary malignancies of the bone and are the second most common non-haematogenous primary bone malignancy. They can occur either primarily (peak age 40-60 years) or secondary to malignant transformation of a previously benign lesion such as an enchondroma or osteochondroma (peak age 25-45) and can be asymptomatic. In this article we will present a case that was seen and managed in our clinic and will discuss key clinical, radiological and pathological features that a treating physician should know when treating cartilaginous tumours.

Clinico-Pathological Case Discussion

Cartilaginous Tumours

Sumon Salman Huq
Gurpal Singh
Division of Musculoskeletal Oncology

What pertinent information should be obtained at this stage?

Growth – The patient denied ever noticing any recent growth of the lump, nor did he notice it growing since puberty.

Pain – None noticed in region of lump. No referred or night pain. Only reported some discomfort when putting on trousers.

Neurovascular status – The patient denied any numbness or weakness of the lower limb – Numbness of the lateral thigh may be caused due to the proximity of the lateral femoral cutaneous nerve.

Systemic symptoms – No weight loss, loss of appetite, loss of weight, shortness of breath

Past and Family History – The patient denied noticing any more lesion anywhere else on his body. He also denied having any significant family history that would suggest syndromes such as Maffucci’s, Ollier’s or Multiple Hereditary Exostoses.

A healthy 23-year old man, with no past medical history, was referred from ED for investigation of a large lump that was incidentally found in an area overlying the anterior aspect of his right hemipelvis (Figure 1). On further questioning in clinic the patient admitted the lump to have been there since the age of 8.

Figure 1: Clinical picture of the lesion in question
Examination

In the clinic, the patient was comfortable and showed no evidence of on-going weight loss. The lump was found to be irregular in shape, hard and immobile. It measures around 15cm at its maximum diameter while the skin overlying the lesion was noted to be normal in appearance and freely mobile with no temperature changes noted. Range of motion of the hip was full and pain free. His gait was noted to be undisturbed. Sensation and power of both lower limbs was full and pain free. Distally both limbs were well perfused with dorsalis pedis and posterior tibial pulses palpable on both sides.

What would be the differential diagnosis at this stage?

Considering the location of the lesion and the length of time that it was there for, the initial clinical impression was of an osteochondroma although malignant transformation could not be ruled out at this stage.

Diagnosis / Imaging

Figure 2 shows the subsequent XR that the patient had after initial assessment.

![Figure 2: X-ray taken in clinic](image)

Are there any suspicious radiological signs on this x-ray?

The chondroid pattern of calcification of the majority of the lesion may be in keeping with an osteochondroma while there doesn’t seem to be any scalloping of the pelvic cortex. However, the heterogenous appearance on the lateral aspect of the lesion may be an indication of an aggressively destructive process.

What further tests could this patient need?

Local imaging – CT and MRI are essential to visualise the pattern of calcification and soft tissue involvement respectively. Both modalities can also assess the cartilaginous end-cap. Although no cut-off is diagnostic for malignancy with regards to its size, convention dictates that a size >2cm should raise suspicion[1]. Figures 3 and 4 show our patient’s CT and MRI respectively with the former correlating with the previous XR and the latter study showing inferior extension of the tumour extending to be intramuscular within gluteus medius.
Figure 3: CT showing heterogeneous calcification within the inferolateral aspect of the lesion

Figure 4: MRI showing intralesional fluid changes and a cartilage end cap >2cm

**Staging Studies** – A bone scan and CT of the thorax, abdomen and pelvis should also be obtained in order to detect distant metastatic spread, particularly in the lungs where it is more common although extra-pulmonary metastases are associated with a poorer prognosis. Both these studies showed no evidence of distant metastases. Figure 5 shows the bone scan with increased local uptake in the region of the lesion.

Figure 5: Bone scan showing increased uptake in the area of the tumour but no skip
Treatment

What would you do now?

Now would be a good time to discuss the case with your MDT colleagues. From this subsequent discussion secondary chondrosarcoma was deemed a plausible diagnosis. When also considering the location of the lesion (in a non-weight-bearing, superficial area of the pelvis) primary resection of the tumour was deemed the best management going forward. Figure 6 shows the resected specimen encapsulated within a gluteal muscle sleeve while Figure 7 shows a post-op x-ray that strongly implies a successful and complete resection was achieved.

![Figure 6: Pathological Specimen, note the encapsulation within the gluteal muscle](image)

![Figure 7: Post-op x-ray shows no evidence of the original lesion](image)

Histology

Success of the resection was confirmed with tumour-free margins demonstrated.

What histological grading system is commonly used for Conventional Chondrosarcoma?

Grading is based on the Evans criteria which is based on mitotic rate, cellularity and nuclear size[3]:

- **Grade 1 lesions** contain small, densely-strained nuclei with occasional areas of pleomorphism, mitotic figures, dense cellularity and a significant number of larger sized nuclei are said to be not present.

- **Grade 2 lesions** contain significant portions of moderately sized nuclei with low mitotic rate (<2 per 10 high-powered fields). Nuclei are often paler.
Grade 3 lesions are identified when there are more than 2 mitoses per 10 high-powered fields. An increased degree of cellularity may also be seen. Although used universally when assessing chondrosarcoma grading it must be noted that this grading system is largely subjective and therefore often open to interpretations. This may dramatically change management or even lead to inadvertent mismanagement.

Figure 8: x20 magnification image showing the lesion (C) invading and abutting adjacent soft tissue (ST)

Figure 9: x100 magnification showing cell atypia and pleomorphysm consistent with Grade 2 lesion

Figure 10 - x200 magnification showing an area of entrapped lamellar bone (B) indicating bone permeation

What are the known alternative Chondrosarcoma subtypes?

**Mesenchymal Chondrosarcoma** – A highly malignant lesion that usually affects younger patients. It is characterised by histology that features varying amounts of differentiated cells mixed in with undifferentiated, small round cells.

**Dedifferentiated Chondrosarcoma** – These tumours feature a high-grade non-cartilaginous sarcoma (most commonly osteosarcoma) lying adjacent to a conventional, usually low-grade, cartilaginous sarcoma, with a well-demarcated border between the two. Prognosis for this tumour is usually poor.

**Clear Cell Chondrosarcoma** – A low-grade tumour characterized by vacuous cells. Metastases are rare but may still occur many years after initial respective treatment.
Prognosis

Prognosis is generally good with overall 5-year survival rates of 90%<sup>3,8</sup>.

What factors affect the prognosis of these tumours?

Most case series as well as a large database study<sup>9</sup> have consistently shown tumour grade and stage to be major prognostic factors. Others, which have also been suggested, include inadequate tumour resection (for higher grade tumours) and local recurrence<sup>10, 11,12</sup>.

How would you further follow-up this patient and why?

There is no role for chemotherapy nor radiotherapy for this patient. Therefore, as the prognosis is generally good for this condition, the patient can be followed-up 6-12 monthly with regular x-rays of the pelvis and chest to monitor for both local recurrence and pulmonary metastases.

Learning Points

Cartilage tumours should be carefully evaluated even if from the outset a patient doesn’t seem likely to have a malignant lesion. A thorough history and exam is therefore crucial – Information regarding the shape and (growing) size of the lesion, overlying skin changes, (night) pain, progressive neurovascular compromise (depending on location of lesion), systemic symptoms and any related syndromes such as Maffucci’s, Ollier’s and multiple hereditary exostosis should all be obtained in clinic.

X-ray, CT and MRI are all essential imaging modalities for the evaluation of chondrosarcoma. They are required to understand the lesion characteristics such including its location, size, aggressiveness and involvement of adjacent soft tissues<sup>7</sup>.

Lesions occur more commonly on the axial skeleton then in the peripheral skeleton. Common locations include the pelvis, proximal femur, scapula. Axial and proximal extremity lesions are more aggressive<sup>13</sup>.

Surgery is the mainstay of treatment. There is currently little to no role for chemotherapy or radiotherapy. Novel methods involving hormonal and growth factor therapy are being investigated in laboratory studies<sup>14</sup>.

Overall prognosis is good with 5-year survival rates of 90% quoted in the literature<sup>8</sup>. Risk factors that can affect survivorship include the grade and stage of tumour. Wide excision with tumour-free margins is essential for higher-grade tumours. Failure to achieve this can lead to local recurrence, which reduces overall 5–year survivorship to 74%<sup>15</sup>.

Variants from conventional chondrosarcoma also exist. These include myxoid, mesenchymal, clear cell and undifferentiated variants.

An MDT approach involving surgeons, radiologists and pathologists is the gold standard of treatment<sup>7</sup>. 
References


Carpal Tunnel Release

Beware the Anatomy

Rishi Malhotra
Mark Puhaindran
Department of Hand & Reconstructive Microsurgery

Case Report

A 57-year-old Chinese male presents 6-month history of numbness in his right thumb, index and middle fingers. He is right-handed and was a chef. On examination, there was evidence of thenar muscle wasting. On testing, normal strength of the Abductor pollicis brevis was recorded. The two-point discrimination was 12mm, 11mm and 11mm in the right thumb, index and middle fingers respectively. Tinel’s, Phalens and Durkans tests were positive at the carpal tunnel.

Subsequently, he underwent right carpal tunnel release. Intraoperatively, a motor branch of median nerve had arisen proximally and through the transverse carpal ligament (TCL). It lay superficial to the ligament distally, before disappearing into thenar muscle bulk (Figure 1). With caution, the carpal tunnel was decompressed completely without damaging the variant motor branch.

Figure 1: Intraoperative images displaying anatomy of the motor branch
Discussion

Anatomy:

Floor and walls of the tunnel are made up of the carpal bones with the hamate and pisiform forming the medial wall and the scaphoid and trapezium forming the lateral wall. The roof is the transverse carpal ligament. The tunnel houses the median nerve and 9 tendons: 4 FDP, 4 FDS, FPL (Figure 2).

According to the Poisel Classification\(^1\), the motor branch may arise in 3 ways:

- **Extraligamentous** – turns in retrograde fashion to thenar muscles
- **Subligamentous** – arises within CT and stays deep to TCL until it reaches muscle
- **Transligamentous** – arises within CT, piercing it and lying superficial to TCL

Literature review of operative and cadaveric studies have shown that the most common variation is extraligamentous, ranging from of 46% to 99%. Subligamentous (0 to 34%) and transligamentous (0 to 23%) variations are less common\(^2\).

The Lanz Classification\(^3\), which classifies all variations of median nerve including the motor branch, is also popular (Figure 3). The normal motor branch is extraligamentous and recurrent. In Lanz Group I of variations, the motor branch is subligamentous or transligamentous, arising from the ulnar aspect of median nerve, or it could also be supraligamentous. In the latter-most case, the motor branch arises from the median nerve within the carpal tunnel at the distal end of the TCL. The nerve emerges to become superficial to the distal edge of the TCL before innervating the thenar muscles.

The transligamentous type is associated with thenar muscle atrophy\(^4\) by compression within the TCL fibres\(^5\).
Conclusion

It is important for the surgeon to be familiar with the variations of median nerve anatomy. Intraoperative dissection could otherwise result in inadvertent nerve injury. This case is a transligamentous variant of the motor branch. This variation is particularly at risk during open and endoscopic carpal tunnel surgery.

Figure 3: Lanz classification. Group 0 is the standard anatomy. Obtained from Demircay et al review article.

References


Choosing the Right Journal

Wee Lin
Aziz Nather
Division of Foot & Ankle

What are the different kinds of publications that are available?

There is a wide range of publications that one can choose to publish in:

- Traditionally Printed Journals
  
  There are now more traditionally printed journals than ever before. As such, there are many more opportunities for one to publish one’s article. There are mainly two different types of journals—general or specialised journals. Clearly, general journals deal with a wider breadth of topics while specialised journals are more specific in their area of focus. Moreover, journals also differ in their focus and areas of knowledge (such as academic journals, trade journals etc)

- Internet Journals
  
  Many of the new internet journals are open access. This means that in order for one to publish one’s paper, one has to pay the internet journal. The advantage of publishing on an internet journal is that when the author has paid a fee, there are no access costs for readers. In theory, this means that one’s papers should be able to reach a wider audience as opposed to traditionally printed journals. (For examples of a range of open access journals, visit the Biomed central website: www.biomedcentral.com)

- Conference Proceedings And Posters

- Free Access Internet News Groups
  
  Free access Internet news groups allow for one’s ideas to be published and disseminated rapidly. However, as such articles are not indexed in computer databases, they are likely to vanish rapidly

- Seminar Proceedings

- Books

- Reports

- Informal Newsletters And Journals
Nevertheless, it is advisable for academics to stick to journals (both internet and printed) for publishing.

Why is it important to choose the right journal?

The objective assessment of the research output of an individual hinges on 1:

- Publication in journals
- Book chapters / Review articles
- Theses / Monographs
- Research Grants obtained
- National / International awards
- Membership on National Research Committees / Editorial Board
- Peer Review

Among these factors, publication output is the most discerning of an individual’s research output and is critical to individual promotion. In fact, the success of one’s research is best judged by the number of tier 1 / tier 2 international refereed publications produced.

As have been previously dealt with, there are a wide range of journals available. Each journal specialises in a highly specific area of research. Consequently, the readership varies considerably from one journal to the next. As such, ensuring that one chooses a suitable journal is paramount as it affects the impact and readership of one’s research article.

In order for one’s research article to make a lasting impact, one must be clear of one’s intended audience, and choose a journal that would allow it to best reach out to its intended audience.
What are the key considerations to take into account when deciding on a journal?

There are a few considerations one should bear in mind before deciding on a journal.

Current updated ranking of journals

One should look at the current, updated rankings of journals (such as the NUS ranking of journals). In general, peer reviewed journals tend to rank higher than journals that have not been peer reviewed. (Garfield and Cawkell 1978)¹

There are three important criteria that determine a journal’s ranking: absolute citation frequency, immediacy index and impact factor. The higher the ranking of the journal, the wider its reach (based on impact factors, absolute citation frequency, immediacy index [Garfield et al., 1978]), and the more likely one’s research would have a greater impact.

Absolute citation frequency²

The absolute citation frequency refers to the number of times a particular journal has been cited in other journals. The disadvantage that lies therein in this method is that a journal published more frequently theoretically has an advantage over one that is published less frequently. As such, this measure may not provide an accurate gauge of the ranking of the journal.

Immediacy Index²

The immediacy index is a measure of how quickly an article in a particular journal is cited. It can be calculated by taking the number of articles from a particular journal that have been cited in a given year, divided by the number of all articles published by the same journal in the given year. Once again, this measure runs into problems as it favours journals which are published more frequently, hence giving rise to a biased ranking of journals. After all, a journal published more frequently would have a higher probability of being cited than one published less frequently.

Impact Factor²

The impact factor can be taken to be a relative approximation of the importance of a journal within its field of study. The higher the impact factor of the journal, the more important it is deemed to be.

The impact factor is determined by measuring the average number of times articles from a particular journal are cited. It can be roughly calculated by taking the number of all the citations published in a given year by the journal in question, divided by the number of all articles published by said journal in the chosen years.
By far, the impact factor is the most reliable index when it comes to the ranking of journals. This is because the impact factor is not affected by the size of the journal, frequency of publication of the journal, and age of the journal. The impact factor of journals is published in annual volumes of the Journal Citation Reports, and in various citation indices published by the Institute of Scientific Information.

The National University of Singapore Tiering List 2012 Ranking Exercise serves as a useful guide for research workers. Using impact factor as its only consideration, journals are ranked according to their various specialties (such as Orthopaedic surgery, trauma) and sub-specialties (such as Spine, Hip and Knee, Sports Medicine etc.). Journals are ranked into five different tiers. The higher up the tier a journal is ranked, the better regarded it is.

With all this factors taken into account, one should preferentially choose a journal that has been internationally refereed to be tier 1 or tier 2, with a high impact factor.

### Tier Journals Graded

<table>
<thead>
<tr>
<th>Tier</th>
<th>Journals Graded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Top 10% of all journals graded</td>
</tr>
<tr>
<td>Tier II</td>
<td>Top 20% of all journals graded</td>
</tr>
<tr>
<td>Tier III</td>
<td>Top 25% of all journals graded</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Top 45% of all journals graded</td>
</tr>
<tr>
<td>Untiered</td>
<td>Remaining 55% of journals graded</td>
</tr>
</tbody>
</table>

The journal chosen should be tailored to the standard of one’s research. There are mainly three different types of journals: international refereed, regional refereed and local refereed. Below is a brief list of journals belonging to each category:

**International Refereed:** Journal Bone and Joint Surgery (American), Journal Bone and Joint Surgery (British), Clinical Orthopaedics and Related Research

**Regional Refereed:** Journal of Orthopaedic Surgery, Journal of ASEAN Orthopaedic Association, Malaysian Orthopaedic Journal, The Malaysian Orthopaedic Journal is a peer reviewed journal accepted by West Pacific Region Index Medicus. However, it has yet to secure a PUBMED ranking

**Local Refereed:** Annals Academy of Medicine

Internationally peer reviewed journals are regarded more highly than regional refereed journals. The latter is in turn better received than local peer reviewed journals.
Suitability of journal to one’s research

Last but not least, one should consider how suited the journal is for one’s research article. The journal chosen should be relevant to one’s area of research. With knowledge becoming increasingly specialised, it would be good for one to submit articles to journals that are geared towards one’s relevant subspecialty. A journal which focuses more on one’s chosen research area would inevitably be more suited for one’s article than a journal whose focus is only loosely connected to one’s field of research.

Journals suitable for clinical research are grouped under General Orthopaedics (Table 1), Spine Surgery (Table 2), Adult Reconstruction (Table 3), Paediatric Orthopaedics (Table 4), Trauma Surgery (Table 5), Ankle and Foot Surgery (Table 6), Hand and Reconstructive Surgery (Table 7), Shoulder and Elbow Surgery (Table 8) and Tissue Engineering (Table 9). Journals suitable for Basic Research is listed in Table 10. The ranking and impact factor for these journals are listed according to the NUS Classification of journal for the year 2012.

### Clinical Research:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Journals Graded</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Journal of Bone and Joint Surgery – Am Vol</td>
<td>2.287</td>
</tr>
<tr>
<td>Tier II</td>
<td>Journal of the American Academy of Orthopaedic Surgeons</td>
<td>2.102</td>
</tr>
<tr>
<td>Tier II</td>
<td>Orthopaedic Clinics of North America</td>
<td>1.692</td>
</tr>
<tr>
<td>Tier II</td>
<td>Journal of Bone and Joint Surgery – Br Vol</td>
<td>1.868</td>
</tr>
<tr>
<td>Tier II</td>
<td>Clinical Orthopaedics and Sports Physical Therapy</td>
<td>1.481</td>
</tr>
<tr>
<td>Tier III</td>
<td>Journal of Orthopaedics and Sports Physical Therapy</td>
<td>1.481</td>
</tr>
<tr>
<td>Tier III</td>
<td>Acta Orthopaedica</td>
<td>1.285</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Archives of Orthopaedic and Trauma Surgery</td>
<td>0.913</td>
</tr>
<tr>
<td>Tier IV</td>
<td>International Orthopaedics</td>
<td>0.903</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Orthopade</td>
<td>0.693</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Orthopedics</td>
<td>0.581</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Orthopaedics and Trauma</td>
<td>0.140</td>
</tr>
<tr>
<td>Tier IV</td>
<td>American Journal of Orthopaedics</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Current Orthopaedic Practice</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Orthopaedics</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Orthopaedic Surgery and Research</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Musculoskeletal Surgery</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Operative Techniques in Orthopaedics</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Techniques in Orthopaedics</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Orthopaedics and Traumatology</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>European Journal of Orthopaedic Surgery and Traumatology</td>
<td>NIL</td>
</tr>
</tbody>
</table>

*Table 1: General Orthopaedics*
### Table 2: Spine Surgery

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Spine</td>
<td>2.793</td>
</tr>
<tr>
<td>Tier II</td>
<td>European Spine Journal</td>
<td>2.021</td>
</tr>
<tr>
<td>Tier III</td>
<td>Journal of Spinal Disorders and Techniques</td>
<td>1.303</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Seminars in Spine Surgery</td>
<td>NIL</td>
</tr>
</tbody>
</table>

### Table 3: Adult Reconstruction

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>American Journal of Sports Medicine</td>
<td>3.397</td>
</tr>
<tr>
<td>Tier I</td>
<td>Arthroscopy – The Journal of Arthroscopic and Related Surgery</td>
<td>2.296</td>
</tr>
<tr>
<td>Tier I</td>
<td>Gait and Posture</td>
<td>2.743</td>
</tr>
<tr>
<td>Tier II</td>
<td>Knee Surgery Sports Traumatology Arthroscopy</td>
<td>1.626</td>
</tr>
<tr>
<td>Tier II</td>
<td>Journal of Arthroplasty</td>
<td>1.609</td>
</tr>
<tr>
<td>Tier III</td>
<td>Knee</td>
<td>1.307</td>
</tr>
<tr>
<td>Tier III</td>
<td>Hip International</td>
<td>0.190</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Operative Techniques in Sport Medicine</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Techniques in Knee Surgery</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Sports Traumatology and Related Research</td>
<td>NIL</td>
</tr>
</tbody>
</table>

### Table 4: Paediatrics Orthopaedics

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier II</td>
<td>Journal of Paediatric Orthopaedics – Am Vol</td>
<td>1.036</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Paediatric Orthopaedics – Br Vol</td>
<td>0.619</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Children’s Orthopaedics</td>
<td>NIL</td>
</tr>
</tbody>
</table>

### Table 5: Trauma Surgery

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier II</td>
<td>Injury</td>
<td>1.509</td>
</tr>
<tr>
<td>Tier III</td>
<td>Journal of the Orthopaedic Trauma</td>
<td>1.429</td>
</tr>
</tbody>
</table>

### Table 6: Ankle and Foot Surgery

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier II</td>
<td>Foot and Ankle International</td>
<td>0.956</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of the American Podiatric Medical Association</td>
<td>0.407</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Foot and Ankle Surgery</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Foot and Ankle Surgery</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Techniques in Foot and Ankle Surgery</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>The Foot</td>
<td>NIL</td>
</tr>
<tr>
<td>Rank</td>
<td>Title of Journals</td>
<td>Impact Factor</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Tier II</td>
<td>Journal of Hand Surgery – Am Vol</td>
<td>1.071</td>
</tr>
<tr>
<td>Tier III</td>
<td>Journal of Hand Surgery – Br and Eu Vol</td>
<td>0.824</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Hand Clinics</td>
<td>0.743</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Hand</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Techniques in Hand and Upper Extremities Surgery</td>
<td>NIL</td>
</tr>
</tbody>
</table>

(Table 7: Hand and Reconstructive Surgery)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier III</td>
<td>Journal of Shoulder and Elbow Surgery</td>
<td>1.348</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Techniques in Shoulder and Elbow Surgery</td>
<td>NIL</td>
</tr>
</tbody>
</table>

(Table 8: Shoulder and Elbow Surgery)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Tissue Engineering</td>
<td>4.065</td>
</tr>
<tr>
<td>Tier I</td>
<td>Journal of Tissue Engineering and Regenerative Medicine</td>
<td>2.826</td>
</tr>
</tbody>
</table>

(Table 9: Tissue Engineering)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title of Journals</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>Bone</td>
<td>4.145</td>
</tr>
<tr>
<td>Tier I</td>
<td>Osteoarthritis and Cartilage</td>
<td>4.082</td>
</tr>
<tr>
<td>Tier I</td>
<td>Journal of Orthopaedic Research</td>
<td>2.437</td>
</tr>
<tr>
<td>Tier I</td>
<td>Calcified Tissue International</td>
<td>2.435</td>
</tr>
<tr>
<td>Tier II</td>
<td>Clinical Biomechanics</td>
<td>1.642</td>
</tr>
<tr>
<td>Tier III</td>
<td>Connective Tissue Research</td>
<td>1.085</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Orthopaedic Science</td>
<td>0.704</td>
</tr>
<tr>
<td>Tier IV</td>
<td>Journal of Musculoskeletal Research</td>
<td>NIL</td>
</tr>
<tr>
<td>Tier IV</td>
<td>European Journal of Experimental Musculoskeletal Research</td>
<td>NIL</td>
</tr>
</tbody>
</table>

(Table 10: Basic Research)
How do you know what is the right journal for you?

Since there are a huge range of journals one can potentially choose from, it is crucial that one first narrows down the possibilities by understanding the focus and readership of the different journals. One should compare the focus and readership of the journals chosen with one’s intended target audience, and the content of one’s article.

One should also look through past issues of the journals in question. In doing so, one should ascertain whether one’s article is suitable for the readership of the journal. A question that one should constantly ask oneself is: does this journal allow people interested in similar topics to find out more about one’s study? A good indication that a journal is suited for one’s article would be if there were studies similar to one’s article that were published in previous issues of the journal in question.

Reading through previous editions of the journals allows one to familiarize oneself with the format of the journal in question. One should also determine the type of articles published by the journal whether the journal predominantly publishes case reports, review articles or original articles. Original articles should be awarded the most points, and case reports the least. Review articles should be awarded lower points compared to original articles. This reflects scholarship of integration, another component of intellectual activity of the individual (Holmes et al 2000).

Other journal publications include editorials, further opinions and letters to editors. Book chapters can also be counted as publications. More points should be awarded if an entire book is written by a sole author. Conversely, fewer points should be given for editing a book with only several chapters contributed by the editor. Even fewer points are to be allocated for editing a book without any chapter contributed by the editor. Additionally, lower recognition is given to a book chapter than to original articles in peer reviewed journals. This is mainly because books are not peer reviewed. However, if the book goes on to become a bestseller, the book becomes more important as a publication since the market reviews the book.

Having understood the focus and readership of each journal, and glimpsed through past issues of the journals in question, it would then be possible for one to narrow the scope. One should select 2 or 3 journals in the relevant area of research which have relatively high impact factors, and which are focused towards one’s area of research.

Upon settling on two or three journals, one should then discuss with one’s mentor on the possible journal options, and settle for the journal which can best capture the main essence and spirit of one’s article. Furthermore, there are several online journal selectors such as Springer Journal Selecter (online app) that can offer an effective and fast search for journals best suited to one’s research paper.
What are the steps to take once you have decided on the right journal?

Once you have decided on the right journal for you, the next step that follows would be to check the journal’s submission criteria and required format. Read the “Instructions to Authors” provided for by the chosen journal very carefully. Modify one’s paper accordingly, ensuring that it is in compliance with the journal’s requirements. Once this is done, one can then submit the paper to the journal.

References


Uncovering the Review Article

Ang Yi Yen Zest
Aziz Nather
Division of Foot & Ankle

What makes a good review paper?

A review paper provides a summary of the latest developments of the current state of research in a given topic, with recommendations for future research directions. It is an amalgamation of technical information amassed from previously published transcripts, put together to form a coherent piece. Review articles communicate important messages, contributing to intellectual enrichment and enhancing standards of research1.

Writing a review article is challenging—it would usually necessitate reading relevant texts and other related pieces in detail, to eventually present a sound and well-informed judgment of the topic.

Review articles give insights by providing an alternative point of view on previously unknown or not well-understood relations among distinct studies. Reviews therefore attract more journal, textbook, and thesis citations than any other types of articles, and substantially contribute to the impact factor of journals. Thus, review articles have earned a highly regarded place in scientific research.

Review articles can be classified either according to their mandate or methodological approach.

Mandate

Review articles can be invited or unsolicited submissions. Invited review articles are written by invited experts in the relevant field of study. Unsolicited submissions are written by choice, after researchers have chosen to study a particular field of interest.

Methodological approach

Review articles can also be classified according to their method of approach, and are sorted into 2 main categories. The categories are narrative and systematic.

i. Narrative review articles

Narrative reviews adopt the traditional approach, and does not include a section describing the methods used in the review. Methods of selecting articles are arbitrarily based on the experience and subjectivity of the author, who is often an expert in the area. There is a substantial weakness in the validity of this form of review, since different research workers may employ different methodologies. The absence of a clear and objective methodology section leads to a number of methodological flaws, which can bias the author’s conclusions3.

ii. Systematic review articles

A systematic review article is one in which the authors have systematically searched for, appraised, and summarised all data available in the articles selected. This is done using a clearly defined methodology, which is reproducible4.
Unlike the unstated methodology of narrative reviews, systematic reviews aim to minimise bias by using explicit and pre-selected criteria to obtain objective information. The methodology used is clearly documented in the Methods Section, and is detailed enough to ensure it can be reproduced for verification.

Ranked with providing the strongest evidence and is most free from various biases in medical research, systematic reviews top the hierarchy of evidence (Figure 1), and are commonly used as evidence-based medicine.

The key differences between systematic and narrative reviews are summarised in Table 1:

<table>
<thead>
<tr>
<th>Scope of Content</th>
<th>Narrative</th>
<th>Systematic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a broad overview of an area of research</td>
<td>Investigates a clearly defined clinical question</td>
<td></td>
</tr>
<tr>
<td>Transparency of Search</td>
<td>No methods section</td>
<td>Include methods section</td>
</tr>
<tr>
<td>Search Criteria</td>
<td>Search protocols or selection criteria for selecting evidence are seldom reported</td>
<td>Studies selected for review using an explicit protocol that specifies inclusion and exclusion criteria</td>
</tr>
<tr>
<td>Scope of Articles to review</td>
<td>Only refers to published data</td>
<td>Refers to unpublished data to minimise the risk of publication bias</td>
</tr>
<tr>
<td>Degree of Objectivity</td>
<td>More prone to author’s bias</td>
<td>Less prone to author’s bias</td>
</tr>
<tr>
<td>Analysis of Results</td>
<td>Results are analysed on a qualitative level</td>
<td>Results are analysed on a quantitative level</td>
</tr>
</tbody>
</table>

Figure 1: Levels of evidence
Functions of review articles

Review articles are written for the following reasons:

- to **organize literature** and relate it to your research topic
- to **synthesize results** into a **summary** based on what is and isn’t known
- to **rank** literature based on significance
- to **analyse** the contents of articles
- to **evaluate** literature—identify the strengths and weaknesses of a text, based on specific criteria
- to **identify patterns and trends** in literature
- to **identify inconsistencies, contradictions** and **research gaps**, and henceforth **recommend** new research areas
- to **draw a conclusion** based on the information gathered from various resources

Choosing a topic

One must think carefully about the topic to be chosen for review. It is important to consider the following factors:

- **Have significant clinical impact**
  - Your review article should provide evidence that a new treatment is helpful for clinical practice. It could also provide evidence that a standard treatment is no longer helpful.

- **From a well-studied field**
  - An area having many more authors, perspectives, theories, and controversies is easier to study than one involving only a few people.

- **Be of current interest**
  - Pick a timely topic that is currently of keen interest in research.

- **Be of interest to you**
  - Don’t just pick a topic because it's a hot field of study. Pick one of personal interest.

- **Narrow research topic**
  - It must not be too broad. Estimate how long of a review you want to produce.

- **Be controversial**
  - Make sure you have something to evaluate. You should pick a topic that has at least two competing hypotheses to explain/test it. In this way, one can arrive at a stand.
A sound review article is characterized by a thorough and disciplined literature search. It is important to take into account all relevant studies, to provide a holistic view and weed out bias.

Article searches can be performed in the following:

1) **Computerised literature in electronic bases**
   
a. Typically, published papers and abstracts are identified by a computerized literature search of electronic databases that can include PubMed and Cochrane Central Register of Controlled Trials (CENTRAL). It is recommended to present a full electronic search strategy for at least one major database to be presented8.
   
b. **Reference lists**
   
   Located at the end of every research paper, reference lists provide a list of references cited by the research paper. They are treasure troves of good websites and sources to refer to. By checking the reference list of each research paper, you can easily find other related and useful chapters, articles, and web pages to extract valuable information from.

c. **Hard copy searches**
   
   Look through library resources for relevant papers, books, abstracts, and conference proceedings.

d. **Citation Index**
   
   One of the best sources there is. It is a compilation of all the articles referenced by recently published articles.

e. **Web searches**
   
   To increase the possibility of securing good articles, it would help to use different databases sources other than Google, such as Web Crawler, Google Scholar, and Web of Science. These websites cast a wider net for searches by using several search engines concurrently.

Do not use material from the Internet unless it is a professional, peer-reviewed scientific journal, of which there are now many on the Internet. Most of these are published by professional associations. If you are not sure of the validity of your source, seek a second opinion.
Selecting articles to review

How do you know it is “The One”?

After you have successfully chosen a topic, the next step would be to start the search. In selecting articles to review, adopt the following methodology:

1) Start from most recent articles related to the topic
2) Select 30
   Select those with the most important references.
3) Read and make a summary for each.
   Do this in the form of a bulleted list of the conclusions drawn from each figure.
4) Combine all into a single table.
   Each research article should occupy a row and the publication issues should be in columns. This allows for easy viewing of which papers agreed on which topics, what trends emerged over time and where the controversies in the field lie.

Afterwards, rank each article according to the following criteria (Figure 2):

- **Relevance to topic**
  Is the content of the article suitable for your topic? Does it answer the right questions?

- **Quality and accuracy of article**
  Does the information provided have contradictions or conceptual errors which would undermine its credibility?

- **Clarity of article**
  Is it understandable, or does it hide behind a wall of scientific jargon and terminologies?

- **Content**
  Is the article substantial enough?

- **Reliability**
  Is it oft-cited? Is the research from a credible institute?

---

**Figure 2**: Process in selecting an article to review
The next step would be to start dissecting the articles you have selected. Show your understanding of an article’s ideas and develop a thoughtful response to ideas that bring up key points of conflict.

To aid your evaluation of the articles, it would help to ask yourself the questions as listed in Figure 3 below.

### Figure 3: Outline of evaluation criteria

#### Significance to the Field
- What is the author’s aim of conducting the research, and to what extent has it been attained?
- How is this work related to others in the same field?
- What knowledge does this research add to the field, and what is the extent of its usefulness/applicability?

#### Methods and Materials Used
- What type of approach was used? (Quantitative or qualitative, analysis or review of theory or current practice etc…)
- Is the approach objective? Do you detect bias?
- What framework is used in the analysis of results?

#### Content and Use of Evidence
- Which studies support your thesis?
- Are there studies that support alternative hypotheses?
- Is there controversy in the scientific community, or is there general consensus?
- Is the evidence valid/dependable?
- How useful is the evidence in supporting the argument?
- What are the conclusions drawn, to what extent are they justified?

### Writing the review article

After analysis and evaluation of the research articles, it would be time to begin writing your article. A review typically consists of a general introduction of the context. Towards the end, the main points covered and take-home messages are reiterated.

### General structure of a review article

The general structure of a review article is as follows:

i. Introduction

ii. Body
Introduction

Length

An introduction is typically one paragraph long for a journal article review and two or three paragraphs long for a longer book review. It should be less than 1/5 the length of a paper.

Elements

Introductions should include a few opening sentences that announce the author(s) and the title, and briefly introduce and explain both the topic and thesis. Provide necessary background information required to understand the upcoming discussion. Present the aim of the text and summarise the main finding or key argument, and outline the order in which you will discuss it. Conclude the introduction with a brief statement of your evaluation of the text. This can be a positive or negative evaluation or, as is usually the case, a mixed response.

Body of the paper

The body usually consists of 2 parts—the summary and the critique.

Summary

This consists of a summary of the main points of the article in the same order the writer uses. Omit any descriptive details such as statistics and examples, and include only the main points. Use clear, incisive sentences that can deliver the message effectively.

You must rephrase and refrain from using the same word combinations that the author used. If you use quotations from the article, use quotation marks to make this clear. Plagiarism is serious and an egregious mistake to avoid at all costs.

Critique

The critique section can be classified as the most important part of the review article, where you critique and value add to the primary literature you have sourced for. Give evidence to substantiate your interpretation of the data and the stand you would eventually take. A critical response should be balanced and well-considered including both positive and negative statements. It is important to include other referenced sources to support your evaluation, and to link and compare between studies.

Your evaluation should be based on certain criteria, such as the following:

1. What is the main point or argument in the article?
2. Do the points of other writers concur with or differ from the arguments in the article?
3. Do the writer’s ideas help or hinder their argument?

4. Are the methods used sufficient to meet the study’s aims, or reported in such a manner that the study’s conclusions can be relied upon

   (Is it a double-blinded and randomised clinical trial?)

5. Does the writer possess any bias?

6. Is the writer qualified to make such claims?

**Organise your content**

When writing your article, it would help to draw a conceptual scheme of the review\(^1\), e.g., with mind-mapping techniques. Such diagrams can help recognize a logical way to order and link the various sections of a review. A careful selection of diagrams and figures relevant to the reviewed topic can be very helpful to structure the text too.

Sort and arrange your ideas into paragraphs. Arrange your paragraphs such that they convey one idea at a time, for example, one paragraph per methodology evaluated. End your paragraph with a stand regarding the extent to which the point is still applicable.

Use topic headings to indicate to the reader what concepts or ideas will be covered in that section. Your headings should be informative, such that anyone reading just the headings in the article will be able to get a brief idea on the structure and organisation of the article.

Include a paragraph on recommendations on how the research can be improved, in terms of research methodology, ideas and analytical frameworks used

**Incorporate feedback from peer reviewers**

Reviews of the literature are normally peer-reviewed in the same way as research papers. Having read the review with a fresh mind, reviewers may spot inaccuracies, inconsistencies, and ambiguities that had not been noticed by the writers. It is thus critical to incorporate feedback from reviewers in shaping your final manuscript to produce the best possible results.

**Conclusion**

Your conclusion should leave a lasting impression on the reader, and gain their interest for further developments in that field.

The conclusion is typically a very short paragraph, in which you firmly state your overall stand for your thesis. Succinctly summarise all main points covered, and point out the significance of these results. Ensure that you have a clear take home message that integrates the points discussed in the review.
Captions

Captions are one of the most important elements of a review article. A reader can take one look at the captions and decide whether the article is worth the read. Hence, a caption should be clear and succinct, yet detailed, and should convey all the information needed for a reader to understand the figure, without reading the whole manuscript.

Good captions do not regurgitate information in a figure/table, but explain what it means and why it is important.

Captions have a lot of information to relay, so they must be longer than one or two sentences, but shouldn’t be longer than about 10 sentences.

Now that you have been well briefed on how to write a review article, it is time to put your skills to the test. All the best!
References

4. Law K, Howick J. OCEBM Table of Evidence Glossary. Retrieved April 15 2014 from
6. Murphy, C. Writing an effective review article. J. Med. Toxicol. 2012; 8: 89–90
“Dealing with Deformity in Total Hip Replacement”

2014 V K Pillay Lecturer

Date: 23 April 2014

Venue: NUHS Tower Block Auditorium

The V K Pillay Lecture was established in 2004 in honour of Dr V K Pillay, a pioneer in orthopaedic academics. The lecturer is a renowned orthopaedic surgeon and academic from overseas.

About the Speaker

Mr. Howie is a Consultant Orthopaedic Surgeon at Edinburgh Royal Infirmary and a Honorary Senior Lecturer in Orthopaedics, Edinburgh University, UK. He is also President-elect of the British Orthopaedic Association, Orthopaedic Advisor to the Chief Medical Officer in Scotland and Editor of the Journal of Trauma and Orthopaedics.

His specialist interest focuses on joint replacement in the upper and lower limbs. His research interest is on clinical outcomes and the biomechanics of joint replacement.

Synopsis of Lecture

While hip replacement is one of the most successful modern medical treatments, it is technically demanding. As a result, those who suffer from pre-existing (congenital or iatrogenic) bone deformities may not benefit. This lecture presents the principles, problems, practical process and results of correcting these complex deformities at the time of arthroplasty (instead of having a staged reconstruction).
“Medical Research: Bed to Bench and Back”

2014 R W H Pho Lecturer

Date: 15 July 2014

Venue: NUHS Tower Block Auditorium

The R W H Pho Lectureship was established in 2004 in honour of Dr. R W H Pho (Emeritus professor). It recognizes his commitment to the training and development of musculoskeletal oncology and microsurgery in Singapore and the region. The lecturer invited is a prominent member in the field of musculoskeletal oncology.

About the Speaker

Dr. Berger is a Professor of Orthopaedics and Chair of the Division of Hand Surgery in the Department of Orthopaedic Surgery. He is also the Dean of the Mayo Clinic College of Medicine. He has served in many leadership positions, including President of the American Association for Hand Surgery (2004) and Chair of the American Academy of Orthopaedic Surgeons (2005-2007).

Dr. Berger has published 3 scientific books, 54 book chapters and 126 research articles in the areas of wrist and distal radio-ulnar joint disease, distal upper extremity trauma, upper extremity peripheral nerve and vascular disease and upper extremity arthritis.

Synopsis of Lecture

Some of the most relevant research for today’s healthcare advancements is the result of translational research not only from the bench to the bedside, but from the bedside to the bench and back to the bedside. Many careers in research produce a "fabric" of various projects over time. Each project can potentially change the direction of research. This lecture will take the learner through a sequence of research initiatives carried out by the author, to illustrate how these phenomena occur and how they can be beneficial.
Commitment to Excellence: Orthopaedic Professionalism
Turning Expectations of Quality into Reality

2014 N Balachandran Professorial Lecturer in Paediatric Orthopaedics

Date: 9 October 2014
Venue: Four Seasons Hotel

The N Balachandran Professorship in Paediatric Orthopaedics was established in 2007 in memory of Prof N Balachandran, one of the pioneers of Orthopaedics in Singapore. The aim of the Professorship is to build up Singapore’s expertise and capability in the area of Paediatric Orthopaedics. The lecturer is a renowned orthopaedic surgeon from Korea.

About the Speaker

Dr. Choi is a Senior Professor of the Department of Orthopaedic Surgery of Seoul National University Hospital. He sub-specialises in paediatric orthopaedics, limb lengthening and deformity correction. He is the incumbent Chairman of the International Education Committee for the International Federation of Paediatric Orthopaedics Society.

He has published 5 books and written 4 book chapters. He has also published 150 articles for international peer-review journals, and has conducted 69 presentations at international meetings.

Synopsis of Lecture

The field of surgery is demanding both technically and intellectually, and the modern diverse patient demands both technical proficiency as well as moral awareness. Characteristics of medical profession include fiduciary obligation in offering their skills and expertise; responsiveness to social needs; empathy; respect for others; accountability; commitment to quality and excellence; ability to deal with ambiguity and complexity; and reflection. However, current problems of health care system are challenging because of increased costs, decreased access, variable quality, increased fragmentation, increased administrative burden, technological imperative, medicolegal liability, and system out of control. Disparity in the quality of medical service among the countries, and between academics and community doctors at the local, state, and national level is critical. There exists a tacit, nonreflective acceptance of detachment and professional self-interest, sometimes affected by the power of the hidden curriculum, devaluing the relationship-centered approaches to medicine. One of the concerns facing orthopaedics is increasing disparity in the number of post-resident fellowship applicants among subspecialties. Exaggerated fragmentation due to subspecialization may lead orthopaedic surgeon to function more as technician rather than physician, which would obviously reduce collegiality among groups and damage the doctor-patient relationship.

Medical professionalism has been known to contain six core competences for excellence: patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and system-based practice. For surgeons, I think, surgical skills should be included as 7th competence. To
accomplish these core competences for excellence, integrated education with horizontal and vertical integration through premedical education, basic medical education, graduated medical education and continuous medical education is essential. Quality improvement in medical care should target on six aims which should be patient-centered, safe, effective, timely, equitable, and efficient. We should all prepare to enter a new era of new healthcare delivery channels, including telemedicine and internet medicine. Evidences suggest that electronic communication between patients and providers is both efficient and effective, improving patient satisfaction and saving patient time.

Despite an increasingly complex and distrustful clinical environment, orthopaedic surgeon should be a leader of a team with outstanding competences as a professional, who recognize the importance of teamwork capacity, management capacity, and who can provide vision and motivation, and who knows the fruits of devotion and virtue of modesty. To be effective, system-based practice requires that orthopaedic surgeon should make a paradigm shift from ‘captains of the ship’ to ‘key team members.’ Let’s make the orthopaedics lead the way by meeting the high standards of professionalism (SOP) with excellence, by enhancing transparency and promoting ethical relationships, by developing evidence-based clinical guidelines, by communicating with the public, and by participating actively in quality movement. Our active participation in a voluntary process of self-regulation and achievement of objectives to ensure continued contemporary competence would comfort our patients. Commitment to excellence would help us to shape the quality movement in a way that will enhance the true value of us as orthopaedic surgeons.
“How to deal with a new healthcare paradigm: What have we learned from SPORT studies?”

2014 Pesi B Chacha Lecturer

Date: 8 January 2014

Venue: NUHS Tower Block Auditorium

The Pesi B Chacha Lectureship was established in October 2012 in honour of Dr. Pesi B Chacha, a pioneer in orthopaedic surgery. It recognizes his contributions to the University and orthopaedic community. The lecturer is a renowned orthopaedic surgeon and academic from overseas.

About the Speaker

Dr. Albert is the Richard H. Rothman Professor and Chairman of the Department of Orthopaedics at Thomas Jefferson University and Hospital. He is also the President of Rothman Institute in Philadelphia, PA.

Dr. Albert serves on the boards of several scholarly journals and was the President of the Cervical Spine Research Society. He was also Chair of the International Meeting of Advanced Spinal Techniques (IMAST) for the Scoliosis Research Society. He is now the Chair of the Development Committee for the American Orthopaedic Association and is on the board of Thomas Jefferson University Hospital.

He has produced 7 books and 233 peer-reviewed publications.

Synopsis of Lecture

This lecture will cover the rapidly changing landscape of healthcare payments and reforms in the United States. Leveraging on that, it aims to teach how to maximize value of one’s healthcare environment by receiving the highest quality of healthcare at the lowest cost. The lecture includes the concepts of value, measurement of outcomes (disease-specific and generic) and cost effectiveness, with emphasis on understanding process measures, patient-based health outcome measures as well as their differences.
Multiple Limb Salvage Attempts For Diabetic Foot Infections – Is It Worth It?

Background and Aims

This is a study of patients undergoing below knee amputation (BKA) for diabetic foot infections. We seek to study the patients’ ability to return to normal life, functional status, prosthesis usage and perspectives on multiple limb salvage procedures that culminated in BKA to review their opinion if they would undertake similar paths all over again.

Methods

This is a retrospective review of 108 patients who underwent BKA from July 2011 to June 2013. They were divided to primary and creeping (prior multiple salvage procedures) amputations. The Barthel’s Index (BI) and the Reintegration to Normal Living Index (RNLI) were utilized to demonstrate functional status and ability to return to normal life after amputation. A telephonic survey on whether the patient would undergo the same multiple attempts at limb salvage again if faced with the same problem was employed.

Results

41 patients were available for review after inclusion criteria were satisfied. The average age was 60 (45 to 83 years). There were 24 primary and 17 creeping amputations. All patients had good average BI of 14.2 (3 - 20) and RNLI of 73.2 (31 - 100). Only 24 (58.5%) patients actively used prosthesis with an average daily usage of 4.4 (0 -12 hours). There were no differences in prosthesis usage, BI and RNLI between both groups. We found that 16 (94.1%) out of 17 patients with creeping amputation surveyed would undergo the same multiple salvage procedures if given the similar option. Conversely, only 15 (62.5%) patients with primary amputation would do the same again while the other 9 (37.5%) patients choose to do everything possible to save their leg if faced with similar situation (p=0.001).

Conclusion

Majority of the patients preferred to undergo multiple procedures to salvage the limb from diabetic foot infections even if it ultimately concluded with a major amputation.
Protamine based polyelectrolyte coated micro-carriers of rhBMP-2 enhanced spinal fusion in rats

Introduction

Recombinant human bone morphogenetic protein 2 (rhBMP-2) is regarded as the most potent bone-inducing growth factor. However, large amounts are required for consistency in clinical outcome, which leads to significant complications. The purpose of this study is to explore a new protamine based polyelectrolyte complex (PEC) alginate microbeads carrier to control the delivery and enhance the biological ability of low-dose rhBMP-2 in spinal fusion application.

Methods

A shell of alternating protamine and heparin was fabricated on a strontium alginate microbead template. RhBMP-2 was incorporated on the outermost layer by heparin-specific binding motif. Formation of the core/shell multilayered microbeads was confirmed by fluorescent imaging. Bone inductive ability of the carrier vehicle was evaluated using a rat posterolateral spinal fusion model. Three study groups were set up:

1. Protamine-PEC microbeads with 500ng rhBMP-2
2. Absorbable Collagen Sponge with 500ng rhBMP-2
3. No rhBMP-2 as negative control.

The quality of fusion was evaluated using manual palpation, micro-CT and histology.

Results

Confocal laser scanning microscopy images showed a sequential coating manner without diffusion into the core. After six weeks implantation, rats receiving PEC microbead treatment had better solid fusion, as determined by manual palpation (p<0.05). Micro-CT images and histology showed localized bone tissue deposition in Group 1. However, unsatisfactory bone formation was observed in Groups 2 and 3.

Discussion

From current study, solid fusion is achieved at 1/20 of conventional dose of rhBMP-2. This new carrier presented dramatically superior osteoinductive activity than collagen sponge at low-dose of rhBMP-2 and could be an alternative carrier for BMP-2 and other heparin binding growth factors.
RESIDENTS OF UOHC
Residents of UHOC

In January 2015, UOHJ has 32 Residents:

- 22 for Dept of Orthopaedic Surgery
- 10 for Dept of Hand & Reconstructive Microsurgery

Dept of Orthopaedic Surgery

Residency Year 1

- Muhammad Nazrul Bin Nashi
- Harish Sivasubramanian
- Tan Shuhui Sara
- Wang Ming
- Pang Khang Chiang
- Matthew Thambiah
- Hong Dehan

Residency Year 2

- Amritpal Singh
- Khor Yuet Peng
- Hong Choon Chiet Andrew
Residency Year 3

Ng Yau Hong

Residency Year 4

Tan Jiong Hao
Jonathan

Lau Puang Huh
Bernard

Yik Jing Hui Kevin

Zubin Daruwalla

Poh Keng Soon

Chua Wei Liang

Han Fucai

Lin Shuxun

Chen Yongsheng

Chua Kerk Hsiang
Zackary

Wong Keng Lin
Francis
Dept of Hand & Reconstructive Microsurgery

Residency Year 1
Benjamin Seah

Residency Year 2
Jonathan Tay  Dong Xiaoke

Residency Year 3
Ryan Yak  Dallan Dargan
Residency Programme Awards 2015

Best Teacher for Professor V. Prem Kumar

Residency Programme 2015

This award recognises an individual faculty for his/her excellent performance in teaching our residents.

Best Junior Resident Award 2015
R2 & R3
Dr Khor Yuet Peng

This award recognises an individual resident from the Junior Resident (R2 & R3) cohort of the NUHS Orthopaedic Surgery Residency Programme for his/her outstanding performance as an all-rounded clinician, resident and colleague.
Best Senior Resident Award 2015
R4 & R5
Dr Wong Keng Lin, Francis

This award recognises an individual resident from the Senior Resident (R4 & R5) cohort of the NUHS Orthopaedic Surgery Residency Programme for his/her outstanding performance as an all-rounded clinician, resident and colleague.

2. Raghothaman D, Leong MF, Lim TC, Toh JKC, Wan ACA, Yang Z, Lee EH.  
Engineering Cell Matrix Interactions in Assembled Polyelectrolyte Fiber Hydrogels for Mesenchymal Stem Cell Chondrogenesis. Biomaterials. 2014; 35 (9): 2607-16

Cross-Talk Between TGF-Beta/SMAD and Integrin Signaling Pathways in Regulating Hypertrophy Of Mesenchymal Stem Cell Chondrogenesis Under Deferral Dynamic Compression. Biomaterials. 2015; 38 : 72-85


7. Tan PHS, Chia SS, Toh SL, Goh J, Nathan SS.  
The Dominant Role of IL-8 as an Angiogenic Driver in a Three-dimensional Physiological Tumor Construct for Drug Testing. Tissue Engineering Part A. 2014; 20 (11-12): 1758-66


Enhancing Analysis of Cells and Proteins by Fluorescence Imaging on Silk-Based Biomaterials: Modulating the Autofluorescence of Silk. Tissue engineering Part C Methods. 2015 Feb; 21 (2): 218-28


Can There be a Place for Intraoperative Salvaged Blood in Spine Tumor Surgery? Annals of Surgical Oncology Epub. 2014; 21 (7): 2436-43

13. Ng DZ, Kumar VP.


15. Ayerst BI, Day AJ, Nurcombe V, Cool SM, Merry CLR.


Accelerated Bone Growth In Vitro by the Conjugation of BMP2 Peptide with Hydroxyapatite on Titanium Alloy. Colloids and Surfaces B: Biointerfaces Epub. 2014; 116 : 681-6

17. Bae DS, Kim JM, Reidler JS, Das De S, Gebhardt MC.


20. Tan SHS, Saseendar S, Tan BHM; Pawaskar A, Kumar VP.

Ulnar Fractures with Bisphosphonate Therapy: A Systematic Review of Published Case Reports. Osteoporosis International 2015; 26 (2): 421-9


The Orthopaedic Research Scene and Strategies to Improve It. The Bone & Joint Journal 96-B. 2014; (12): 1578-1585


Predominant Patterns of Median Nerve Displacement and Deformation During Individual Finger Motion in Early Carpal Tunnel Syndrome. Ultrasound in Medicine & Biology. 2014; 40 (8): 1810-8


26. He M, Sebastian SJ, Gan AWT, Lim AYT, Chong AKS.


27. Yeo Sebastian SJ, Ho SYM, Tay SC, Puhaindran ME, Lim AYT.


28. Puhaindran ME, Pho RW.

Biological Reconstruction for Children with Osteosarcoma Around the Knee. Annals of the Academy of Medicine, Singapore. 2014; 43 (10): 499-505

29. Aung LL, Tin AS, Quah TC, Pho RW.

Osteogenic Sarcoma in Children and Young Adults. Annals of the Academy of Medicine, Singapore. 2014; 43 (6): 305-13

30. Hong CC, Nather A, Lee JKX, Mao HT.

Hydrosurgery is Effective for Debridement of Diabetic Foot Wounds. Annals of the Academy of Medicine, Singapore. 2014; 43 (8): 395-9

31. Wong KL, Nather A, Chanyarungrojin AP, Shen L, Ong TE, Elangovan RD, Lim CT.


32. Tay YWA, Hong CC, Murphy D.

33. Kumar N, Shah SM, Ng YH, Pannierselvam VK, Dasde S, Shen L.


35. Neo PY, Shi P, Goh JC, Toh SL.

36. Chen YS, Singh A, Long YA, Chee YH.
How To Deal With this, that and the Other? An Orthopaedic Surgeon's Unexpected Encounter With A Trio Of Problems In An Elderly Man. BMJ case reports 2014

37. Malhotra R, Chan CS, Nather A.
Osteomyelitis in the Diabetic Foot. Diabetic Foot & Ankle. 2014; 5

38. Nather A, Wong KL, Lim AS, Ng ZWD, Hey HW.

39. Chan SYC, Wong KL, Lim JXJ, Tay YLE, Nather A.

40. Chung SR, Wong KL, Chah AEJ.

41. Chuah YJ, Lee WC, Wong HK, Kang Y, Hee HT.

42. Han FC, Gartner L, Pearce CJ.

43. Hong CC; Nashi N, Prosad RS, Tan KJ

45. Bazley FA, Maybhate A, Tan CS, Thakor NV, Kerr C, All AH.


46. Wu K, Wong KL, Ng SJK, Quek ST, Zhou B, Murphy DP, Daruwalla ZJ, Ren H.


47. Ng ZD, Krishna L.


48. Daruwalla ZJ, Wong KL, Thambiah J.


49. Marcel PH, Gurpal S, Georg G, Markus N, Arne S, Jendrik H.

Stump lengthening procedure with modular endoprostheses - the better alternative to disarticulations of the hip joint? Journal of Arthroplasty. 2015; 30 (4): 681-6

50. Yak R, Lundin AC, Peng YP, Sebastin SJ.


51. Redier JS, Soumen Das De, Schreiber JJ, Schneider DB, Wolfe SW.


52. Pannirselvam V, Hee HT.


53. Manohara R, Liang S, Huang D, Krishna L.


54. Elbaz A, Mor A, Segal G, Aloni Y, Teo YH, Teo YS, Das-De S, Yeo SJ.


55. Shi ZL, Neoh KG, Kang ET, Poh CK, Wang W.

56. Chua KHZ, Chen YS, Lingaraj K.


57. Saseendar, S, Tan SHS, Vijayan S, Pawaskar A, Kumar VP.


58. Nasi N, Hong CC, Krishna L.


59. Wu YN, Law JBK, He AY, Low HY, Hui JHP, Lim CT, Yang Z, Lee EH.


60. Tat LC, Singh G, Jonathan SBY, Leng LS, Liang S, Awiszus F, Lohmann CH, De SD.


62. Toh WS, Casper BF, Pei M, Po HHJ.


63. Daruwalla ZJ, Wong KL, Pillay KR, Leong KM, Murphy DP.


64. Tan VH, Murugan A, Foo TL, Puhaindran ME.


67. Hong CC, Tan KJ, Lahiri A, Nather A.


68. Hong CC, Lee WT, Tan KJ.


69. Han FC, Daruwalla ZJ, Shen L, Kumar VP.

A Prospective Study of Surgical Outcomes and Quality of Life in Severe Foot Trauma and Associated Compartment Syndrome after Fasciotomy. The Journal of Foot and Ankle Surgery. 2015; 54 (3): 417-23

70. Rehim SA, Maynard MA, Sebastin SJ, Chung KC.


72. Shah SM, Dutton AQ, Liang S, Ng G, Das-de S.


74. Bazley FA, Pashai N, Kerr CL, All AH.


75. Lohmann CH, Singh G, Willert HG, Buchhorn GH.


My Fellowship Experience with the Sydney Orthopaedic Research Institute

Lai Kah Weng
Division of Sports Medicine

“The Only Source of Knowledge is Experience.” - Albert Einstein.

And experience I certainly did, in North Sydney from June 2014 to Dec 2014, where I spent 6 fruitful months working with Drs Myles Coolican, David Parker and Brett Fritsch at the Sydney Orthopaedic Research Institute (SORI).

My journey for this fellowship started when I was midway through my Advance Specialty Training (AST), when earlier batches of exiting surgeons raised my awareness of the lengthy process involved in arranging for an overseas fellowship position. During a routine breakfast at Kopitiam, my medical school classmate and fellow orthopaedic surgeon, Dr Sean Leo, had just returned from a “tough and challenging” one-year overseas training in Sydney and he groaned about spending his spare time on weekends covering rugby matches. My interest and curiosity were immediately stoked, and I spent the entire morning asking him all about the rugby!

Serendipitously, my AST mentor, A/Prof Howe Tet Sen from Singapore General Hospital happened to work with Dr Coolican when they were clinical fellows together in Cleveland in the 90’s. Through him, I secured an interview with SORI in October 2012, which coincided with an arthroplasty conference in Sydney where I presented a paper. Sean Leo had characterized Dr Myles Coolican as a rugby-loving, friendly and fatherly figure, and this was confirmed the moment we shook hands at the Royal North Shore hospital. Myles has rugger hands – large warm grip, mallet fingers, crooked PIPJ and various other deformities that one can only find in a hand surgery textbook – which are hallmarks of an experienced rugby player. The interview took place after his operating list, and it nearly ended up being a discussion on the current forms of the Wallabies and the All Blacks, the respective national rugby teams of Australia and New Zealand.

As with any fellowship process, the pain starts after being accepted – i.e. when the various application and visa forms need to be filled. On returning to Singapore, I was reminded through my application process that we often take our well-oiled, responsive administrative systems for granted. The almost hair-tearing experience taught me the virtue of patience. Different organizations work on different degrees of urgency, and often, processing timelines are leveled down to the ONE.SLOWEST.RATE.LIMITING step. For fellowship applicants, be ready for delays and frustration.

Back in NUH, I was very fortunate and humbled to have Prof Wong HK and A/Prof Wilson Wang as Department and Division chair respectively, who had supported my fellowship application readily. Their sterling character references for me have certainly helped smoothen the bumpy application process. So, in early June 2014, armed with the Department’s blessing and some papers from the Australian immigration authorities, I set foot onto the plane bound for Sydney.
The winter in Sydney caught me by surprise, as I had not expected it to be so windy. I anticipated that the temperature would be cold, but when the Southern Ocean Winds blew from Antarctica, the chill was palpable even under my fleece-lined Gortex jacket and was evidently more intense beneath my Singapore cotton boxer shorts. Shorts which were more suited for tropical weather. It was in this retracted state that I turned up for my first day of work on 15 June 14. However, the warmth of the surgeons and staff at SORI blew me away immediately. Interestingly, the warmest welcome was from the incumbent SORI fellow from Scotland, who has been there for 6 months already. I guess he must have been lonely as the sole fellow for about 4 months, but I could not suppress a tinge of suspicion that he seemed relieved to have another fellow to share the presumably heavy workload.

“Geography is Destiny” - Abraham Verghese in Cutting for Stone

So, why Sydney? In terms of population numbers, Sydney and the state of New South Wales are the largest city and state in Australia respectively. In 2011, the population of Sydney was 4.39 million with a median age of 36 and 12.9% of people are 65 or older. Having a good mix of young and elderly within a relatively large population meant that there will be a plethora of cases ranging from paediatric trauma to multi-ligament sports injuries to degenerative conditions requiring realignment, arthroplasty and revision arthroplasty. It looked like I was set for a great learning experience.

For thousands of years, the area around Sydney has been inhabited by indigenous Australians until the first British settlers arrived in 1788 with Captain Arthur Phillip. He founded Sydney as a penal colony and convict transportation only ended in the mid 1800s. Coinciding with the discovery of goldfields, multi-ethnic migrants began to arrive in New South Wales in large numbers. Resentment among white miners towards the successes of Chinese miners led to tensions between groups and eventually a series of riots between 1857 and 1861. This led to restrictions being placed on Chinese immigration which remained in force until the early 1870s. In 1901, soon after the formation of the Federation of Australia, a “White Australia Policy” came to fruition, which comprises various historical policies that intentionally favoured immigration to Australia from certain European countries, and especially from Britain. Although the policies were progressively dismantled between 1949 and 1970s, there remained a requirement for an English proficiency test for non-British nationalities. Thankfully, despite being labeled a non-British, I managed to pass the IELTS and confirm my fellowship position in SORI.
SORI was established in 2001 when Dr David Parker returned from his fellowship at Fowler-Kennedy Sports Medicine Centre in London, Western Ontario to join Myles’ solo practice. Together they were the pioneers in establishing a research-based clinical fellowship program in New South Wales, privately-funded by monthly contributions from both surgeons and the government funding (Medicare) derived from fellows assisting in the private cases. There are 2 types of fellowships within the SORI framework – a clinical fellow (with some research responsibilities) and a full-time research fellow. I belong to the former, and in fact, most of my time is allocated to clinical work, with research taking up 20% of the entire week.

The SORI fellowship is accredited by the Australian Orthopaedic Association, and more importantly, it is also one of only five fellowships in Australia (and the only one in Sydney) accredited by International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS). Without doubt, this prestigious fellowship program is expected to be rigorous, “tough and challenging” as described by my classmate. Hopefully, my foundation laid in NUH will put in good stead to overcome some of these tough challenges.

“In order to succeed, your desire for success should be greater than your fear of failure.” – Bill Cosby

Armed with a sense of purpose (and some confidence in my proficiency in the English language), I started my clinical work in Royal North Shore Hospital (RNSH) in our favorite office – the operating theatre (OT). Similar to Singapore’s national training program for specialists, the Australians are also undergoing a transition from their traditional AST-type training to a dedicated through-train specialist training called (surprise, surprise) – residency. Over the last 10 years, there has been a trend amongst Australian Universities to offer medicine as an US-styled post-graduate program and, with it came a corresponding demand for residency training. The consultants are responsible for the training of their own residents as well as guiding their own fellows to learn from them.

Typically, the consultant will have to supervise the surgeries in 2 or 3 OTs, including the overnight trauma cases. He will split the cases and direct the manpower accordingly. Most of the time, the other fellow and I will alternate to operate and assist each other in one OT independently, whilst the consultant will usually scrub in with the senior resident (registrar) to supervise his work. In the 6 months, highlight of the cases that I have been exposed to included complex primary multi-ligament reconstruction (total cases in parenthesis: 10), arthroscopic reattachment of paediatric ACL tibial avulsions (7), high-tibial osteotomies for young medial compartment knee osteoarthritis (8), staged-revision ACL reconstruction (3), femoral osteotomy for congenital dysplasia (1), fibula head tuberculosis (1) and bilateral knee arthroplasty in oversized and obese patients (2). Of course, there were also the standard anterior cruciate ligament reconstruction and primary total knee replacement surgeries (many).
Performing a navigated total knee replacement for the same patient.

The clinical exposure in the OT was certainly worth the while, with much learnt about operating on patients with a different profile in a different system. Coming from our medical records system where we have transitioned from hand-written notes to typing our own operative findings, the use of the Dictaphone was somewhat of a culture shock. Dictating notes need mental organization and practice, and unfortunately between cases, there just was not much time to practice! Mastery of the Dictaphone continued to elude me by the end of the fellowship, and I could only console myself that it is probably fine to skip a generation – just like our current housemen who never have to use pagers and understand what the different number codes meant. Guess what? Pagers are still being handed out and used regularly in RNHS.

Outside of the OT, I was exposed to patients of various ethnicities in the clinics, with the majority being English-speaking Caucasians. Interestingly, the minorities form about half the clinic load, and they include ethnic Armenians, Lebanese, Indians, Fijians, Samoans, Tongans and Chinese. The Chinese form a significant proportion of the minorities, and my fluency in Mandarin was often put to good use as a translator. Specific to sports injuries, many of the players of contact sports (rugby union, rugby league and Aussie Rules football) all turned up in the clinic with various injuries, with some of them having played professionally. Those with injuries serious enough (such as multi-ligament knee injuries) would have been admitted directly, and prepared for surgery within 2 – 3 days. They would have been picked up over the weekend by the covering medical doctor, a role which I fortuitously performed for the Gordon Rugby Football Club for the remaining part of their 2014 rugby season.

Team Doctor during an away game for the Gordon Rugby Football Club
As the work started to get into full swing, the concept of work-life balance was tilted strongly towards work on weekdays. On most operating days, the day starts at 7am sharp with residency teaching for about an hour. The cases start at 8:30am, and will not end until 8pm. Occasionally, the list ends at 10pm and even stretches past 11pm. I only realized that these working hours are atypical of Australian standards when I trundle out of the OT to find out, to my chagrin, that most dining venues were closed by 9pm. After a few nights rolling in bed with bouts of hunger pangs, I quickly learnt about the best instant meal at the nearest 7-eleven store, and also how to cook quickly for one person. It suddenly dawned on me that this was the reason why the incumbent fellow at SORI showed me such warmth at the start!

“A pint of sweat, saves a gallon of blood.” - George S. Patton

Do not be mistaken that my supervisor is a workaholic, only concerned about performing surgery without guided training. In fact, Myles firmly believed that more of the “sweating” should be done outside of the operating theatre, and I was fortunate enough to attend cadaveric courses on revision total knee arthroplasty and ACL/multi-ligament reconstruction at Macquarie University, chaired by himself and David Parker respectively. The revision knee arthroplasty course was particularly memorable, as the cadavers were custom ordered with previously implanted knee prosthesis. As a result, the removal of the implants was not imagined. We had to actually sweat over their explantation, and inhale some of the pungent fumes from the freshly sawed cement. The added benefit was that I got to keep the removed implants, to be used as a memento from the course and a teaching tool during FRCS vivas. For the ACL/multi-ligament reconstruction cadaveric course, I was exposed to various techniques from the eminent knee surgeons from Sydney, Melbourne and Queensland. The hands-on workshop gave me the opportunity to clarify the practical tips that were highlighted by the surgeons, and allowed me to incorporate some of them into my own practice.
My learning was furthered when Myles gave me time off to attend the Australian Orthopaedic Association Meeting in Melbourne. More importantly, he helped me obtain an invitation for the Australian Knee Society – a closed meeting that only members of the group and invited guests are allowed to attend. I was able to listen to many lectures by the 2 renowned surgeons, Drs Mark Snyder and Paul Marks. At the same sitting, I had the fortune of meeting with Dr John Bartlett, a senior Australian orthopaedic surgeon from Melbourne who has mentored many local and regional surgeons.

“Get your facts first, then you can distort them as you please.” - Mark Twain

As part of research portfolio, I had to undertake a study on patients who were dissatisfied from their primary TKRs. I had the opportunity to learn about designing, planning and collecting data for the study. My bedside manners were especially sharpened because I had to cajole and convince unhappy patients that they should come back for an assessment, for their own good and SORI’s – but mainly SORI’s. Also, I was given an opportunity to write up a book chapter in a Sports Medicine textbook on the controversies in the use of local anaesthetics, and the management of concussion in sports.

“The two most important days in your life are the day you are born and the day you find out why.” – Mark Twain

The extended time away in Sydney had given me the opportunity to rekindle a passion which I had neglected since starting orthopaedics: reading books. And I do not mean orthopaedic textbooks. I ploughed through at least 10 fiction/non-fiction books, relishing the lessons put forth that provided me with an enlightened perspective about our profession that could not be obtained passively.

One of the books was “Talent is Overrated - What Really Separates World-Class Performers from Everybody Else” by Geoff Colvin. His main message is that people are not born with all the natural talent and abilities that will make them great, including Mozart or Tiger Woods. He asserts that, aside from some physical attributes that may give an athlete an advantage in a particular sport, everyone can achieve world-class performance through “deliberate practice”. This deliberate practice – when it is properly designed, gets repeated a lot, whilst providing constant feedback, with features of being highly demanding mentally AND not being much fun – will allow a person to attain mastery in his chosen field. In our context of being orthopaedic surgeons, I could definitely relate to the notion of designing such deliberate practice and setting our paths towards world-class performance.

“Two roads diverged in a wood, and I took the one less traveled by. That has made all the difference.” - Robert Frost

Final thoughts: The fellowship has enriched me in an experience that cannot be replicated anywhere else. And, I believe that all junior surgeons should embark on such a journey overseas, to find out about the best practices in different hospitals of the world, about the latest surgical techniques in different operating theatres, and most importantly, to find out more about themselves in a different culture and setting.
Hip & Knee Surgery Fellowship

Fellow : Dr Nimmagadda Pradeep Kumar  
Supervisor : Associate Professor Wilson Wang  
Period : September 2013 – March 2014

“I got to know all about the current and emerging trends in knee and hip surgery…”

“Good learning experience overall from my supervisor and other faculty of NUH…”

University Spine Centre

Fellow : Dr Arjun Jain  
Supervisor : Professor S Das De  
Period : February 2014 – August 2014

“Excellent guidance, good case exposure, hands on training, amazing facilities…”

“… Learn the methodology and then apply for future use”

“… Always available for advice.”

Fellow : Dr Feng Jin  
Supervisor : Professor Wong Hee Kit  
Period : October 2013 – April 2014

“… Prof. Wong’s practice is exclusively in the sub-speciality of spine surgery focusing on the management of degenerative, infective, metabolic and neoplastic conditions of the spine. He is very kind to everyone. He is willing to guide my training very patiently…”

Fellow : Dr Wali Zubair Abdulhamed M.  
Supervisor : Associate Professor Gabriel Liu  
Period : January 2014 – January 2015

“Teaching was good…”

“Learnt a lot about spine surgery…”
Sports Medical Fellowship

Fellow : Dr Sandeep Vijayam  
Supervisor : Professor V P Kumar  
Period : September 2013 – March 2014

“Good mentorship, ample hands on training, good academic teaching programme and able to follow up the operated patients in the clinic. The most important aspect is an excellent supervisor in all sense…”

“… I was tagged with all three consultants in the division, so I got maximum exposure in the operation theatre and also adequate time in the subsidised clinic as well.”

“A very simple, but ‘young at heart’, dynamic person who ‘loves’ to teach… always open for discussion and very receptive. He is highly knowledgeable, has his own style of doing things and well respected by everyone…”

“Always encouraging… and appreciative of good things done by me… but at the same time points out my mistakes as well. Discusses at length about each procedure he is doing and always guides me in the operating room and clinic.”

Fellow : Dr Aditya Chandrakant Pawaskar  
Supervisor : Professor V P Kumar  
Period : January 2014 – July 2014

“The programme has a good teaching schedule, excellent supervisor with in-depth knowledge of subject and excellent surgical hands on exposure.”

“Fair amount of time spent in operating theatre either assisting or operating. This gave better understanding of the clinical problems and treatment at the same time. Time spent in clinics was useful to sharpen examination skills and form differential diagnoses.”

“Lucky to be under such a supervisor who gave me so much operative freedom as well as timely and appropriate inputs in day to day clinical matters.”

“Supervisor and other consultants in division were always there by our side while we operated and to point out and correct our mistakes.”

Fellow : Dr Saseendar Shanmugasundram  
Supervisor : Professor V P Kumar  
Period : March 2014 – September 2014

“Good hands-on exposure to clinical assessment, planning of management, surgical treatment and post-operative care.”

“Prof Kumar is an excellent teacher, a very altruistic person with respect to teaching. In addition to the surgical skills and the tricks and nuances of surgical and conservative management I learnt a lot of values from him.”

“Prof Kumar was available all the time to make clarifications, teach and demonstrate the signs/surgical procedure.”
Paediatrics Orthopaedic Fellowship

**Fellow**: Dr Joanne Marie Dartnell  
**Supervisor**: Professor James Hui  
**Period**: July 2013 – July 2014

“Enjoyed my attachment with Paediatrics…”

“… Learnt a lot about Paediatric Orthopaedics.”

---

**Fellow**: Dr Andrea Yeo  
**Supervisor**: Professor James Hui  
**Period**: January 2014 – July 2014

“… Good exposure overall to clinical and operative cases. Also to better understand cultural influences. Good opportunities in theatre too.”

“Good exposure to different cases and some particularly complex ones…”

“… Given ample opportunities to lead in theatre and my supervisor was keen to teach.”

---

**Fellow**: Dr Kadek Ayu Candra Dewi  
**Supervisor**: Dr Andrew Lim  
**Period**: February 2014 – August 2014

“Many clinical experiences and many case variations…”

“… My supervisor was very patient and knowledgeable always ready to help and very encouraging.”
Musculoskeletal Trauma Fellowship

Fellow : Dr Vikas Bacchal  
Supervisor : Associate Professor Joseph Thambiah  
Period : June 2014 – August 2014

“Academic sessions were a delight where I’ve learned a lot during these 6 weeks...”

“I felt that Prof. Thambiah and other trauma surgical team members were always available and eager to help me in their aspects.”

“Prof Thambiah and other trauma consultants were always available and explained all aspects of management from preoperative management to surgical and postoperative aspects...”

Musculoskeletal Oncology Fellowship

Fellow : Dr Salunke Abhijeet Ashok  
Supervisor : Dr Mark Puhaindran  
Period : August 2013 – August 2014

“... It was a good training programme with all components of a good fellowship. Optimum number of patients, proper surgical work and optimum number of publications and presentations.”

“Dr Mark gave me a proper overview of how a good clinician can be a good researcher. He is a good teacher and was helpful during the fellowship period...”

“... This is a good Bone & Soft Tissue Tumour fellowship. I will be happy to recommend this training programme to others.”
Annual Giving Tree Event

24 November 2014

Contributed by: Ms Eunice Mok, Operations & Administration, UOHC

The inaugural Giving Tree was set up as a small internal hospital fundraiser back in 2010. Over the years, it has grown with the help of generous donations from staff, individuals, corporations, foundations and sponsors. All proceeds raised go to the NUHS Fund Limited.

24 November 2014 marked the start of the annual Giving Tree event – the fifth year it was organised. Professor John Wong, the NUHS Chief Executive officially launched the event by lighting up the Giving Tree at the NUHS Tower Block foyer. This year’s Giving Tree event aimed to raise $300,000 for the financially disadvantaged patients. With the festive season of giving coming, it was definitely an opportune time for us to remember the needy and less fortunate and donate generously.

This was also the third year that the NUHS University Orthopaedics, Hand and Reconstructive Microsurgery Cluster (UOHC) organised the Fund Run together with the Giving Tree event. Approximately 300 staff and friends of the NUHS showed up for the Fund Run in support.
Huge turn out of participants for the Fund Run, with approximately 300 staff and friends of the NUHS showing up in support!

The sky was gloomy but the weather definitely did not dampen the participants’ spirits. Everyone cheered each other on during the Run. It was refreshing and the route was not difficult.

More than $40,000 was raised for the Run in total, from both external corporate donations and staff registration fees for the Run.

The NUHS Development team has also started sending donation envelopes out to each department, so look out for them!
Our annual University Orthopaedics, Hand & Reconstructive Microsurgery Cluster Retreat on 31 January 2015 began in the Wine Glass Seminar Room in Marina at Keppel Bay. A diverse array of staff members from doctors and nurses to researchers and administrators shared in a fruitful UOHC Workplan 2015 Discussion through mass and small group discussions.

Staff members sharing, planning and presenting during the UOHC Workplan 2015 Discussion
Once the seriousness of the morning was over, it was time for the real fun to begin! After a relaxing lunch at Privé grill on Keppel Bay, staff members divided themselves into their respective groups for the Social Teambuilding segment of the day. Once ready, we set off on yachts to Lazarus Islands for the games to begin.

We had a thoroughly enjoyable and exciting time on the island. Highlights of the afternoon include the Kayak and Paddle-board relay races, kite making and flying, and not to mention lounging on the luxurious yachts!
To end the fun-filled day, staff members savoured a delicious BBQ dinner spread before returning to Keppel Marina at sunset.

It was truly an unforgettable day for all of us, fostering stronger ties and friendships that will strengthen us as a team as we contribute towards making our shared vision a reality this coming year.
Instructions to Residents

The University Orthopaedics and Hand Journal welcomes abstracts that contribute to orthopaedic knowledge. Contributions will include extended abstracts from award winning papers, published articles and work in progress from residents and medical students. Full articles from invited authors will also be published.

**STRUCTURED ABSTRACT**

When submitting your contribution, it is essential to follow the following instructions:

1) Contributions will be accepted in the form of a structured abstract.

2) Each abstract should not exceed one A4-sized page for a published article, a research award paper or work in progress.

3) The manuscript must be typed, with spacing of 1.15pt and at least one inch margin on both sides and bottom. On the first page, please provide the title of article, name(s) of author(s) and name of department and institution in which the work was done.

4) Please prepare the abstract using the following structured format:
   a. Objective
   b. Methodology
   c. Results
   d. Conclusion

5) For a letter to editor, a review article or a case report, the abstract need not be structured.

References need not be included.

**FULL ARTICLE (upon invitation only)**

The manuscript must be typed using similar instructions as in the abstract. This should include illustrations/figures, tables and references. The article should not exceed 7 A4-sized pages, including illustrations and tables.

**Illustrations/ Figures**

All illustrations will be published in black and white. Please insert the illustration(s) in the appropriate section of the manuscript.

**Legend**

Supply a caption for each illustration. Use Arabic numerals to number the figures consecutively as they appear in the text.
Tables

Type each table and its title in the appropriate section of the manuscript. Use Arabic numerals to number the tables as they appear in the text.

References

Number the references consecutively in the order in which they are first mentioned in the text. Use the form of references and title of journals abbreviated according to the style used in Index Medicus. List all authors. Examples of correct forms of references are:

Journal


Corporate Author


Books

Schneider FR. Orthopaedics in emergency care. The CV Mosby Co. St Louis. 1980
