Two years have passed since the inaugural & commemorative issue of University Orthopaedics & Hand Journal was launched to commemorate the 60th Anniversary of the NUS Department of Orthopaedic Surgery. This journal is the first to be produced by a cluster in NUHS!

The first issue documented our history and showcased the achievements made by our cluster over the last ten years. The second issue – UOHJ 2013, adopted a new format directed to the training needs of our residents. For this purpose, a large “Residency Teaching Section” has been created. UOHJ has now become the official publication of the UOHC Residency Training Programme.

This teaching format includes articles on clinical orthopaedics update, basic science update, clinical examination, surgical approach as well as case discussions on trauma, orthopaedics, hand and clinical pathology. These articles are contributed by the residents themselves. This new format received excellent feedback from both residents and clinical teachers.

In addition to the winning teaching format adopted for UOHJ 2013, this issue includes two articles on planning and writing research to promote research by residents. I am confident that UOHJ 2014 will continue to receive equally good feedback from all our readers.

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60 Years of Orthopaedics

Associate Professor Aziz Nather, Editor, UOHJ

The Department of Orthopaedic Surgery, National University of Singapore (NUS), commemorated its 60th Anniversary in 2012. Three distinguished professors were invited to the department from 8 to 12 October 2012.

Professor Gary G Poehling, North Carolina, USA as V K Pillay Lecturer

“Evolution of Arthroscopy from Wrist to Hip”

Professor Franklin H Sim, Mayo Clinic, Rochester, USA as R W H Pho Lecturer

“New Paradigms in Musculoskeletal Oncology”.

Professor Kaye E Wilkins, San Antonio, Texas, USA as N Balachandran Professorship Lecturer

“Leave skills in addition to your scars”

These lectures were delivered at the 35th Annual Scientific Meeting of the Singapore Orthopaedic Association held at the Four Seasons Hotel. In addition, five workshops were also run for the Residency Teaching Programme in the University Orthopaedics, Hand & Reconstructive Microsurgery Cluster (UOHC), namely: Musculoskeletal Oncology Symposium, Acetabular Reconstruction Workshop, Workshop on Examination Technique, Paediatric Trauma Workshop and a writing workshop.

60th Anniversary Celebration Dinner

A gala dinner was held in the Shangri-La Hotel ballroom on the 10th October 2012 with Professor Yeoh Khay Guan as the guest-of-honour, attended by more than 300 guests. Guests invited included more than 20 clinical fellows who have worked with the department in the past. The fellows came from several countries in the region which included Bangladesh, India, Indonesia Malaysia, Pakistan, Philippines, South Korea, Sri Lanka, and Thailand.
From left: Dr Saw Aik, Mrs Wilkins, Dr Kaye E Wilkins, Dr Gary G Poehling, Mrs Hui, Professor James Hui during the 60th Anniversary Celebration Dinner.


Our Nurse Managers enjoying the party.

Our residents entertaining us with “Gangnam Style”.

New Lectureship

During the dinner, Professor Wong Hee Kit, Chair UOHC, also announced the formation of a new lectureship, the Pesi B Chacha Lectureship in Spine and Scoliosis Surgery.

“It will be used to invite world renowned Orthopaedic Surgeons in the field of Spine and Scoliosis Surgery to share with us their experience and knowledge……”

–Professor Wong Hee Kit
Chair, UOHJ
PB Chacha Inaugural Lecture 2014

Professor Todd J Albert, Philadelphia, PA, USA as Pesi B Chacha Inaugural Lecturer

“How to deal with a new healthcare paradigm: What we have learnt from the SPORT studies”

8 January 2014

The inaugural lecture on ‘How to deal with a new healthcare paradigm: What we have learnt from the SPORT studies’, was delivered by Professor Todd J Albert at the NUHS Auditorium on 8 January 2014.

Professor Todd J Albert is the Richard H. Rothman Professor and Chairman of the Department of Orthopaedics at Thomas Jefferson University and Hospitals and is President of The Rothman Institute in Philadelphia, PA.

He also serves as Co-Director of Reconstructive Spine Surgery and the Spine Fellowship Program at Thomas Jefferson University Hospitals.

Professor Albert serves on the boards of several scholarly journals and is Past President of The Cervical Spine Research Society and Past Chair of The International Meeting of Advanced Spinal Techniques (IMAST) for the Scoliosis Research Society. He serves as the Chief of the Development Committee for the American Orthopaedic Association

New Research Fund

In addition, a new Orthopaedic Research Fund was set up. This was made possible by a donation of $625,000 from the Kwang Inn Thong Hood Cho Temple and further boosted by another $100,000 from the Lee Foundation and top-up fund of another $100,000 from our Departmental Fund. All these donations were matched one-to-one by the Government.

“……This fund is meant to provide small start-up research grants for residents and young doctors embarking on research for the first time……”
A special commemorative issue for University Orthopaedics & Hand Journal was launched by Professor Yeoh Khay Guan during the 60th Anniversary celebration dinner.

The special issue documented our achievements during the last 10 years from 2001 to 2011.

“……The achievements of the Department is best summarised by the nine Special Awards received by the Department over the last 10 years including the Lee Foundation – NHG Lifetime Achievement Award 2004 (Emeritus Professor RWH Pho), NUS Outstanding Researcher Award 2006 (Professor EH Lee), National Outstanding Clinician Mentor Award (Professor EH Lee), Lee Foundation-NHG Lifetime Achievement Award 2008 (Professor EH Lee), Healthcare Humanity Award 2011 (Associate Professor J Thambiah), NUS Annual Safety and Health Performance Award 2011, Master Clinician Award 2011 (Professor Wong Hee Kit), and National Outstanding Clinician Award 2012 (Professor Wong Hee Kit) – an outstanding achievement by a single Department……”

—Associate Professor Aziz Nather
Editor UOHJ
The journal documented 28 Research Awards and also recorded our history as a mark of tribute to the contributions made by our predecessors and colleagues.

“……It will help teach your young residents in an interesting and novel way on how to do research, how to teach and also how to do clinical practice by sharing our best clinical practices and advances…….”

- Professor Yeoh Khay Guan
The special mural designed in conjunction with our 60th Anniversary Celebration, is now displayed at the department of Orthopaedic Surgery, Level 11 in NUHS Tower Block. The mural marked some of the Department’s milestones in recognition of the important contributions made by our predecessors, and also our future plans.

Then

The University Department of Orthopaedic Surgery was set up on 1 April 1952 in the Singapore General Hospital (SGH) with Professor J A P Cameron as Head of Department. In January 1961, Professor D R Gunn assumed the Headship. The first research laboratory was built in 1964. In 1983, an Animal Experimental Surgery Laboratory and Biomechanics Laboratory was set up in SGH’s “Harrower’s Hall”. Other laboratories included Histology, Motion Analysis and Cadaveric Research Laboratory. In June 1985, the Department moved into the newly built National University Hospital.
Now

Under NUHS, Department of Orthopaedic Surgery is combined with Department of Hand and Reconstructive Microsurgery to become the University Orthopaedics, Hand & Reconstructive Microsurgery Cluster (UOHC). UOHC provides tertiary subspecialty care with University Spine Centre and Divisions of Hip & Knee, Shoulder & Elbow, Sports Medicine & Surgery, Paediatric Orthopaedics, Musculoskeletal Trauma, Musculoskeletal Oncology and Foot & Ankle Surgery in addition to Hand Surgery by Department of Hand & Reconstructive Microsurgery. The cluster now provides good infrastructure and research facilities in six core areas: cell and tissue culture, histology, biomechanics, motion analysis, bone densitometry and X-ray. It is actively engaged in cutting edge translational research and has won several local and international research prizes.
Following the successful inaugural issue of UOHJ in October 2012, a second issue of UOHJ was produced in October 2013.

Whilst the inaugural issue showcased achievements made by the Cluster, the second issue focused on the need to train our residents. The new format included a large “Residency Training Section” with articles contributed by the residents, covering the various aspects of Orthopaedics and Hand & Reconstructive Microsurgery.

Following excellent feedback from both residents and clinical teachers, the current third issue – UOHJ 2014 is produced in a similar format, with additional articles contributed by the clinical teachers.
The V K Pillay Lectureship was established in 2004 to honour one of our pioneer orthopaedic academics, Dr V K Pillay for his contributions not only to the University, but also to the international orthopaedic fraternity.

**About the Speaker**

Dr Mark Myerson is recognised for his dedication to the medical profession by being named Top Doctor in the Orthopedic/Foot and Ankle specialty by *Baltimore magazine* and *U.S. News & World Report*.

Dr Mark Myerson, who is the founder of the Institute for Foot and Ankle Reconstruction at Mercy Medical Center in Baltimore, is one of the world’s foremost experts for foot and ankle reconstruction and injury. He has pioneered surgical techniques that have revolutionised the diagnosis, treatment and recovery of disorders of the foot and ankle. He has authored textbooks such as *Foot and Ankle Disorders* and *Current Therapy in Foot and Ankle Surgery*. Dr Myerson has also written various scientific textbooks and published numerous professional and medical journals.
R W H Pho Lectureship 2013
The Hand Surgeon’s Role in Facilitating Communication

17-20 July 2013
Venue: NUHS Auditorium

The R W H Pho Lectureship was established in 2004 to honour Professor Robert W H Pho for his selfless commitment to training and development of musculoskeletal oncology and microsurgery in Singapore and the region.

About the Speaker

Dr Kozin is Clinical Professor of Orthopaedic Surgery at Temple University School of Medicine and Hand Surgeon at Shriners Hospital for Children.

Dr Kozin has served in many leadership positions in the fields of orthopaedics and hand/upper extremity surgery, including President of the American Association of Hand Surgery (2008-2009) and Council Member for the American Society for Surgery of the Hand (2009-2012).

N Balachandran Professorial Lecture 2013

Clubfoot: A Philosophy of Paediatric Orthopaedia

7-8 October 2013

Venue: NUHS Auditorium

The N Balachandran Visiting 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. Internationally renowned paediatric orthopaedic surgeons are invited to spend some time with us to teach and do scientific exchange with the staff.

About the Speaker

Professor Dimeglio is professor at the Medical School University of Montpellier and Chairman of the Paediatric Orthopaedic Department in Montpellier and Palavas. Professor Dimeglio has published many scientific papers about paediatric spine disorders, covering subjects such as fusionless procedures for the management of early-onset spine deformities, how spinal deformities influence normal spine and thoracic cage growth, giant cell tumour of the cervical spine in children, and the progression and management of adolescent idiopathic scoliosis during puberty. He has also authored many books on clubfeet, elbow trauma, and spondylolysthesis in children. Professor Dimeglio is also a member of many international scoliosis societies, including the Scoliosis Research Society.

Alain Dimeglio
Chairman
Paediatric Orthopaedic Department Medical School University of Montpellier
Chief, Paediatric Orthopaedic Department Hospital Lapeyronie Montpellier, France
RESIDENCY
TEACHING
SECTION
Clinical Science Update

Osteomyelitis in Diabetic Foot

Rishi Malhotra, Chan Shu-Yi Claire, Aziz Nather
Division of Foot and Ankle Surgery

Abstract

Osteomyelitis is a common complication of diabetic foot ulcer or diabetic foot infection. This review discusses the clinical features and investigations required to diagnose osteomyelitis. The medical and surgical treatment of osteomyelitis will also be outlined. The key to the treatment of osteomyelitis is antibiotic therapy for a prolonged period coupled with adequate debridement or excision of the osteomyelitic bone. Osteomyelitis is found to have high morbidity requiring amputation of the lower limb. The risk of below-knee amputation is significantly higher when the hindfoot is involved compared to midfoot and hindfoot OM.

Keywords: osteomyelitis, diabetic foot, ulcer, infection, bone debridement, bone excision, antibiotics, below-knee amputation

Introduction

"Osteomyelitis" (OM) is derived from 3 Greek words: ‘osteon’, ‘myelos’ and ‘itis’. It refers to the inflammation or infection of the bone and bone marrow. It is frequently missed and underdiagnosed in patients with diabetic foot problems. A high index of clinical suspicion is required to make a diagnosis. Yet it is very important to diagnose it early as undiagnosed OM often leads to the dreaded complication of limb amputation. The risk for amputation in acute diabetic infections is 4 times higher with OM than with soft tissue infection alone (1). Also, the presence of OM requires a longer duration of antibiotics and a longer duration of stay, thereby raising the hospitalisation costs specifically for patients with OM.

The objective of this review is to analyse the basic science, clinical presentation, assessment and treatment of OM. It is hoped that with better understanding and recognition of OM, its morbidity and mortality can be considerably reduced.

Pathogenesis

Unlike haematogenous OM (seeding via bloodstream) and direct inoculation (via open fractures), in the diabetic foot, the spread is due to contiguous infection in a foot with vascular insufficiency. Histologically, it is characterised by the presence of leukocytes or inflammatory cells, such as lymphocytes and plasma cells, and by the presence of bone necrosis.
Incidence

OM is a common complication of diabetic foot. It has been reported to occur in 15% of patients with diabetic foot ulcers (ii), and in 20% patients with diabetic foot infections (iii). The risk of developing OM increases with a history of previous ulceration, multiple ulceration, or ulceration penetrating to the bone or joint (3).

Location

The most common sites of OM are in the forefoot (90%) and then in the midfoot (5%) and hindfoot (5%)(iv - viii). The common bones involved are the weight-bearing bones of the foot, particularly the “tripod of the foot” (Fig. 1): the first metatarsal head, fifth metatarsal head and calcaneum. Other sites include the bones underlying lateral decubitus ulcers: the lateral malleolus, base of the fifth metatarsal and calcaneum. In a review of 33 cases of OM in 2013, the authors found OM to be present in 20 metatarsals, 6 phalanges, 3 calcanea, 2 cuboids, 1 talus and 1 lateral malleolus.

Clinical Examination

The ulcer must be assessed meticulously in terms of site, size, edge, floor, content and adjacent skin environment. The foot must be assessed for vasculopathy, neuropathy and immunopathy.

The Probe-to-bone test (Fig.2) evaluates ability to contact bone in the depth of the ulcer and must be performed. It is a reliable test to diagnose OM (ix,x). Lozano et al (2010) found a sensitivity of 98% and a specificity of 79% (ix). Aragon-Sanchez et al (2011) found a sensitivity and specificity of 95% and 93% respectively (x).

Differential Diagnosis

Common problems which can be mistaken for OM in the diabetic foot include Charcot Joint Disease (especially the inflammatory phase), gout and reflex sympathetic dystrophy. In such cases, a WBC scan is often required to confirm OM.
Investigations

Blood investigations that should be performed include markers of infection (WBC, CRP, ESR) and markers of healing (HbA1C, Urea / Creatinine, Albumin and Haemoglobin). Mutluogu et al 2013 compared OM with soft tissue infection and found no difference in terms of WBC, CRP, and renal function (i). However, ESR was found to be significantly higher in the OM group (90 vs 70 mm/h) and the mean Hb to be lower in the OM group (10.8 vs 12.0) (i). A meta-analysis by Butalia et al (2008) showed that ESR > 70 mm/hr indicates an elevenfold greater risk of osteomyelitis (xi). Michail et al (2013) found WBC, CRP, ESR and Pro-Calcitonin to be significantly higher in OM compared to soft tissue infection (xii).

Imaging

X-Ray

Plain films (Fig. 3) do not show changes in the first few weeks. However, they should be done initially as a baseline to assess development and presentation of OM.

Computerised Tomography Scan

CT scans show OM earlier. They are able to pick up fine bone details – sequestrum, involucrum, marrow and cortical abnormalities. However, this high radiation scan is unlikely to be used when MRI is available (xiii).

Nuclear Imaging

MRI

In OM, the loss of signal in $T_1$ weighted images and higher intensity on $T_2$ weighted images (Fig. 4) can reveal the pathology as early as 3 days after infection (xiv). However, this bone oedema can be difficult to differentiate from non-infectious causes of oedema (xv). The accuracy of MRI is challenged when CJD or recent surgical change is present. Meta-analyses and reviews show that MRI is probably the most useful imaging modality for assessing OM with a sensitivity of about 90% and a specificity of about 80% (xi,xvi,xvii). MRI gives good anatomical correlation. However, it is limited in terms of functional correlation.
Bone Scan
The 3-phase bone scan using Technetium-99m-Medronic Acid Biphosphonate provides a 2-dimensional image of areas in bone with active bone turnover. Hence, it is not disease-specific. It shows ‘hot spots’ for not only OM (Fig. 5) but also bone metastases, CJD, gout, fracture or even recent surgery (xiii,xviii). Also, the anatomical detail is poor unless combined with computerised tomography.

Single Photon Emission Computerised Tomography (SPECT) imaging combines bone scan with computerised tomography to improve anatomical-functional correlation. It provides 3-dimensional images of the foot. However, the technology is still not widely available and its diagnostic potential for OM is still being researched (xiv).

Bone scans have a sensitivity of 80 to 90% but a specificity of less than 50% (xix,xx). WBC scans have a sensitivity of at least 80% and a specificity of at least 70% (xix,xx).

Only a few studies have been done using Positron Emission Tomography (PET scan). PET scan images radioactive fluorine attached to 2-fluoro-2deoxy-D-glucose which accumulates at sites of increased intracellular glucose metabolism such as infection, inflammation or malignancy. Its sensitivity ranges from 80 to 100% while its specificity has been reported as 93% (xix,). Combining PET with CT improves the anatomical detail available (xix).

Duplex Ultrasonography
In addition, duplex ultrasonography is useful to conduct an accurate vascular assessment of the foot to help decide the type of surgery or ablation that is required for treatment of OM. It combines standard ultrasonography with Doppler ultrasonography to provide information on vascular anatomy and blood flow.

Bone culture
It is mandatory to obtain a bone specimen to identify the causative organisms for the appropriate antibiotics to be given. Bone culture is considered the microbiological gold standard for diagnosis of OM (xxii).
**Medical Treatment**

Antibiotic therapy must be administered for a prolonged period usually for at least 6 weeks. A peripherally inserted central catheter (PICC) line is appropriate for delivery of antibiotics over such a duration.

**Surgical Treatment**

The operative aim for management of diabetic OM is to resect the affected bone and avoid leaving residual disease (xxiii). IDSA guidelines 2012 recommend effective surgical debridement followed by antibiotic treatment, with duration dependent on clearance of the infection (xxiv).

Surgical removal of an osteomyelitic digit is likely to be more acceptable to a patient as it still provides a satisfactory weight-bearing foot. For OM involving distal phalanx or middle phalanx of a toe, disarticulation may be performed. However, for OM involving the proximal phalanx or the metatarsal head, ray amputation is advised (Fig. 6).

For OM of the calcaneum, partial or sub-total calcanectomy (Fig. 7) is needed and wound closed by direct closure or via a flap. This operation is less likely to be acceptable to a patient than digital amputation as the operation usually does not result in a satisfactory weight-bearing foot.

Inadequate clearance is the cause of re-operation. About a quarter of patients treated for OM have been shown to require operations. This was more likely if initial surgery was conservative, or if necrosis or ischaemia were involved (vii) The risk of below-knee amputation was significantly higher with hindfoot OM – 50% risk, compared to forefoot OM (0.33%) and midfoot OM (18.5%) (viii).

The additional benefit of surgery is the access to bone biopsy for cultures and histology. If surgery is not undertaken, bone may be sampled via percutaneous biopsy (xxv) Swabs of an ulcer are unreliable when examining for likely pathogens affecting bone (xxvi).

Histology is the gold standard to confirm osteomyelitis with a reported sensitivity of 95% and specificity of 99% (xxvii). The histological features in osteomyelitis include: sequestrum, involucrum, necrotic bone, necrotic-inflammatory exudates, fat necrosis, marrow oedema, marrow fibrosis, bone erosions and cellular changes of acute or chronic inflammation (xxviii) However, interpretation of these findings is subjective and discordance between pathologists is not uncommon (xxviii).

The authors recommend that bone histology be used for confirmatory diagnosis. Bone cultures should be taken to guide antibiotic treatment but should not be used to confirm a diagnosis of OM. This is because bone culture is often positive even when histology is negative, probably due to contamination from infected soft tissue (x).
Conservative Treatment

(Antibiotics-only) vs Operative Management

The efficacy of antibiotic-only treatment for OM has been debated. Some studies show that antibiotic-only treatment can be successful in two-thirds of patients with DFO (iv,v,xxi). These studies have used different antibiotic protocols, some even up to 6 months before healing of overlying DFU occurred. However, between 13% and 23% may worsen during treatment and require early surgery (iv,v,xxi). Recurrence of ulceration/infection is common during or after successful treatment as high as 30% (iv,v,xxi), although about two thirds of these recurrences may also be successfully controlled conservatively rather than surgically (iv,xxi).

Conservative treatment with antibiotics only may still be an option in patients who refuse surgery. The decision to treat non-operatively is not easy and should be examined at an individual level, taking into account the patient's viewpoint. However, one must be careful not to give unrealistic expectations. “Cure” is not a promise one can make.

Conclusion

Osteomyelitis is a common complication of diabetic foot ulcer or diabetic foot infection. A high index of clinical suspicion is required for diagnosis. Useful radiological investigations include a combination of plain X-rays, bone scan and MRI. Bone specimen should be sent for culture and sensitivity and histological study. Antibiotic therapy must be continued for at least 6 weeks using a PICC line. The key to surgical treatment of OM is excision of the bone involved. Inadequate removal will lead to re-operation. The risk of below-knee amputation is significantly higher when the hindfoot is involved compared to midfoot and hindfoot OM.

Conflict of interest and funding

The authors have not received any funding or benefits from industry to conduct this study.
Conventional plate and screw constructs follow principles put forth by the AO group back in the late 1950s. At that point, there was an emphasis on rigid fixation with direct or primary bone healing. The focus was on mechanical rather than biological considerations for fixation. The principles of plate fixation include, formation of as stable a construct as possible, preservation of soft tissue and vascularity of bone, placement of the plate in a position relative to bone to minimise stress and to use materials strong enough to resist fatigue failure. Over time however, it became apparent that rigid internal fixation did not always produce desired end result with complications such as non-union, delayed union and sepsis. The observation that flexible fixation such as intramedullary nailing and external fixation devices also heals bone through callus or indirect bone healing led to the evolution of plating techniques that provide more ‘biological’ fixation techniques. This article will provide an overview of plates and modes of plating.

### Types of plates

**Dynamic Compression Plate**

This was first introduced in 1969 and can function in compression, neutralisation, tension band or buttress modes. It is available in three sizes; broad 4.5mm, narrow 4.5mm and 3.5mm. The undersurface of the plate is smooth. The interplay between the screw head and the geometry of the screw hole allows angulation of the screws in up to 25 degrees in the longitudinal plan and up to 7 degrees inclination in the transverse plane. The screw hole is shaped with an inclined plane on the end of the slot. As the screw is tightened, the head engages the slope it slides down the plane shifting the plate relative to the bone. When a neutral screw is placed, this induces axial compression and when a screw is placed eccentrically using the drill guide, this can cause compression of up to 1 mm.
Low Contact Dynamic Compression Plates (LCDCP)

The LCDCP represent a further development of the DCP. The periosteal capillary network is less compromised with the area of the plate-bone contact of the LCDCP reduced compared to the DCP. The undersurface results in even distribution of stiffness making it easier to contour with lesser tendency than the DCP to kink at the holes when bent.

Tubular plates

The one-third tubular plate is only 1.0mm thick hence its ability to confer stability is limited. It is still useful in areas with minimal soft tissue covering e.g lateral malleolus and olecranon.

Reconstruction plate

These plates are characterised by deep notches between holes that can allow accurate contouring. They are not as strong as compression plates and may be weakened by bending. They are useful in fractures with complex three dimensional geometry e.g pelvic, acetabular, clavicle fractures.
**Locking plates**

Conventional plates function by compressing the plate to the bone and generate friction between plate-bone interface to resist motion. However, this resulted in disturbed blood flow responsible for remodelling processes in the area underneath the plate pressed against bone by screws. The development of screws rigidly locked into the plate hole, resulted in the plate that no longer pressed against underlying bone. The preserved blood supply in theory allows for more rapid healing, decreasing incidence of infection, delayed/ non union and secondary loss of reduction. Locking plates have helped in providing an environment more favourable for secondary bone healing and facilitate minimally invasive and indirect fixations techniques. Locked plates function as a single-beam and act as 'internal external fixators'. Conventional screws use most of the pullout force for plate compression compared to locking screws and as such they have less pullout force to resist physiologic forces compared to locking screws. Non-locked screws depend on the surface area of contact between screw and bone as well as quality of bone. In osteoporotic bone, due to poorer bone density, the nonlocked screw is less able to resist toggle. Locking screws fix the angle of the screw such that toggle cannot occur as such is advantageous in fixation of osteoporotic fractures. For the locking screw to fail, it has to cut through the bone along the length of the screw that is in contact with bone. If the locking device fails, it is catastrophic as it occurs as a unit as opposed to sequential failure of screws with non-locking constructs.
Neutralisation

Lag screws provide good interfragmentary compression however in isolation are not strong in resisting bending or rotational force. A plate can supplement this by neutralising these forces and protecting it from failure.

Compression

Compression may be achieved using a tension device, overbending, or axial compression generated with DCP or LCDCP techniques.

Buttress

This construction resists axial load by applying a force at 90 degrees to the axis of deformity. It is usually used in periarticular shear or split fractures where fixation with lag screws alone may not be sufficient.
**Bridging**

This is used in multifragmentary fractures where the two main fragments are fixed to maintain length and alignment leaving the fracture zone untouched to maximise the blood supply.

For implant stability in this flexible fixation, long plates with few screws are used to increase lever arm and distribute the bending force.

**Tension-band**

For a plate to act as a tension-band, the fractured bone must be eccentrically loaded with the plate placed on the tension side. The plate needs to withstand the tensile forces and the bone needs to withstand the compressive force that results from the conversion of distraction forces by the plate. There must also be a bony buttress opposite to the plate to prevent cyclic bending.


Clinical Examination
Examination of Knee Joint

Chen Yongsheng, Lingaraj Krishna
Division of Hip and Knee Surgery

Introduction

The clinical examination of the knee is a thorough and systematic process of evaluating the different anatomical structures within and around the knee joint. This is a process which is guided by a thorough history and is firmly grounded on a good understanding of the relevant anatomy in and around the knee joint. This is a fundamental skill which medical students and junior doctors acquire early in their training to enable them to arrive at an accurate diagnosis, exclude important differentials and to guide treatment. Advances in imaging and arthroscopic techniques should never be a substitute for a well-conducted clinical examination. A good physical examination is as much an art as it is a skill which the master will display with poise and confidence. Such a display not only earns students and trainees the goodwill of examiners during examinations, but more importantly it fosters the trust of the patient and the family. Different textbooks and teachers may differ slightly in the way they teach and conduct the knee examination. However, regardless of the text one uses, the basic tenets of the knee examination do not change. This consists of inspection, palpation, movement and special tests. It does not deviate from the general principles of conducting an orthopaedic examination.

The following article is written with the following groups of people in mind: the medical student pursuing his first qualification, as well as the trainee pursuing his post-graduate qualifications in surgery and orthopaedics.
Preliminaries

The examination begins with a proper introduction and request for permission. A display of proper handwashing prior to patient contact has become an integral part of modern-day practice and has become a point of scrutiny in most undergraduate and post-graduate examinations.

Exposure should start from the hip joints down to the foot, for hip pathology is a commonly forgotten cause of referred pain to the knee. In the context of an examination, most patient subjects will likely be wearing shorts.

Inspection

The inspection begins with the patient standing, followed by an examination of the patient’s gait. Any wasting of the quadriceps, hamstrings, or calves should be immediately obvious. To detect finer differences in thigh girth, it is possible to compare measurements of thigh circumference at a fixed distance (10-15cm) proximal to the superior pole of patella. In addition, one would make a deliberate attempt to look for swellings which may suggest an effusion or haemarthrosis around the knee, particularly in the suprapatellar pouches. Obliteration or fullness of the suprapatellar pouches is a useful sign of a knee effusion. An inflammatory or infective process may also render the skin red and warm.

Important scars such as that of a midline arthrotomy, arthroscopic portals, or scars from a hamstring graft harvesting should be noted. Attention will now be turned to evaluate for any abnormalities in limb alignment. The patient is asked to stand straight with both feet together, pointing forward to the examiner. A normal patient should be able to keep his bilateral knees and feet in contact simultaneously. To allow this to occur, a normal physiological genu valgus which averages 7° in normal individuals must exist.

In a normal patient, both knees and feet can be kept in contact simultaneously. If this relationship is disturbed, one would look for genu varus or genu valgus. Clinical photograph of a windswept deformity, consisting of a genu varus deformity in one knee, and a genu valgus deformity in the other knee.

When this relationship is disrupted, the candidate would attempt to look for any angular deformities such as a genu varus, valgus, procurvatum or recurvatum. A genu varum in one knee, combined with a genu valgus in the contralateral knee would give rise to a windswept deformity.

The suprapatellar pouches, quadriceps femoris muscles, superior pole, body and inferior pole of patella, patellar tendon and tibial tuberosity should be systematically inspected. An isolated swelling of the inferior pole of patella, or more commonly of the tibial tuberosity may be suggestive of Sinding-Larsen-Johanssen disease or Osgood-Schlatter disease respectively. The posterior aspect of the knee should also be examined for swellings, lest a popliteal cyst be missed.
The Q angle or the quadriceps angle is the angle subtended between a line drawn from the ASIS to the centre of patella, and another line drawn from the center of patella to the tibial tuberosity. It averages 14° in men and 17° in women. An increased Q angle has been associated with patellar subluxation. It is increased in genu valgus, femoral anteversion, external tibial torsion, a laterally positioned tibial tuberosity and a tight patellar retinaculum.

After static inspection, the patient is then made to walk. Common gait disturbances such as varus thrust (common in medial compartment OA) or a valgus thrust (less common) gait or an antalgic gait are usually rather obvious. A stiff knee gait is one in which the patient walks with the knee held stiff in full extension. To enable the foot to clear the ground, the pelvis tilts upwards during the swing phase. A stiff knee gait is usually an indication of severe quadriceps weakness. In extreme cases, patients may be seen using the ipsilateral hand to hyperextend the knee when walking.

A flexed knee gait occurs when there is significant fixed flexion contracture (>10°) of the affected knee. The stride length of the affected leg is shorter, and the flexed knee prevents the hindfoot from striking the ground. The foot tends to strike the ground in a foot-flat position as opposed to a classical heel-strike.
**Palpation**

Palpation is the next natural step after inspection. Warmth may be diffuse or localized. Localised warmth and tenderness pinpoints to a problem to a defined anatomical structure, whereas diffuse warmth and redness may indicate an infective or inflammatory process.

**Patella and extensor mechanism**

The patient is made to lie supine with the knee fully extended and relaxed. This provides an excellent opportunity to examine the patella and the patellar facets for tenderness. When the quadriceps are adequately relaxed, the patella is free to move from side to side. Pushing the patella medially with one hand, the medial facet can be examined by feeling the undersurface of the medial facet with the contralateral index finger. The lateral patellar facet can be similarly examined by lateral translation of the patella. Tenderness over the superior pole of the patella or over the site of the quadriceps tendon insertion may be indicative of a quadriceps tendinosis, whereas tenderness elicited over the inferior pole of the patella or tibial tuberosity may be indicative of Sinding-Larsen Johanssen disease or Osgood-Schlatter disease respectively. The body of the patella can likewise be palpated for tenderness, as may be present in a fracture. In addition, any palpable gaps in the extensor mechanism, from the quadriceps insertion to the patella, patellar tendon and tibial tuberosity can be elicited at this stage.

**Joint Lines**

To examine the medial and lateral joint lines for tenderness, the patient’s knee is flexed to 90 degrees. Tenderness along the either joint line usually points toward a meniscal or cartilage injury. Very anterior joint line tenderness however, may be less specific. Anterior joint line tenderness occurring together with a locked knee joint which is unable to extend is compatible with a displaced bucket handle tear.
Collateral Ligaments

The medial collateral ligament (MCL) is palpated from its origin in the medial epicondyle, along its length towards its tibial insertion. Pain arising from the MCL can be differentiated from a medial meniscus pathology by a positive valgus stress test. Other than the MCL or medial meniscus, the other less common causes of medial joint tenderness can include a semi-membranous tendinosis (in which case the site of tenderness is the posteromedial surface of the tibia) or the pes anserinitis (in which case the site of tenderness is the anteromedial surface of the tibia).

The lateral collateral ligament (LCL) is palpated from its origin in the lateral epicondyle, along its length towards its insertion in the fibular head. This can be corroborated by the finding of a positive varus stress test. Two other structures can give rise to tenderness in the vicinity of the LCL. The iliotibial band syndrome causes tenderness which is maximal over the lateral epicondyle. Crepitus at the region of the lateral epicondyle during knee flexion and extension supports the diagnosis, as this condition is thought to be related to friction between the ITB and the lateral epicondyle. Biceps tendinosis is suggested when tenderness is maximal in the region of the fibular head. Flexing the knee against resistance accentuates the tenderness in this condition.

Movement

Most painful knee conditions are associated with some degree of restricted movements. Range of motion is examined actively and passively. A fixed flexion deformity exists when the patient is unable to fully extend his knee actively, and the flexion deformity cannot be corrected passively. This points to either a contracture of the muscles, capsules and ligaments about the knee or a mechanical block to extension, such as a torn meniscus or loose body.

A knee which is incapable of any flexion or extension is ankylosed. This occurs after knee arthrodesis or post-infection sequelae.

Special tests

Effusion

Apart from obliteration of suprapatellar pouches, there are three special tests for effusion. The presence of effusion indicates an intra-articular pathology. A small effusion can be detected by a fluid displacement or bulge test. In this test, fluid is evacuated from the medial side of the joint towards the lateral compartment. The examiner now strokes the lateral side of the knee while looking for a fluid bulge that reappears in the medial side of the knee.

In the presence of a moderate effusion, a cross fluctuance test is performed. In this test, fluid is emptied from the suprapatellar pouch. A palpable fluid wave can be felt alternately between the medial and lateral sides of the knee joint between the thumb and index fingers as shown below.

Finally in the presence of a large effusion, the patellar tap or ballotment test is positive. In this test, fluid is pushed from the suprapatellar pouches into the retropatellar space using one hand. This lifts the patellar off the trochlea. The patella is then pushed downwards using the index finger of the contralateral hand. The test is positive when the patella can be felt to strike the trochlea distinctly.
Tests for valgus and varus laxity

The valgus stress test assesses the various restraints to valgus stress in the knee. The primary restraint to valgus stress is the superficial fibres of the MCL. Secondary restraints include the deep fibres of the MCL, and the posteromedial capsule which is active when the knee is extended. The posteromedial capsule is taut in extension and lax in flexion. Therefore, when the knee is flexed, the posteromedial capsule does not contribute to valgus stability. The cruciate ligaments are tertiary restraints to valgus stress. Bearing the above in mind, one would be able to understand why the valgus stress test is performed in full extension and then repeated in flexion.

To perform this test, the patient is encouraged to relax his knee. With one hand, the patient’s heel is raised off the bed with the knee in full extension. A valgus force is then applied to the knee with the other hand. The test is positive when the tibial and femoral surfaces are felt to separate when the deforming force is applied, and then return to normal when the force is removed. The test is then repeated with the knee in 30° flexion. It is always useful to compare the findings with the contralateral knee. Valgus
laxity in flexion (but normal in extension) indicates an isolated injury to the MCL, as the posteromedial capsule is lax in this posture. Valgus laxity in both flexion and full extension indicates injury to the MCL, the posteromedial capsule, and possibly even the cruciate ligaments.

The varus stress test assesses the various restraints to varus stress. Like its valgus counterpart, it is also performed in full extension and 30° flexion. Varus laxity in flexion (but normal in extension) indicates an isolated injury to the LCL, as the posteolateral capsule is lax in this posture. Varus laxity in both flexion and full extension indicates injury to the LCL, the posterolateral capsule and possibly even the cruciate ligaments.

Tests for anterior laxity

Several tests have been described for the assessment of anterior laxity. The three most useful tests for use in clinical practice and exams are the Lachman, anterior drawer and pivot shift.

The clinical grading of ligamentous injuries is given below:

Grade I: pain/tenderness without laxity
Grade II: pain and laxity with firm endpoint
Grade III: pain and laxity without / indefinite endpoint

The Lachman test was first described by Torg, who named the test after his mentor, Lachman. It is a useful screening tool for anterior laxity of the knee. The test is performed with the knee in 20° flexion. The patient is asked to relax his hamstrings. If the patient is properly relaxed, the knee should feel like a dead weight. With one hand, the examiner’s thumb is placed over the tibial tubercle and the rest of the fingers are wrapped around the patient’s calf. His other hand is wrapped around the patient’s thigh. The tibia is then translated forward (with the thigh being held steady in the other hand) and the degree of anterior excursion and endpoint noted. Comparison is made with the contralateral knee.
The anterior drawer test is performed with the patient lying supine and knee flexed to 90°. The patient is asked to relax his hamstrings. If the patient is properly relaxed, the knee should feel like a dead weight. With the examiner sitting on the patient’s foot, the examiner places both his thumbs over the tibial tuberosity, and the rest of the fingers are wrapped around the patient’s calf. The tibia is then translated forward and the degree of anterior excursion and endpoint noted. Comparison is made with the contralateral knee. Comparison is particularly important in this test because a few millimeters of physiological anterior translation may be possible in normal knees. This test may be easily masked by the effect of tight hamstrings, which occur when the patient is not sufficiently relaxed.

The pivot shift test is a dynamic test of ACL function. To perform this test, the patient lies supine on the examination bed. The patient is encouraged to relax his hamstrings. The leg is elevated allowing the knee to fall into extension by gravity. With an incompetent ACL, the femur falls posteriorly, and the tibia subluxes anteriorly. With the same hand, the examiner applies some internal rotation, which in turn internally rotates the tibia on the femur. Now, with the other hand, the examiner applies a valgus and flexion force onto the lateral calf. A positive test is given by a visible shift of the subluxed tibia back into its normal position somewhere between 20° to 30° of flexion.

Tests for posterior laxity

Clinical examination for PCL laxity begins with inspection. With both knees kept in 90° flexion, a posterior sag can be appreciated in the PCL deficient knee. This occurs as a result of posterior tibial subluxation in relation to the femur. Clues to a posterior sag during inspection include a more prominent patella, and a less prominent tibial tuberosity. It is important not to miss a posterior sag, as PCL tears can give a false impression of a positive anterior drawer.
In this same position, the posterior drawer test may be performed by the examiner exerting a posteriorly directed force on the tibia. Unlike the anterior drawer test, there is usually a firm endpoint in posterior drawer test, even in the case of complete PCL ruptures. The Godfrey test is a less commonly performed test which can be thought of as a modification of the posterior sag. The foot is raised, such that the hip and knee are both flexed to 90° (the so-called 90/90 position). Here, the tibia is seen to sublux posteriorly in relation to the femur due to the effect of gravity on a PCL deficient knee.

Daniel et al described a quadriceps active drawer test to confirm the presence of a posterior sag, especially in equivocal cases. With the knee in 90° flexion, the examiner cups his hand over the patient’s ankle. The patient is then asked to make a resisted knee extension, by sliding his foot forward against the examiner’s hand. This causes an isometric contraction of the quadriceps. When a posterior sag is present, the subluxed tibia is seen to shift anteriorly during this test.

**Tests for posterolateral laxity**

Injury to the posterolateral ligament complex can cause posterolateral instability. It is commonly found in association with ACL or PCL injuries, but can occasionally exist in isolation. When posterolateral laxity is present, the tibia is externally rotated in relation to the femur, and the lateral tibial plateau is subluxed posteriorly in relation to the lateral femoral condyle.

In the tibial external rotation (Dial) test, the supine patient is asked to flex the knees while keeping the knees and ankles together. The examiner then passively externally rotates the feet and compares the amount of external rotation of the involved limb with the normal one. This test is performed in 30° and 90° of knee flexion. The test can also be performed in the prone position. When assessing the patient in the prone position, the thigh-foot angles of both sides are compared. In the presence of combined PLC and PCL injury, increased external rotation is seen in both positions. In the presence of isolated PLC laxity, increased external rotation is seen in 30° but not at 90°.

In the external rotation recurvatum test, both great toes of the patient are simultaneously lifted up. The test is deemed positive when there is excessive external rotation, recurvatum and a subtle varus deformity in the affected knee. A positive test indicates injury to the PCL, PLC and maybe even the LCL. Hughston and Norwood also described the posterolateral drawer sign. This is elicited by performing the posterior drawer test with the patient’s foot in external rotation, neutral position, and internal rotation. An increase of the magnitude of the posterior drawer in external rotation suggests abnormal posterolateral laxity.
Tests for meniscal injury

The two classical tests for meniscal injury are the McMurray test and the Apleys grinding test. In the McMurray test, the patient is supine, and the test begins with the knee flexed. To examine the medial meniscus, the knee is externally rotated and slowly extended with one hand holding the foot. The examiner palpates for tenderness over the posteromedial margin of the joint using the other hand. During extension, a click may be felt. The lateral meniscus is similarly examined, with the knee held in internal rotation, and the slowly extended. The joint is palpated in the posterolateral margin.

The Apley grinding test begins with the patient lying prone, and knee flexed to 90 degrees. One hand cups the heel, while the other stabilises the thigh of the patient against the examination couch. In the first part of the test, the patient's foot and leg is lifted upwards, followed by internal and external rotation of the knee. In the second part of the test, the procedure is repeated, but this time applying a downward force, followed by internal and external rotation of the knee. In a positive test, popping and pain localised to the site of injury will be present.

Conclusion

In this paper, we have presented a succinct summary of the relevant parts of a knee examination. Every student or junior doctor will eventually develop his own system of knee examination as he progresses in his training.

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References


Clinical Examination
Examination for Low Back Pain

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Introduction

Low back pain is the most common complaint in the Orthopaedic outpatient clinic. Epidemiological studies from Sweden and the US estimate the lifetime prevalence of low back pain to be between 60% and 80% in the general population.1 A detailed history and physical examination are vital to establish key differential diagnoses prior to any imaging investigation. This article presents an overview of the essential steps involved in the physical examination of a patient who presents with low back pain, keeping in mind that the extent of physical examination of the patient frequently depends on the nature of the problem presented and the time available to perform the examination.

Look

The physical examination should start off with inspection of the patient’s gait and stance as he enters the consult room. An antalgic or short leg gait may suggest alternative differential diagnoses or a non-spinal cause for low back pain. A high stepping gait from a footdrop may indicate possible ipsilateral L4-L5 radiculopathy. A listed stance suggests acute disc protrusion, frequently contralateral to the side of the list. Other subtle signs that can be identified prior to formal physical examination include use of an ambulatory aid and presence of an in-dwelling urinary catheter. Proper physical examination requires adequate exposure with the patient clothed only in undergarments. The patient’s posture should be inspected for any loss of normal lumbar lordosis and any abnormal lateral listing. Presence of any scars, sinuses or skin changes should be noted. The examiner should also observe for neurocutaneous features, such as café au lait spots, pigmented nevi or tuft of hair over the lower back.

Feel

The spinous processes of the vertebral column should then be palpated for any tenderness, step deformity or interspinous widening. The posterosuperior iliac spines (PSIS) are then palpated for tenderness. Renal punch test can be done to look for a possible renal pathology, like pyelonephritis, presenting as low back pain.
A full neurological examination should then be performed on the lower limbs. The following tests are typically done to evaluate the individual myotomes:

L2—hip flexion
L3—knee extension
L4—ankle dorsiflexion
L5—big toe dorsiflexion
S1—ankle plantarflexion

Figure 1 illustrates the sensory dermatomes that must be tested as part of the neurological examination.

The tone of the musculature and reflex testing are also essential to differentiate between an UMN and LMN lesion, which could help to localize the site of lesion in the patient.

The Babinski and myoclonus tests are also routinely performed.

Spinal flexion is assessed by asking the patient to bend forward and try to touch his toes with his knees fully extended. Range of motion can be assessed in both the thoracic and lumbar spine. Normal range is 45° in the thoracic spine and 60° in the lumbar spine.
Modified Schober’s test (Figure 2) is done to assess for limited spinal excursion seen in patients with ankylosing spondylitis. Two bony points are marked along the axial spine, one point 10 cm above the imaginary line joining the posterior superior iliac spines (PSIS) and one point 5 cm below this line. The patient is then asked to touch his toes with his knees fully extended, and the excursion between the 2 points is measured. An excursion of less than 5 cm is indicative of severe limitation of lumbar spine flexion.

Spinal extension is assessed by asking the patient to arch backwards while stabilizing his pelvis with one hand. Normal range is 25° in the thoracic spine 35° in the lumbar spine.

Lateral flexion is tested by asking the patient to slide his hand down the side of the ipsilateral leg in turn. Normal range is 30°. Rotation is tested with the patient seated with both arms folded across the chest and asking him to twist round each side in turn as much as he can. Normal range is 40°, with most of the rotation contributed by the thoracic spine.

**Special Tests**

The straight-leg raise test (SLR) is performed to identify lumbosacral nerve root tension usually as a result of disc herniation. A positive test results in the patient experiencing sciatica, with back pain that radiates down the buttock and posterior thigh, and sometimes down the leg. The angle at which this pain occurs is noted. Normally, there should be no pain with a straight leg raise to 90°. Sciatica reproduced at 30° to 70° SLR indicates a positive test for lumbosacral nerve root tension. Reproduction of back pain alone does not constitute a positive SLR. A Cochrane meta-analysis reported a high sensitivity of 92% in pooled estimates for this test, with a varying specificity. The specificity of the test can be enhanced with the crossed sciatic testion test, where the SLR done on the unaffected side reproduces sciatic pain on the affected side.

**Figure 2. Modified Schober’s test**

**Figure 3. Straight leg raising test**

**Figure 4. Sciatic nerve stretch test**
The SLR test (Figure 3) can be supplemented by passively dorsiflexing the ankle upon eliciting a positive SLR test (Figure 4), which would further aggravate the sciatica in a patient with lumbosacral nerve root tension.

The sciatica brought on by the SLR is rapidly relieved with knee flexion, and then reproduced again with the “bowstring test” which is performed by digital pressure of the common peroneal nerve behind the knee.

With the patient lying prone, the femoral stretch test (Figure 5) is then performed by either flexing the knee with the ipsilateral hip flat against the examination bed or by hyperextending the hip. A patient with lumbar root tension would experience back pain that radiates down the front of the thigh. A recent prospective cross sectional study of 57 patients reported a sensitivity of only 50% but a specificity of 100% for midlumbar nerve root impingement.³

The sacroiliac joints are tested with the Faber test (Figure 6). The patient’s legs are placed in a figure-of-4 position, with the hip of the tested side flexed, abducted and external rotated. An external rotation stress is then placed on the hip joint by applying a posteriorly directed force on the medial side of the bent knee. Pain with this maneuver could suggest sacroiliac joint dysfunction or a hip pathology.
A proper abdominal examination should be performed if there is any suspicion of referred back pain due to an intra-abdominal pathology eg acute pancreatitis and symptomatic abdominal aortic aneurysm. Rectal examination must be done to assess the anal tone and perianal sensation if there is any concern for cauda equina syndrome. All lower limb pulses should also be palpated in a routine physical examination for low back pain to rule out peripheral vascular disease as a cause for the patient’s symptoms. Aortoiliac occlusive disease can sometimes cause buttock pain and claudication symptoms that may be wrongly attributed to the spine.

Non-organic signs in low back pain have been described by Waddell et al⁴ for patients with suspected functional overlay. These patients usually demonstrate superficial non-anatomic back tenderness; reproduction of low back pain with axial loading over their heads; marked improvement in straight-leg raising on distraction as compared to formal testing; partial cogwheel “giving way” of multiple muscle groups in a non-myotomal distribution; non-dermatomal distribution of sensory loss; overreaction during physical examination.

The senior author of the paper also recently described an additional triad of tests with high predictive values for patients with secondary gain motives⁵. The triad of tests includes the resistive straight leg raise test (rSLRT) where the patient would exert a downward resistive force on the examiner’s hand while the examiner tries to lift his leg; the resistive forward bend test (rFBT) where the patient would actively resist the examiner’s hand while being guided to bend forward during a routine Schober’s test; the heel compression test (HCT) where a force applied on the patient's heel along the axis of the lower limb, with the hip and knee completely extended, elicits low back pain.

Conclusions

Low back pain is a common and important problem in the Orthopaedic outpatient clinic. A detailed history coupled with a thorough physical examination is essential in identifying red flags, narrowing down the list of differential diagnoses and guiding us in further investigation and management.

References


Surgical Approach
Antero-lateral Approach to the Hip

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**Introduction**

Operations around the hip joint is one of the most commonly performed procedures in Orthopaedics. Surgical exposure of the hip for trauma, reconstruction and infection can be achieved using four basic approaches. These are namely the anterior, anterolateral, posterior and medial approach. For this article, we will focus on the anterolateral approach.

The anterolateral approach was first described by Watson-Jones in 1936.\(^\text{1}\) It exploits the intermuscular plane between the tensor fasciae latae and the gluteus medius.\(^\text{1,2}\)

**Indications**

1. Total hip arthropasty
2. Hemiarthroplasty
3. Open reduction and internal fixation of femoral neck fractures
4. Synovial biopsy of the hip
5. Arthrotomy washout of the hip

**Positioning**

1. Supine
2. Lateral
1. Incision:
   a. Straight longitudinal incision centered on the tip of the greater trochanter. The incision crosses the posterior third of the trochanter before running down the shaft of the femur. [Figure 1]

2. Internervous plane:
   a. No true internervous plane as the gluteus medius and the tensor fascia latae have a common nerve supply, the superior gluteal nerve.

3. Superficial dissection:
   a. Incise the fat in the line of the skin incision to reach the deep fascia of the thigh.
   b. Use a moist penny towel to push back the subcutaneous fat off the fascia lata.
   c. Incise the fascia lata at the posterior margin of the greater trochanter and enter the bursa that underlies it.
   d. Divide the fascia lata in the line of its fibers superiorly heading proximally and anteriorly in the direction of the anterior superior iliac spine.
   e. Complete the fascial incision distally.
   f. Elevate the vastus lateralis flap anteriorly using a retractor.
   g. Detach the few fibers of gluteus medius that arise from the deep surface of this fascial latae.
h. Ligate the vessels crossing the interval between the gluteus medius and tensor fascia lata. [Figure 2]

![Figure 2. Ligate the series of vessels that cross the interval between the tensor fasciae latae and the gluteus medius](image)

i. Retract the gluteus medius and minimus proximally and laterally from the superior margin of the joint capsule.

j. External rotate the hip and put the capsule under tension.

k. Identify the origin of the vastus lateralis at the vastus lateralis ridge.

l. Incise the origin using a cautery knife, and reflect the muscle inferiorly.

4. Deep dissection: Involves the detaching part or all of the abductor mechanism and then dissecting up the femoral neck superficial to the capsule of the joint

   a. Place a stay suture in the anterior portion of the gluteus medius just above its insertion into the greater trochanter

   b. Cut the insertion of this off anterior portion off the trochanter

   c. Identify the thick white tendon of the gluteus minimus as it inserts onto the anterior aspect of the trochanter and incise it

   d. Flex the knee and detach the reflected head of the rectus femoris from the joint capsule to expose the anterior rim of the acetabulum. [Figure 3]

   e. T-shaped capsulotomy
Dangers

1. Femoral nerve
   a. Most lateral structure in the femoral triangle

2. Femoral artery and vein
   a. May be damaged by incorrectly placed acetabular retractors that penetrate the iliopsoas, piercing the vessels as they lie on the surface of the muscle
   b. The profunda femoris artery lies on the psoas muscle, deep to the femoral artery and can also be damaged by poorly placed retractors

3. Fractures of the femoral shaft
   a. Can occur during dislocation or relocation of the hip
   b. Ensure adequate capsular release and osteotomise the femoral neck if necessary

Reference


Surgical Approach
Anterior Approach to the Shoulder

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Anterior Approach to the Shoulder

Also known as deltopectoral approach, this is a commonly used exposure to the shoulder. It is fairly extensile, allowing access to the anterior, medial and lateral parts of the shoulder. Some of the common indications include proximal humerus fracture fixation, shoulder arthroplasty, arthrotomy and washout for shoulder septic arthritis, repair or stabilization of the tendon of the long head of biceps.

Positioning of Patient

The two most popular patient positions are the beach chair and the supine position. In beach chair position (Figure 1), the patient is positioned with upper body raised at about 30-45 degree, knee flexed at 30 degree with the head stabilised in a head rest. Care must be taken to avoid excessive extension or lateral flexion of the neck to prevent brachial plexus injury. In our center, T Max shoulder positioner (Smith and Nephew) is commonly used. The advantages of beach chair position are the arm can move in a wide range of motion and gravity can aid with the reduction of the fracture.

In supine position, the patient is lying supine on a radiolucent table with a sandbag placed beneath the ipsilateral scapula to protract the shoulder. This position has the advantage of getting an axial view of the shoulder intraoperatively without much manipulation of the shoulder.

Figure 1. Positioning of the patient
Skin Incision

A 12-14 cm incision is made following the line of the deltopectoral groove and can be guided by corocoid process proximally and axillary crease distally especially in obese patients. (Figure 2)

Figure 2. Skin Incision

Superficial Dissection

This approach uses internervous plane between deltoid (supplied by axiallry nerve) and pectoralis major (supplied by medial and lateral pectoral nerves) with cephalic vein lying in between (Figure 3). Deltopectoral fascia is incised, cephalic vein is freed and can be retracted medially or laterally. Deltoid is retracted laterally and pectoralis major is retracted medially.

Figure 3. Superficial dissection
Deep Dissection

Blunt dissection down the deltopectoral interval is made to expose the clavipectoral fascia. Coracoid process and conjoint tendons (made up of short head of biceps and carocobrachialis) are identified. The clavipectoral fascia is incised lateral to the conjoint tendon and inferior to the acromioclavicular ligament, the conjoint tendon is retracted medially to expose the underlying subscapularis tendon and lesser tuberosity (Figure 4). Alternatively, the two muscles can be detached with the tip of the coracoid process to allow more exposure. The coracoid process is predrilled and tapped before osteotomy is performed to ease the fixation back later.

External rotation of the humerus at this point stretches the subscapularis tendon and capsule, moving the point of incision of the tendon away from axillary nerve. Subscapularis tendon is divided vertically at its musculotendinous junction and reflected to expose the anterior capsule. A leash of vessels distally marks the caudal end of the subscapularis. A couple of stay sutures may be used to tag the muscles belly to prevent it from retracting and dissappearing medially and to allow easy repair later. A vertical capsulotomy is made medial to the lateral stump of subscapularis allowing access to the shoulder joint.

![Deep Dissection](image)

Applied Anatomy and Structures at Risk

The neurovascular structures that cross in the surgical field are cephalic vein, anterior and posterior circumflex humeral arteries, axillary nerve and musculocutaneous nerve. Cephalic vein lies in the deltopectoral groove and should be preserved as far as possible to prevent edema of the upper limb post operatively.

Muscolocutaneous nerve enters the coracobrachialis muscles as high up as 2 cm distal to the coracoid process from its medial aspect. All dissection should therefore stays on its lateral side. Vigorous retraction under the muscle can cause neuropraxia and weakness of the elbow flexors.

Axillary nerve runs on the surface of subscapularis along the posterior wall of the axilla before entering the quadrangular space bounded superiorly by the inferior border of the subscapularis. It then winds around the humerus and enters the deltoid muscle from its deep surface, about 7cm from the tip of the acromion. It could be injured during dissection of the subscapularis.
RA is characterized by chronic inflammatory response in the joint synovium leading to capsular distension, ligament laxity, joint erosion and destabilization resulting in deformities. Rheumatoid forefoot commonly presents with a hallux valgus deformity and dorsal subluxation of the lesser metatarsophalangeal (MP) joints. It is also associated with claw toe deformity. This is due to the disruption of the 1st MP joint from chronic destabilization of the joint capsule, collateral ligaments and plantar plate combined with progressive bony erosion leading to hallux valgus deformity. As a result, a greater force is being transferred to the lesser MTP joints causing dorsal subluxation of the proximal phalanges and a resultant plantar displacement of the metatarsal heads. The plantar fat pad also displaces dorsally with the plantar plate further uncovering the metatarsal heads. Due to imbalance of the intrinsic-extrinsic muscles of the foot, progressive deformity of the lesser toes causing claw toes occurs. Upon weight bearing, chronic depression of the metatarsal heads causes metatarsalgia, corns and calluses over the plantar aspect of the metatarsal heads which may then ulcerate.

Foot orthotics such as custom made footwear with metatarsal bar or dome, footwear with wide toe boxes and rocker shoes are the mainstay of non-surgical management for rheumatoid foot and ankle. Studies have shown that these foot orthotics reduces plantar pressure and therefore provide pain relief for patients. Surgical intervention is recommended when conservative management with foot orthotics had failed and patient presents with persistent pain and progressive forefoot deformities. Here, we describe the modified Kates Kessel Kay (KKK) operation for rheumatoid forefoot reconstruction.

**Positioning**

1) Patient is put in prone position.

2) A pneumatic tourniquet is applied on the thigh but not inflated.

**Procedure**

1) A single elliptical plantar incision convex proximally is made from the neck of the second metatarsal neck to the neck of the fifth metatarsal neck to excise all the lesser metatarsal heads. [Figure 1]

2) The skin and subcutaneous layer are carefully dissected away from the underlying tissues. [Figure 1]
3) Vertical incisions along the axis of the lesser metatarsals are made from the second to fifth MTP joint to expose the joint and metatarsal heads. This is done carefully to prevent damage to the neurovascular bundles.

4) Metatarsal heads of the second to fifth toe are transected in that order with special attention paid to maintain the parabolic curvature of the metatarsal necks. Reconstitution of the smooth arc allows for even distribution of weight bearing stress during ambulation. [Figure 1]

5) Subsequently, make a separate dorsomedial incision over the hallux to expose the first metatarsophalangeal (MP) joint capsule.

6) Dorsal and volar skin flaps are created and made along the capsular plane to prevent damage to the cutaneous nerves. Following that, the extensor hallucis longus is retracted laterally and a longitudinal capsulotomy performed to visualize the joint.

7) Joint capsule is stripped off the medial eminence to expose the prominence and bunectomy performed in line with the medial aspect of metatarsal shaft. Joint surfaces are prepared till healthy cancellous bone is seen with appropriate sized chisels. Use a 1.1mm Kirschner wire to perform mini perforations over the cancellous bone surfaces for better fusion.

8) A separate dorsolateral incision is made over the first MTP joint to expose and release the adductor hallucis tendon.

9) The hallux is reduced and held temporarily with Kirschner wires such that it is not impinging on the second toe and is 5 - 10 degrees off the axis of the floor. Confirm the final reduction and alignment with orthogonal views using fluoroscopy guidance.

10) Arthrodesis is then completed with a crossed compression screw construct using the cannulated screw system.

11) Wounds are washed, medial capsular repair carried out and skin closure using interrupted skin suture with a synthetic, absorbable suture (Monocryl).

12) Dermoplasty is performed to realign the dorsally displaced plantar fat pad under the refashioned metatarsal heads followed by subcutaneous and skin closure. [Figure 1]
13) In the presence of lesser toe deformity such as claw toe, a dorsal incision over the proximal interphalangeal (PIP) joint is performed.

14) Careful dissection is done to expose the capsule and the PIP joint following that. The extensor tendons of the lesser toe are tenotomized to correct the dorsal subluxation of the MTP joint and the PIP joint surfaces prepared for arthrodesis. [Figure 2]

15) A Kirschner wire is then inserted to hold the lesser toe in line with the second metatarsal under fluoroscopic guidance. Similar steps are taken for the reconstruction of the other lesser claw toe deformity if required. [Figure 2]

16) A below knee Plaster of Paris backslab is then applied to immobilise the limb.

Figure 2. Picture A showed a typical claw toe from rheumatoid forefoot deformity. Picture B and C showed an extensor tendon tenotomy and reduction of the MP joint with arthrodesis of the PIP joint using a Kirschner wire.

Adapted from Heide et al ²
1) Non-weight bearing is maintained for 6 weeks to allow fusion to take place. The limb is placed in a below knee cast initially but converted to Darco Wedge shoe after initial wound dressing change at 1 week postoperatively.

2) Weight bearing is allowed from 6 weeks onwards. Complications encountered include wound infection, delayed wound healing, delayed union or nonunion, malunion with dorsiflexion or plantarflexion deformity, loss of fixation at the MP joint due to loosening and screw breakage.

Figure 3 shows a patient with rheumatoid forefoot deformities. Patient underwent the procedure.

Figure 4 shows the post operative radiographs and clinical photographs of the foot.

Rehabilitation

**Conclusion**

The modified Kates Kessel Kay operation for rheumatoid forefoot deformities is a reliable method of achieving correction of progressive deformity.

**Reference**


Trauma Case Discussion
Management of Complex Tibial Fractures
with Ilizarov Ring Fixator

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Division of Musculoskeletal Trauma

Case Presentation

This patient is a 40-year old Chinese gentleman who was admitted to our institution after being involved in a road traffic accident. He was a motorcyclist who was hit from behind by another vehicle at high speed, after which he was flung off his motorcycle. He was reviewed in the Emergency Department and was found to be alert with a GCS of 15 and was haemodynamically stable. The main clinical finding was that of gross deformity and swelling of the right knee with absent dorsalis pedis, posteri tibial and popliteal pulses with a palpable femoral pulse. Manipulation and reduction of the right lower limb was done in the emergency department. A subsequent Doppler ultrasound examination revealed a positive Doppler signal for both the posterior tibial and popliteal pulses, but no dorsalis pedis pulse was detected.

In view of the above findings an urgent Computed tomography scan of the thorax, abdomen and pelvis as well as an angiogram of the right lower limb was performed. Concurrently the patient was resuscitated according to Advanced Trauma Life Support (ATLS) protocols.

Investigations

The following injuries were found after Computed Tomography Scan.

1. Comminuted right proximal tibial fracture with a coronal split and intra-articular extension and a comminuted displaced right proximal fibula fracture. (Figure 1)

2. A short segment of non-visualised anterior tibial artery with opacification distally, normal opacification of the posterior tibial and peroneal arteries

Figure 1. Initial Radiographs showing a comminuted proximal tibia fracture with intra-articular extension
In view of the above findings, the patient underwent right lower limb bridging external fixation followed by an on-table angiogram of the internal iliac vessels and the right lower limb (Figure 2). The on-table angiogram revealed occlusion of the anterior tibial artery at its origin with reformation of the vessel distally. In view of this no vascular intervention was attempted.

The patient was managed in the Surgical High Dependency Unit. In view of the extensive swelling and hemarthrosis noted over the fracture site as well as the comminution of the fracture, the decision was made for closed reduction and definitive external fixation of the fracture. An Ilizarov External Fixator application and closed reduction was performed by the senior author of this paper six days post injury (Figure 3).
Post-operative radiographs were satisfactory (Figure 4) and the patient was allowed to weight-bear partially 2 weeks post injury. Additionally the patient was prescribed an Orthofix bone ultrasound device to aid fracture healing. In view of a persistent foot drop post injury, an Ankle Foot Orthoses was applied and the patient was discharged for rehabilitation at a community hospital.

The Ilizarov External Fixator was removed 6 months post-operatively and radiographs of the right tibia/fibula showed union of the fracture fragments with maintenance of knee joint space and alignment. On further review 1 year postoperatively, the patient was ambulant and had returned to work. Radiographs showed complete union of the fracture with no knee joint or ankle joint osteoarthritis.

In multiple-trauma patients, initial management is done according to Advanced Trauma Life Support principles with management of the patients Airway, Breathing, Circulation and Disability taking priority. Vascular injuries associated with fractures and dislocations are uncommon and are associated with high energy trauma. Early reduction and realignment of the limb done in this setting is crucial as this may restore blood flow to the affected limb. Doppler ultrasound screening can be done in the emergency room setting with excellent sensitivity and specificity, but it is operator dependent. CT Angiography has good sensitivity and specificity and can be used to delineate the extent and location of the injury as in this case. In a pulseless limb, vascular repair is usually performed first as delays in repair are associated with high rates of amputation. However, disruption of the repair can occur with subsequent reduction and fixation. In cases where pulses are still present and an intimal injury is suspected, as in this case, orthopedic stabilization may be performed first.

This patient was managed according to Damage Control Orthopedics principles, which are based on reducing the complications arising from acute surgical burden after trauma on critically injured patients. Pape et al classified trauma patients into stable, borderline, unstable and in extremis, based on the presence of hypotension, hypothermia, coagulopathy and soft tissue injuries. In a prospective randomized trial by Pape et al, borderline patients like the above patient were shown to benefit from external fixation and delayed definitive management, with decreased respiratory complications. In view of the above, the patient was managed with a bridging external fixator first before definitive treatment at a later date.

Discussion

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Management of complex Tibial Fractures with the Iliazarov method:

Complex fractures of the tibia are high energy injuries with high rates of complication. The tibia has a large subcutaneous border with a tenuous blood supply and soft tissue injury at the time of injury and surgery can lead to poor fracture and wound healing. This can lead to complications including deep wound infection (up to 47%), non-union (up to 29%) and amputation (up to 7%).

Although closed treatment of complex tibial fractures with casting or functional bracing has been described, their biological advantages are limited by inadequate stability. Intramedullary nailing appears to be the most commonly used method. In the process of surgical dissection and reaming, disruption of the remaining vasculature can occur, leading to devascularisation of the fracture site. This can lead to delayed union or nonunion of the fracture.

The Ilizarov method for treating tibial fractures has proven to be useful in the acute and subacute treatment of tibial fractures. It allows for indirect reduction of the fracture with minimal surgical dissection. Incisions are only made for passage of the olive wires and release of skin tension at the wire skin interface. It allows for multilevel and multiplanar fixation with early weight-bearing and mobilization of the adjacent joints. Post traumatic shortening, rotational or angular malalignment can be treated at any time during fracture healing by adjustment of the external fixator. Cyclic compression and distraction can be used to stimulate callus formation and this can avoid the need for open bone-grafting and surgical techniques for treatment of non-union or delayed union.

In a study of 40 patients with complex tibial fractures treated by the Ilizarov method by Foster et al, there was a 90% rate of primary fracture union, with a mean time of healing of fracture of 180 days which was similar in our patient. These patients had good postoperative functional scores, with 25 patients (78%) having Tegnar activity scores of more than 2 and being able to participate in light activities or sports. In these patients, 75% had good or excellent Lysholm Knee scores with a median score of 97 out of 100. In this cohort of patients, 81% had good or excellent Olerud and Molander ankle scores with a median score of 80. Similarly, our patient achieved primary fracture union and had good functional recovery at the time of removal of the Ilizarov fixator.

In other smaller studies by Otzurkmen et al, Tinlicheridis et al and Giotakis et al, patients treated by Ilizarov external fixation also showed similarly high rates of primary union rates of at least 90%, although functional scores were not recorded.

The main complications associated with the Ilizarov method are pin tract infection and patient inconvenience such as difficulty with clothing and sleeping. Pin track infections in these patients tend to be very responsive to oral antibiotics, and can be prevented by adhering to published pin-site care method recommended by the Russian Ilizarov Centre for Restorative Traumatology and Orthopaedics. These include inserting the wires in a pulsed stop start fashion to avoid overheating, using non-shedding sterile dressings that covered the pins at all times and ensuring that the pins are cleaned weekly. Our patient did not develop a pin site infection in the course of his treatment.

This case discussion demonstrates that Ilizarov external fixation is a safe and reliable way of treating complex tibial fractures, with high rates of fracture union, post-operative patient function and low rates of complication.


Clinical Pathological Case Discussion

Giant Cell Tumour

Zachary Chua Kerk Hsiang, Mark Edward Puhaindran
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“Tumours”.... Specifically the phrase “bone tumours is very much feared by most, if not all Orthopaedic residents. Haunted by imaginary fears that we would one day in the course of our careers dismiss a patient’s concerns about bone aches and pains. But instead be ashamed and frightful of the patient’s wrath, whom we missed the diagnosis of a malignant bone tumour.

Before we present an interesting case of giant cell tumour, we would like to revise several basic principles of bone tumours.

The common presenting complaints of patients with bone tumours are that of musculoskeletal pain. However, such a statement would leave the resident in a dilemma as many of the patients seen in clinics present such complaints.

The art of history-taking becomes paramount. Several pertinent points about the nature and characteristics of the pain must be fleshed out.

i) The pain is deep seated. Some patients may describe it to resemble a toothache.

ii) The pain may start off to be intermittent and related to activity but it usually progresses in intensity and becomes constant.

iii) Patient experiences night pain.

iv) It is not relieved by NSAIDs or weaker synthetic opioids such as tramadol.

Patients with low grade tumours such as chordoma, chondrosarcoma, adamantinoma present with a long history of mild to moderate pain (6 to 24 months). Conversely, patients with high grade sarcoma present with a much shorter duration of 1 to 3 months history of pain.

Moving on to physical examination, the resident should always examine patients with suspected bone tumours with due care.

Points to note specifically are presence of soft tissue masses, adenopathy, overlying skin changes and general musculoskeletal condition of the patient. A history of weight loss is always concerning as the tumour would likely have progressed to a more advanced stage. When there is a suspicion of metastatic disease, other organ systems such as the abdomen, thyroid gland, prostate, and breasts should be examined as appropriate.

Next in the sequence of work-up for patients with suspected tumours would be imaging. The resident has to be familiar with the strengths and weaknesses of various imaging modalities in order to select the most appropriate one. Plain x-rays are still the first line of imaging. This modality is where tell-tale pathognomonic signs such as sun-ray spiculations, codman’s triangle, onion skin appearances can be seen.
A CT scan is a good modality for screening for metastases bone malignant bone tumours should it involve other organ systems or for staging a non-bone primary metastases.

Meanwhile, an MRI is an excellent modality for soft-tissue contrast and differentiation of tissue of tumours. It also visualizes the extent of localize spread and aids the surgeon in planning resection with regards to how close neurovascular bundles are. MRI is also good for screening the spine for occult metastases, myeloma or lymphoma. Truly, it is a modality that has evolved into one of the staples of tumour imaging.

Another imaging modality that is widely used is the technetium-labeled bone scan. These are excellent modalities to search for or monitor already existing occult bone involvements. However, in patients with myeloma whom scan results may be negative, a skeletal survey is more sensitive.

**Case Presentation**

After going through some of the basic principles of how to approach bone tumours, we would like to share with residents an interesting case of a recurring giant cell tumour in the wrist.

The patient is a 35 year old male who works as a technician in the armed forces. His dominant hand is his right hand. His past medical history includes a previous excision of a giant cell tumour on his right wrist. The tumour was previously treated with extended curettage with cementation overseas. He presented to the outpatient clinic with a recurrence of his right distal radius giant cell tumour detected on MRI done overseas.

On examination there was no lump, no swelling and no erythema of his wrist. There was no history of night pain and no symptoms of systemic malaise. The functions of his right hand and wrist were not affected.

Before we present what was done surgically for the patient, the following images (Figures 1 to 3) will allow the resident to have a better appreciation of the extent of his tumour.

*Figure 1. X-ray on presentation*
Figure 2. CT scan of the tumour- note how the recurrence has spread past the previous cementation.

Figure 3. MRI- Almost 50% of involvement of the articular cartilage region with nearly no bone beneath the cartilage.
In view of the recurrence and extent of involvement, the patient underwent a right distal radius resection of recurrent GCT, local adjuvant with argon beam coagulator and reconstruction with iliac crest bone grafting and radio-scapho-lunate arthrodesis. On his last follow-up 2 months post-op, the patient was doing well. (Figure 4)

Giant cell tumours are benign, aggressive bone tumours consisting of distinct undifferentiated mononuclear cells. Although benign, they can cause symptoms and problems for the patient when it spreads to a large area and involves joints. Most cases occur in patients 30 to 50 years of age. Females are affected more that males.

These patients usually present with pain and swelling for 2 to 3 months. Patients may also complain of decreased range of motion. They can also present with pathological fractures. The most common locations for fractures include the distal femur, proximal tibia, distal radius, sacrum, proximal femur, proximal humerus and pelvis.

In terms of imaging appearances, with reference to the images above, the lesions can be eccentric, lytic lesions located in the epiphysis/metaphysis of long bones. The lesions extend to the subchondral surface with no sclerotic rim. It can destroy the cortex and extend into the surrounding tissues.

Treatment of giant cell tumours usually involves thorough curettage and local adjuvants such as phenol, cryotherapy and argon beam to decrease local recurrence. The subsequent defect can be filled with either bone graft or methylmethacrylate. Aggressive lesions may require resection and reconstruction, which were done in this patient. The rate of local recurrence with intralosomal treatment is 10 to 15%. Lastly, the resident needs to be aware of the phenomenon of benign metastasizing giant cell tumour that can occur in about 2% of patients.

We hope the case discussed has been interesting to the reader and has acted as the first ripple in the pond of knowledge of orthopaedic tumours.
Hand Case Discussion

Aberrant Flexor Digitorum Superficialis of the Little Finger Causing Carpal-Tunnel Syndrome

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Department of Hand and Reconstructive Microsurgery

Objectives

Anomalies of the flexor digitorum superficialis (FDS) are uncommon. They are encountered in cadaveric dissections and are only occasionally found during surgical exposure of the hand. Therefore, the frequency of their occurrence is unknown.

They may present as compression of the median nerve within the carpal tunnel or painful mass or pseudotumour around the wrist or in the palm. It usually occurs without an obvious extrinsic cause, but the presence of anomalies muscles in the hand causing carpal tunnel syndrome have been documented.

We present a case of a 60-year-old, right hand dominant female with severe right carpal tunnel syndrome as the result of an aberrant FDS to the little finger and searched the available literature for all previous case reports of anomalies of FDS in the palm and carpal tunnel.

Case Report

A 60-year-old, right hand dominant housewife presented to the outpatient clinic complaining of more than ten year history of intermittent bilateral hand numbness and weakness worse on the right. There was no preceding history of trauma or change in activities. Her symptoms had progressively worsened in the last few months before presentation with persistent pain and paraesthesia in the thumb, index finger and middle finger of her right hand associated with a weak pinch grip.

On examination, her right hand had decreased sensibility to the thumb, index finger, middle finger and radial half of the ring finger. She also had thenar atrophy and weakness in abduction of the thumb. Tinel’s and Phalen’s tests were strongly positive. Nerve conduction test and electromyography are consistent with bilateral severe grade median neuropathy across the wrists, right worse than left.
She was planned for carpal tunnel release and a modified Camitz transfer. At surgery, an aberrant FDS of the little finger was found to be compressing the median nerve. This muscle belly arose from the undersurface of the radial aspect of the TCL. Its insertion is into the FDS of the little finger at the level of the lumbrical origin. A branch from the ulnar nerve supplies this aberrant FDS. The muscle was excised followed by a Camitz transfer. At three months post-operatively, she had no more numbness and her pinch strength has much improved. An ultrasound of the left hand was done which demonstrated median nerve swelling but no aberrant muscle or tendon within the carpal tunnel.

Of the 21 clinical cases of FDS anomalies reviewed, there are 9 cases causing carpal tunnel syndrome, 6 cases presenting as a palmar mass, 2 cases of incidental finding during removal of a lipoma, 2 cases associating with flexor tendon rupture, 1 case presenting with ulnar neuropathy and 1 case causing triggering of the finger at the wrist.

Secondary carpal tunnel syndrome caused by anomalous muscles is rare but have been well described, especially in patients with frequent and repetitive use of their hands. These muscle anomalies include a hypertrophic or an aberrant flexor digitorum superficialis, an abnormal palmaris longus and hypertrophic or abnormal lumbricals.
Smith (4) first described anomalous muscle belly of the FDS indicis causing carpal tunnel syndrome in a twenty-eight year old housewife. She had a two year history of a painless swelling in her palm prior to the development of sudden onset of burning pain in the right palm with radiation to the index and middle fingers and thumb. At surgery, the FDS tendon of the index within the palm and extending to the transverse carpal ligament (TCL) was found to be replaced by a fleshy muscle belly. Proximally, it lay directly deep to the median nerve compressing it against the TCL. The anomalous muscle belly was complete excised with fully recovery of the flexion, extension and strength of the index finger.

Kono (5) reported an unusual case of acute carpal tunnel syndrome in a 33-year old man following an operation for the trans-scaphoid perilunate dislocation. Surgical exploration of the carpal tunnel four hours after the initial operation revealed the severely compressed median nerve between the swollen muscle bellies of FDS of the middle and ring fingers and the TCL. Postoperative pain and paraesthesia was treated with carpal tunnel release.

Hutton et al. (6) and Ametewee et al. (7) published two similar cases of acute carpal tunnel syndrome, both of a 23-year old nurse with a nine month history and two weeks history of symptoms respectively. An anomalous muscle, originating from the tendon of FDS indicis distal to the TCL, and inserting distally into the tendon at the level of the metacarpo-phalangeal joint was found by Hutton et al. The muscle was excised, and the patient remained symptom free at the three months follow up. In the case reported by Ametewee et al. the median nerve was entwined and displaced by the anomalous muscle arising from the FDS of the index finger. The muscle was freed but not excised. At six months post-operatively, there were no signs of recurrence.

A more recent case report by Schön et al. (3) presented a 26-year old with a 10-year history of pain and swelling in the right wrist and palm. A carpal tunnel release was performed 8 years prior to the redevelopment of symptoms of median nerve compression. Intra-operatively, the anomalous muscle belly of the FDS to the index and the middle finger were excised. Postoperative recovery was uneventful.

Figure 4. Presentation of 21 clinical cases of FDS anomalies.
Conclusion

All the cases described were young patients between the ages of 23 to 33 years old. Except the case described by Kono, the median nerve was always compressed by the anomalies of the FDS indicis muscle. Our own patient was unique as she was middle-aged with a relatively longer history of symptoms and the anomaly was related to the FDS of the little finger. The incidental finding of muscles anomalies in these cases including our own case at the time of surgery highlights the importance of an adequate exposure to identify the structure responsible for the compression of the median nerve. Excision of the aberrant muscle belly and decompression of the median nerve have been shown to relieve symptoms of carpal tunnel syndrome without compromising the function of the finger related to the anomaly.

References


The writing style of a scientific paper should be clear, concise and direct. The aim of a scientific paper is to communicate information to the reader quickly and effectively. Writing in a straightforward and concise way will increase the readability and accessibility of your article. Here are 8 simple rules on scientific writing have been developed with this in mind.

Rule 1: Write an Outline First

Before embarking on your scientific paper, it is important to write an outline. A well-developed outline keeps ideas and information organised and helps in the process of writing by acting as a conceptual skeleton for the paper to be built upon. A well-structured outline will also result in good flow of a paper for the reader to easily follow and understand.

Before starting

In writing an original article, follow the standard IMRAD (Introduction, Methods, Results and Discussion) format. Other types of writing include meta-analyses, review articles, case series and case reports. These have different formats.

The audience of your paper is an important factor to consider. In writing for a journal targeted for a more general audience, more explanation of technical terms and a general overview of the topic is required than if writing for a subspecialty journal.

Developing the outline

List the major points for each section, and arrange them in proper sequence. To better illustrate some points, figures, diagrams, graphs, tables and charts can be used. Certain facts need to be substantiated by appropriate references.
Rule 2: Constructing Paragraphs

Write in continuous prose, expressed in paragraphs. Appropriate paragraphing makes an article more readable and easy to follow.

Rules for writing paragraphs:

1. **One point per paragraph**
   a. Do not cram too much information or details into a single paragraph. Breaking up your content into short paragraphs makes it easier for the reader to understand.
   b. Most readers are accustomed to one main idea per paragraph. This easily signals to the reader the start of a new topic with the start of a new paragraph.
   c. If your paragraph is getting too long, split the content into two or more sub-points. Devote one paragraph to explain each sub-point.

2. **Topic sentence**
   a. The topic sentence introduces the main point. It serves as a signpost for the reader. It informs the reader of the topic at hand, allowing the reader to anticipate the discussion that follows.
   b. Having a topic sentence at the start of each paragraph helps to direct your writing. The rest of the paragraph should be organised to support the topic sentence.

3. **Logical flow of information**
   a. The topic sentence at the start of the paragraph tells the reader what the paragraph is about.
   b. The paragraph body should support the main point stated in the topic sentence.
   c. After finishing a paragraph, read through it to check that all sentences and information help to develop the main point. If there are any irrelevant sentences, delete them and place them in paragraphs where they are more relevant.
   d. At the end of the paragraph, reiterate the main point by restating the topic sentence. This emphasises the main point again before the reader moves on to the next paragraph.

Rule 3: Building Sentences

Sentences are the building blocks of paragraphs. They convey ideas within a paragraph to the reader.

**Guidelines for sentence-writing:**

1. **Writing short sentences** helps makes one article concise and easy to understand.

2. **Subject-verb proximity**
   a. The verb should follow immediately after the subject of the sentence. A common mistake is to interrupt the subject-verb complex with many distracting details.
   b. Separation of the subject and verb can easily occur when too much information is
crammed into a single sentence. Split long sentences into two or more parts using full stops. This helps to make sentences concise. Each sentence or clause delivers one piece of information, with the verb following directly behind the subject.

3. **Placement of information**
   a. **Put known information first** (information previously referred to in the paper). This is useful in two ways:
      i. It provides context for new information at the end of the sentence.
      ii. It helps a paper flow more logically. Known information links new information to the rest of the paper.
   b. **Put new information last**
      i. This helps to underscore new information in the mind of the reader.
      ii. This end position should be reserved for the most important new information in the sentence.
      iii. Putting new information at the start of the sentence introduces a new idea without providing any context. This may be confusing for readers.

**Rule 4: Use proper choice of words**

Choosing simple, direct and specific words is key to writing a scientific essay well.

1. **Place actions in verbs**
   a. Express the action of a sentence in the main verb, rather than using nominalisations. This makes sentences easier to understand.
   b. Nominalisations are the noun forms of verbs. For example:
      i. to analyse ➝ analysis
      ii. to regulate ➝ regulation
      iii. to correlate ➝ correlation
      iv. to investigate ➝ investigation
2. **Omit unnecessary words** which add no new information or value. Longer phrases can be replaced by shorter ones or a simple word.

Examples:

<table>
<thead>
<tr>
<th>Lengthy Phrase</th>
<th>Equivalent Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>The vast majority</td>
<td>Most</td>
</tr>
<tr>
<td>Are capable of</td>
<td>Can</td>
</tr>
<tr>
<td>Due to the fact that</td>
<td>Since</td>
</tr>
<tr>
<td>With precision</td>
<td>Precisely</td>
</tr>
<tr>
<td>In the event of</td>
<td>If</td>
</tr>
</tbody>
</table>

3. **Avoid vague words and qualifiers** that provide only qualitative information and do not tell the reader anything useful.

   i. Common qualitative words and phrases to avoid:

   - Quite, rather, several, fairly, sufficiently, appropriate

4. **Avoid colloquialisms and contractions**

   a. Colloquialisms specific to your field may not be known to the reader. They should be replaced with more precise terminology.

   b. Contractions such as it’s, there’s and short forms such as lab should be avoided.

5. **Limit use of jargons, abbreviations and acronyms**

   If one has to use acronyms and abbreviations, ensure they are clearly defined the first time they appear.

6. **American and British spelling**

   a. Conform to the correct style of English required by the journal. If the journal does not have a specific preference, you can use either, but be consistent.

7. **Know the meaning of every word**

   a. Avoid using “big words” or words you are unsure of. If used wrongly, they can lead to misunderstandings and confusion.

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**Rule 5: Grammar and Punctuation**

Good grammar and punctuation holds a scientific paper together. Poor grammar is immediately obvious. Not only is it irksome to read, it may cause confusion for the reader who has to decipher what a poorly crafted sentence means.

Guidelines for grammatical usage in scientific writing:

1. **Use of the past/ present tense**

   a. Use the past tense when describing your own experimental work or that of others since you are speaking of past events.

   b. Use the present tense when discussing results as you are discussing current thoughts and ideas.
2. **Use of the third person**
   
a. Use of the third person is most accepted for scientific writing. It does not directly involve the writer (first person “I”) or the reader (second person “you”). This results in a more objective and professional tone.

3. **Use of active voice and passive voice**
   
a. **Brief overview**
   
i. Most sentences have "actors" and "receivers of action".
      
      - E.g. **Nurses educated the patients and caregivers** before discharge.
      
      - Here, "nurses" are the actors who carry out the education, while "patients and caregivers" are the receivers of this action.
   
   ii. **Active voice: the actors “act upon” the receivers of action directly.**
      
      - Structure: **Actor-verb-receiver**
      
      - E.g. as above: **Nurses educated the patients and caregivers** before discharge.
   
   iii. **Passive voice: the subject “is acted upon” by the verb**
      
      - Structure: **Receiver-verb-(actor)**
      
      - E.g.
         
         - The **patients and caregivers** were **educated** by **nurses** before discharge.
         
         - The **patients and caregivers** were **educated** before discharge.
      
      - The actor is optional: it can easily be omitted from the sentence
   
   b. **Use active voice most of the time**
   
i. **Missing actors in the passive voice:**
      
      - Use of passive voice can leave out important information about actors. Readers may know the action and receiver, but not who carried out the action. Using the passive voice makes the actor uncertain if there are multiple possibilities for the actor.
   
   ii. **Less wordiness with the active voice:**
      
      - Sentences written in the active voice tend to be shorter, resulting in a more concise paper.
      
      - Use active voice where possible. It is more direct and concise, and clearer for the reader.
   
   c. **Use passive voice to emphasise receiver of action**
   
i. **To draw attention to the receiver**
      
      - **All patients diagnosed with diabetic foot problems** were placed on the clinical pathway and included in the study.
ii. When the actor is not important
- The one-way ANOVA was used to compare the mean hospitalisation cost from 2005 to 2010.
- This is often the case when describing materials and methods, since focus is on techniques used rather than the researcher performing them.

4. **Using computerised checking tools**
   a. Spelling and grammar checkers
      i. Computerised spelling checkers offer quick checks of one’s paper and standardises American or British English in your paper – select the appropriate option for your spellchecker.
      ii. Manual proofreading of your paper is still necessary. Spellcheckers may not pick up typographical errors that result in different (but incorrectly used) words.
         - E.g. for → four, moral → morale, peak → peek, etc
   b. “Find and replace” tools
      i. Use “find and replace” to check for unnecessarily long phrases. Replace them with their shorter equivalents.

**Rule 6: Be simple and concise**

By using simple language, one enforces accurate thinking. Consistently ask oneself whether a sentence can be shortened, simplified or deleted. Every word should serve a purpose. If not, it should be removed. Excess words divert the reader’s attention and hinder his learning process. Page limits also call for one to make the best of available space.

**Rule 7: Use of Specific and Concrete Language**

Concrete language helps actively engage the reader by raising specific questions in his mind. This benefits in the reader’s learning process. He learns as he seeks answers to the questions raised.

Specific language clearly points out essential details to the reader. It makes it easier for the reader to comprehend broader implications of the issue at hand. It ensures that the reader firmly grasps and understands core ideas of the paper. Avoid using vague qualifiers such as “quite”, “rather” and “several”. Instead, use specific quantitative information that strongly substantiates one’s case.

**Rule 8: Checking the flow of your Scientific Paper**

After writing your paper, give it a read-through to check that it has a good flow in the writing, reading smoothly from one sentence to the next, and from one paragraph to the next. There should be a good sequence of ideas. Transitional words make relationships between successive sentences clearer.

Some common transitional words:
- However / Nevertheless / In contrast / Conversely / Notwithstanding
- Therefore / Thus / Hence / Consequently / As a result / Accordingly
- Additionally / In addition / Also / Furthermore / Moreover
Choosing the Right Journal

The research paper should be targeted to be written for a highly rated (by university involved) Tier 1 or Tier 2 internationally refereed journal of outstanding repute, with a high impact factor to gain maximal impact from the paper published. Each university has its own rankings of journals. It is wise to closely follow the University’s order.

Consideration must also be made whether the work should be directed to a journal publishing General Orthopaedics and if the research embarked upon follows this theme.

One must aim high and approach the highest tier journal one estimates one’s work could potentially be accepted. In the event the paper is rejected, the reviewer’s comments can be studied and the writing re-directed to the next appropriate journal.

The aim is to get the paper published in an internationally refereed highly tiered journal. It is only when this fails that one could think of sending one’s article to a regional or locally refereed journal.

Authorship and Copyright

All investigators concerned must meticulously read and comprehend the “Instructions to Authors” provided for by the journal chosen.

The authorship has to determine on the main author and co-authors as well as the order in which co-authors are to be listed in the article. This is dependent on the amount each co-author has contributed to the research process. This ensures that all who have contributed to the research and writing process are duly recognised.

The “Letter of Transmittal” has to be signed by all authors and sent to the editor of the chosen journal.2
The typical structure of a research article is as follows:

- Abstract
- Introduction
- Experimental Section
- Results
- Discussion
- Conclusions
- Acknowledgements
- References

With that in mind, each of the individual components of the research article will be addressed separately.

**Title**

There are a few points that must be captured within the title of the article:

- Subject matter
- Research results
- Authorship and the order in which it is represented

The title should be specific in describing the contents of the paper, but not too technical that only experts would understand.

**The Abstract**

The abstract appears right at the beginning of the research paper, and provides a brief overview of one's study. It is typically about 200 to 350 words. The abstract can be structured or non-structured. A structured has sub-headings which summarizes and accurately reflects the:

- Introduction
- Specific Objectives
- Clinical Significance
- Methodology
- Results
- Conclusions of one's study

Where the journal does not require a structured abstract, it is still wise to write the abstract along these lines, with one paragraph for each item.

The abstract is pivotal in determining reviewer and reader interest in subsequent parts of the article. To write a good abstract, one should:

- Keep the abstract short and effective
- Exercise creativity in writing the abstract- this helps generate reader interest.
- Not include abbreviations, footnotes or citations in the abstract
The Introduction

The introduction typically consists 2 to 4 paragraphs, (about 250 words, compromising 20% of total length of study, not exceeding one A4 page) which:

• provide a general background of the study
• discuss previous work that has been done in the area of study
• describe the problem one is addressing in the paper
• elaborate on one's contributions to the area of research
• raise new issues that are going to be addressed
• justifies research relevance
• Examples can be used to illustrate points

Experimental Section

The experimental section should elaborate on the materials and methods one has used to arrive at the research results.

This includes:

• experimental design
• statistical methods used to analyse data

Details of materials or instruments used

• names and locations of companies that have supplied various equipment and instruments for conducting one’s research. This enables other investigators to reproduce the experiments.
• Relevant ethical considerations
• Preliminary results of experiments conducted prior to the main experiment, if it helps to explain the main procedure.

Results of one’s experiments should not be included at this point.

Results

In this segment, one should record in detail, the results attained through the course of one’s experimental research. The order in which the results are presented should follow the discussion themes, rather than the order which they were attained through the experimentation process.3

Well-constructed and organised tables and graphs provide useful pictorial representations of the results attained and provide a good and lasting impact. Pictures and graphs should not be used excessively, and should be limited to about 3 figures or tables. Main findings should still be provided in the main text, in addition to the graphs and diagrams used.
One should also objectively compare and contrast one’s results with the results of similar experiments conducted by others previously.

Discussion

The discussion section should aim to fulfill four main functions:

• **Answer the research questions and objectives previously put forth in the introduction section.**

  The discussion highlights the most significant results obtained during the research process. One should attempt to explain how the results obtained answers the research question at the beginning of the paper. This should be done in reference to key data in figures and tables to remind the reader how answers were drawn from data.

• **Take into account the strengths and limitations of the present research study.**

• **Consider whether the data obtained is consistent with one’s hypothesis, and with what other investigators have reported in previous studies.**

  If one’s results do not cohere with one’s hypothesis, one can then attempt to explain why this may be so. One should also address how one’s results fit in with findings already established, and whether any further research is necessary to address questions raised by one’s results.

• **Conclude with a clear statement of the clinical implications and potential applications that may result from one’s research.**

If one’s research has lead to new and promising results,

The discussion should clearly and completely state how important this original work is in contributing to the pool of existing knowledge.

If one’s research does not lead to any novel results,

It is still useful to publish negative results so that others are informed of the study. A good review of literature must also be performed.

One should focus on explaining how one’s present work is different from that published by other research workers. Relevant points to be discussed include:

• a bigger cohort size

• a better methodology.

• the use of animals higher up on the evolutionary scale
• more accurate experimentation equipment
• more data collected
• stronger evidence in support of the conclusions reached

A good literature review must include articles from Tier 1 or Tier 2 refereed journals, and work from prevalent institutions and well-known research workers. Randomised control studies are meta-analyses and should be preferred to case studies and case reports. References should also include the latest and most important contributions. The review of literature should include the latest and most important contributions, and references cited should be comprehensive.

It is also important to include one or two references from the same journal the article is being sent to. The number of references to be appended depends on the type of journal it is being sent to. British Journals usually prefer less than 10 good references, while a more extensive list of references is normally published in articles appearing in American journals.

The discussion is important in determining the success of a research paper:

• The discussion should have good depth, to support the case in point.
• There should be a coherent structure, with flow and order.
• It should include a good and extensive literature review.

Conclusion

The conclusion should aim to answer the question that is being asked in the introduction. It should include:

• Significant results of the study
• Clinical significance of the study
• Possible future applications of this work

Acknowledgement

It is important to thank all who have contributed in one way or another throughout the process of one’s research. Failing to give credit to others can be detrimental to one’s paper, as it amounts to plagiarism.

References

There are two main systems used for scientific research papers- the Vancouver system and the Harvard system.

Vancouver System

References are numbered according to the chronological order in which they are quoted in the text. Numbers must appear in correct sequence throughout the text. References present in tables or figures should be cited, and included in the reference list in the correct numerical order.

References cited in the text should either be numbered within square brackets or as superscript numbers. If the number appears at the end of the sentence, it should appear within the punctuation. The same reference should also be assigned only one text number throughout the research article.

Example: Nather [1, 3] demonstrated that...

It was demonstrated that1,3...
Within each reference, the various components such as author name, journal title, and date should be recorded in a consistent way.

**Harvard System**

If there is only one author to be cited,

- Mention the last name of the author in one’s sentence, followed by bracketing the year in which the source was written.

**Example:** Nather demonstrated that... (2000)

- Alternatively, one could bracket both the last name of the author and the year in which the source was written at the end of the sentence

**Example:** It was shown that.... (Nather, 2000)

- If the same author and year date is cited from different sources, use a, b and c in the research paper to distinguish the different sources

**Example:** (Nather 2000a, b)

For two authors,

- Mention both author’s names in one’s sentence, before bracketing the year in which the source according to the last name of the authors

**Example:** Nather and Wong showed that... (2013)

- Brackets the last names of both authors and the year which the source was written at the end of the sentence

**Example:** It was established that... (Nather & Wong, 2013)

If there are three or more authors,

- Mention the last name of the first author, followed by et al.

**Example:** Nather et al showed that...

If the author is unknown,

- The name of the journal and the date it was published should be used. Example: There was clear evidence that... (Lancet, 1998). In this case, the source should be listed under “L” in the references section.

At the end of each chapter, or at the end of the book, a “References” list should be inserted. The list should not be numbered, but should be ordered in alphabetical order according to the last names of the authors.

For references starting with the same surname and initials, single-author works should be listed first, followed by two-author works, and finally multiple-author works. Within each reference, components such as authors’ surnames, initials, journal articles and titles should be recorded in a consistent manner. For multiple author and two author works, names of authors should be listed alphabetically.\(^6\)
In order to write an effective research paper with a lasting impact on its audience, one's research paper has to go through numerous rounds of editing. The main purpose of editing is to:

- Improve the standard of the paper, by editing to ensure the work is written in the best and clearest way possible.
- Delete unnecessary words in the original manuscript and trim tables, figures and legends. The original manuscript, perhaps 10 to 15 pages, may be shortened to a final acceptable size of not more than 6 to 8 pages through editing.

Editing is often a long and tedious process. Tips to ease the editing process include:

- Aside from editing one's own paper, the primary author should also ask all co-authors to edit the paper before arriving at the final manuscript. Use the “Put on the shelf” technique.

After writing several drafts of the same research article, one would inevitably be exhausted. The primary author should put aside the finished product for a week and go for a break. After about 2 weeks, one can then re-visit the finished product. The author will be surprised that he now sees the same product with new sight or with fresh lenses. Mistakes previously gone unnoticed may now appear. This eventually leads to a better end-product.

References


Dr Diarmuid Murphy completed his medical training at the Royal College of Surgeons in Ireland in 1992. He subsequently served as a Demonstrator of Anatomy in RCSI. He completed his basic Surgical Training and Advanced Surgical Training in Orthopaedic Surgery in Ireland and was Chairperson of the Irish Orthopaedic Trainees association (IOTA) from Year 2005 to Year 2007 and represented them on the Federation of Orthopaedic Trainees in Europe.

Dr Murphy joined the Department of Orthopaedics at NUH as an Associate Consultant with a primary interest in the management of complex intra-articular fractures and their sequelae, including deformity correction, bone loss and infection. He also performs fixation surgery for pelvic and acetabular fractures and fragility fractures as well as hip and knee arthroplasty.

While Dr Murphy is a member of the local faculty for the annual postgraduate orthopaedic course, held in NUH, and has organised, or has been a member of faculty, for numerous training courses, attended by both local and regional orthopaedic trainees. He also teaches at the operating theatre, nurses postgraduate training course as their in-service training sessions as well as regularly being invited to speak at regional training courses.

Dr Murphy brings passion and zeal to all his endeavours but is very humbled to have been chosen by the postgraduate trainees for such a prestigious award.
RESEARCH AWARDS
Eliminating Tumor Cells from the Cell Saver in Metastatic Spine Tumor Surgery Using a Leucocyte Depletion Filter: Dispelling an Old Myth

Naresh Kumar, Y. Chen, Q. Ahmed, V. Lee, R.W.M. Lam, H.K. Wong

Background
Catastrophic bleeding is a significant problem in metastatic spine tumor surgery (MSTS). However, cell savers (CS) have traditionally been avoided in tumor surgery because of the theoretical concern of promoting tumor dissemination by re-infusing tumor cells into the circulation. Although CS has been extensively investigated in patients undergoing surgery for gynaecological, lung, urological, gastrointestinal, and hepatobiliary cancers, to date, there is no prior report of the use of CS in MSTS.

Hypothesis
Our hypothesis is that LDF can eliminate tumor cells from blood salvaged during metastatic spine tumor surgery.

Materials and Method
After Institutional Review Board (IRB) approval, 15 consecutive patients with metastatic spinal tumors from a known epithelial primary (defined as originating from breast, prostate, thyroid, renal, colorectal, lung, nasopharyngeal, hepatocellular) who were scheduled for MSTS were recruited with informed consent. During surgery, a CS device (Dideco, Sorin Group, Italy) was used to collect shed blood from the operative field. Salvaged blood was then passed through a leucocyte depletion filter (RS1VAE, Pall Corporation, Portsmouth, UK). 15-ml specimens of blood were taken from each of three consecutive stages:

(i) from the operative field prior to cell saver processing (Stage A);
(ii) from the transfusion bag post-cell saver processing (Stage B);
(iii) from the filtered blood after passage through LDF (Stage C)

Cell blocks were prepared by the pathology department using a standardized laboratory protocol. From each cell block, 1 haematoxylin and eosin (H&E) slide, and 3 slides each labeled with one of the following monoclonal mouse cytokeratin antibodies AE1/3, MNF 116 and CAM 5.2 were prepared. The cytokeratin antibodies are highly sensitive and specific markers to identify tumor cells of epithelial origin. These slides were read by one of two consultant pathologists who was provided full access to information on the histology of the primary tumor and operative notes, but was blinded to the actual stages from which the slides were derived.

Results
1 case was excluded when final diagnosis was revised to infection instead of metastatic spine tumor. Of the remaining cases, 5/14 tested positive for tumour in Stage A, 1/14 positive in Stage B. No specimen tested positive for tumour in Stage C. In 5 cases, posterior instrumentation without tumour manipulation was performed.

Conclusion
In this first-ever report of cell saver use in spine tumor surgery, we prove that:

(i) Leucocyte-depletion filters (LDF) can effectively eliminate tumor cells from blood salvaged during MSTS.
(ii) It is now possible to conduct a clinical trial to evaluate CS-LDF use in MSTS.

Our results are consistent with published results of similar studies performed on CS and LDF use outside the field of spine and orthopaedic surgery.

Pinal metastases originate from a myriad of primary cancers across various organ systems. If LDF can remove tumor cells from blood salvaged during surgery for spinal metastasis of different histological origin, then the finding can likely be extrapolated to several other fields of surgery where cell salvage and LDF have also not yet been attempted such as in neurosurgery, otolaryngology and even general musculoskeletal oncology.
Injectable cultured Bone Marrow derived Mesenchymal Stem Cells in Varus knees with cartilage defects undergoing High Tibial Osteotomy: A prospective, randomized controlled clinical trial with 2 years follow up.

Wong Keng Lin Francis, Lee K. B. L. Bee C. T. , Law P. , Hui. J.

Objectives
To analyze the results of the use of intra-articular cultured autologous bone marrow–derived mesenchymal stem cells (MSC) injections in conjunction with microfracture and medial opening-wedge High Tibial Osteotomy (HTO).

Materials and Method
Fifty-six knees of 56 patients with uni-compartmental osteoarthritic knees and genu varum were randomly allocated to the cell recipient group (n=28), or control group (n=28). Patients who have joint line congruity angle of more than 2°, mal-alignment of knee secondary to femoral causes, fixed flexion deformity and age >55 years were excluded. All patients underwent HTO and microfracture. The cell recipient group received intra-articular injection of cultured MSC with hyaluronic acid (HA) 3 weeks after surgery, whereas the control group only received HA. The primary outcome measure was International Knee Documentation Committee (IKDC) scoring at intervals of 6 months, 1-year and 2-years post-operatively. Secondary outcome measures were Tegner and Lysholm clinical scores and 1-year post-operative Magnetic Resonance Observation of Cartilage Repair Tissue (MOCART) scores.

Results
Both treatment arms achieved improvements in Tegner, Lysholm and IKDC scores. After adjusting for age, baseline scores and time of evaluation, the cell recipient group demonstrated significantly better scores. Effect of treatment shows an added improvement of 7.65(95% CI:3.04-12.26,p=0.001) for IKDC scores, 7.61(95% CI:1.44-13.79,p=0.016) for Lysholm scores, and 0.64(95% CI:0.10-1.19,p=0.021) for Tegner scores. MRI scans performed 1-year after surgical intervention shows significantly better MOCART scores for the cell recipient group. The-adjusted mean difference in MOCART score was 19.6(95% CI:10.5-28.6,p <0.001).

Conclusion
Intra-articular injection of cultured MSCs provide short-term clinical and better MOCART scores in varus knees with cartilage defects undergoing HTO and microfracture.
Hydrosurgery System for Debridement of Diabetic Foot Wounds - A Pilot Study by NUH Diabetic Foot Team

_Hong Choon Chiet Andrew, A. Nather, Kee X L, J, HT Mao_

**Introduction**

Diabetic foot wounds are serious complications of the diabetes mellitus. Surgical debridement is a very important part of the management of diabetic wounds. Sharp debridement using the scalpel is normally performed. Versajet II Hydrosurgery System is an alternative technique for debridement. To our knowledge, this is the first study conducted to evaluate the use of hydrosurgery debridement for diabetic foot wounds.

**Methodology**

This pilot study included 15 consecutive patients with diabetic foot wounds admitted to our NUH Diabetic Foot Team from June to December 2012. All wounds underwent hydrosurgery debridement. Patients' demographic details, clinical details on wound assessments, and outcome were recorded and analyzed.

**Results**

Versajet was found to show some advantages over standard surgical scalpel debridement. It allowed adequate debridement whilst preserving more viable tissue to promote rapid healing. It could be maneuvered over complex wound terrain. The time required for debridement was short - average of 9.5 minutes. Good wound healing was achieved in all 15 cases. Only 1 Versajet debridement was required in 13 cases and 2 required 2 debridements. 12 wounds healed by split thickness skin grafting (STSG) and 3 wounds by secondary healing. Two STSG became infected and were treated with dressings and healed.

**Conclusion**

Although good wound healing was achieved in all cases, a more detailed study is required using a randomized controlled trial to evaluate the effectiveness of Versajet II Hydrosurgery system.
A modified three dimensional polyelectrolyte scaffold for cartilage tissue engineering.


Background

Stem cell based approaches for cartilage tissue engineering offer an attractive alternate to repair cartilage defects, owing to the poor regenerative capacity of avascular cartilage. Though a mature vista of tissue engineering, the quality of clinical repair achieved through existing approaches remains suboptimal. Recent insights from tissue engineering paradigm underscore the need for cells to interact and remodel their extracellular matrix (ECM) for optimal tissue regeneration. Providing an instructive, permissive three-dimensional (3D) matrix for cartilage regeneration is critical.

Materials & Methods

To this end, a chitin-alginate based 3D scaffold was developed through interfacial polyelectrolyte complexation (IPC), for encapsulation and chondrogenic differentiation of human bone marrow derived mesenchymal stem cells (MSC). An IPC based approach was employed for fabricating instructive matrices as it offered great control in varying ECM cues within the 3D niche of encapsulated cells. MSC were encapsulated in IPC scaffolds with and without type I collagen (Col-I) incorporation, to study the effects of Col-I on MSC chondrogenesis. Chondrogenic differentiation was analysed by qualitative histochemical staining and quantitative measurement of the components of cartilaginous ECM formation.

Results

Our results show that Col-I incorporation promoted superior chondrogenic differentiation of MSC. It also caused significant changes in cell morphology and cell-cell interactions as observed by F-actin and N-cadherin staining.

Conclusion

Thus IPC based scaffolds offer an attractive platform to study the effect of various ECM cues on MSC chondrogenesis, pertaining to the functional tissue outcome. Such knowledge would be crucial in tailoring optimal matrix properties for cartilage regeneration.
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Famous for The Beatles, Anfield LFC where ‘You’ll Never Walk Alone’ and the European Capital of Culture 2008…

It was the summer of August 2012 when my wife, daughter, son and I set soil together as a family in the UK, arriving at Manchester and travelling to our destination in Liverpool for what was to be our home till the next summer.

My wife and I had already made a preliminary trip in June to check out our area of relocation and school for the children. It was a fairly smooth transition as my fellowship mentor, Mr Durai Nayagam, had simply recommended his area of residence for us to call home. Crosby, a coastal town north of Liverpool city, was made popular by British sculptor Antony Gormley's Another Place, an art installation of numerous cast iron figure replicas of himself, spread over a 2 mile stretch of beach.

The Royal Liverpool Children’s Hospital, also well known locally as Alder Hey Hospital, was where I would spend all of my time during my Paediatric Orthopaedic Fellowship. The drive from Crosby would take me about half an hour on a good clear day.
Compared to our modern day hospitals, Alder Hey was a very traditional brown brick English hospital of only 3 storeys but with paediatric services of numerous disciplines including orthopaedic surgery with a very large regional catchment covering Merseyside and the north-west region of England. The paediatric orthopaedic services were provided by a total of 9 consultant orthopaedic surgeons as follows:

1. Upper and Lower Limb Reconstruction (Durai Nayagam, Leroy James)
2. Pelvic and Hip Reconstruction (Colin Bruce, Neeraj Garg)
3. Cerebral palsy / Neuromuscular with Gait Laboratory (Alf Bass, David Wright)
4. Spine (Neil Davidson, Jay Trivedi)
5. Sports (Nick Barton-Hanson)

My fellowship in limb reconstruction first began with the attendance of a 3 day course in Hull, east of England, where I learnt about the principles of lower limb deformity correction. It was almost similar to learning a different language, where the terms MAD (mechanical axis deviation), CORA (centre of rotation and angulation) and ACA (axis of correction of angulation) came into my vocabulary.

The limb reconstruction service at Alder Hey hospital was established about 15 years ago. Under the very experienced leadership of Durai Nayagam and Leroy James, important members of the team included the specialist nurse clinicians (Alison Lee and Rose Davies) and physiotherapists (Dave McWilliam and Sharon Atherton).

I encountered a large spectrum of both congenital and acquired limb deformity and deficiency conditions, ranging from the upper to lower limbs. A few of the conditions could undergo acute correction but many complex deformities and deficiencies required gradual correction with an external fixator or frame. I learnt that patient selection was very important as external fixator treatment required the participation and co-operation of both the child and family. Likewise, support from members of the team to the child and family was equally important for a successful collaboration and good outcome. The pre-operative preparation included a visit to the ward and engaging other children and families undergoing similar treatment. The post-operative external fixator treatment process was often labour intensive with weekly outpatient visits for pinsite dressings, monitoring of the correction process and physiotherapy including pool hydrotherapy. The external fixator treatment would on average last about 6 months. In certain cases, substitute internal fixation devices could be used to shorten the time spent in the external fixator, such as during the consolidation phase of the regenerate column in limb lengthening.
The management of patients with neuromuscular disorders and cerebral palsy was likewise a multi-disciplinary team approach. With the service headed by Alf Bass and David Wright, patients who were ambulatory would be assessed thoroughly by the physiotherapists and undergo instrumented gait analysis for objective evaluation both pre and post operatively. Certain patients with foot disorders were able to undergo pedobarography. Functional assessment scores were also used for clinical evaluation. The gait laboratory was well managed by Gill Holmes with support of the medical technologist engineer Daniele Trinca. The concept of single event multi-level surgery (SEMLS) was widely practised for this group of patients requiring bilateral lower limb soft tissue releases and corrective osteotomies for joint realignment to reduce the number of hospital admissions.
I also gained invaluable experience from the hip service, led by Colin Bruce. There were a large number of patients with developmental dysplasia of the hip ranging from the neonate to adolescent age. Common procedures were the Salter and Pemberton osteotomies of the pelvis for the younger child. In the adolescent group, if the hip joint was incongruent, a shelf osteotomy would be performed. In a congruent hip joint, a redirectional peri-acetabular osteotomy, as described by Ganz, was the best option to preserve integrity of the pelvic ring. This was certainly one of the surgical procedures that attracted a large crowd of keen registrars and fellows.

In hip conditions resulting in severe avascular necrosis of the femoral head, such as the unstable high grade slipped upper femoral epiphysis, short of a femoral head replacement, the pelvic support osteotomy appeared to improve the Trendelenburg gait of these patients.
Avascular necrosis of the femoral head from slipped capital femoral epiphysis treated with a pelvic support osteotomy in an adolescent patient

The vast surgical spectrum for the management of different paediatric orthopaedic conditions was indeed an eye-opener and invaluable learning experience. In the midst of acquiring such a wealth of orthopaedic knowledge, the opportunity to travel to neighbouring Europe and Scandinavia added greater value to the time spent there with my family. It was also during my time in Liverpool that my mentor, Durai, truly became an inspirational teacher and friend to me. I am certainly looking forward to return one day when the new hospital Alder Hey in the Park opens in 2015…
My Fellowship Experience

A short invaluable year

Dr. Bryan Tan Hsi Ming

Division of Shoulder and Elbow Surgery

I had cleared the FRCS Orthopaedic examinations in May 2010. I was jubilant that I had also been accepted into the Shoulder and Elbow Division headed by Professor Kumar. The following 2 years was an exciting time of intense learning. I was in no hurry to go for fellowship. Prof Kumar is the most generous and supportive Divisional Head anyone could ask for. He even allowed me to share his operative list where I could independently list and do cases. Yet, whenever I had a case which I was not confident about, he would stay and take me through it.

Meanwhile the scramble was on to find a suitable centre for my fellowship. This turned out to be a convoluted and difficult task. I had been reassured by a consultant from another hospital (under whom I had worked as a registrar previously) that he maintained close contact with a prominent shoulder surgeon and that getting a fellowship position under him would have been a breeze. However after months of badgering, I was finally told that this prominent surgeon was in semi-retirement and was not taking fellows. Out of desperation, I sent emails to prominent authors of papers we presented during our divisional journal clubs and approached the instructor (Dr Simon Tan from St Vincent's Hospital, Sydney) of a cadaveric course, which I had attended, requesting a fellowship. To my surprise, Professor Pascal Boileau from Nice, France responded to my email and was agreeable to take me as a fellow! At the same time, Dr Simon Tan had also agreed to take me! Things were finally falling into place. Thus began the long and arduous process of applying for a visa. My predecessors had warned me that the process could be a long one and my case proved to be no different. It was to be over a year of making multiple trips to the French embassy, getting stacks of documents signed and resigned by a notary public, countless emails and multiple couriered document packages sent and resent before I finally got the requisite visas. In fact, I had to fly to Sydney on a tourist visa to start my fellowship first while I made frequent trips down to the Australian Health Practitioners Registration Agency in downtown Sydney when I finally met a helpful administrator who probably took pity on me and personally expedited the process.

On 18th March 2012, filled with trepidation and dragging a heavy luggage filled with my belongings, I boarded a plane bound for Sydney. Most newly qualified surgeons in my position are married and go on fellowship with their spouses (and kids for some) in tow. I know this adds a whole new dimension of complexity to the preparation, but it is also extremely comforting to know that even if you are in a foreign place, you have familiar faces with you. In my case, I only had my trusty Macbook and a couple of acquaintances with me in Sydney.

I had booked a vacation home for 3 weeks with the intention of hunting for a more permanent place to rent when I got there, because all I had was a visitors’ visa which made it impossible to rent a place via a housing agent. The vacation home I rented was not bad at all. But it also cost almost SGD$3,000 for a short 3 week stay (The Australian dollar was a lot more robust at that time). The same day I got to Sydney, I was pleased to find a Woolworths supermarket just round the corner. I was rather enthusiastic about cooking then and was keen to prepare myself a quick dinner before getting some much-needed sleep. I had been warned that if the fire alarm was activated, I had 5 minutes to clear the smoke before the system alerted the fire department and dispatched a fire engine to the location. That fateful evening, I was happily cooking myself a pot of ‘lup cheong fan’ on the stove top. The gentle clouds of steam...
emanating from the pot carried a delicious aroma and I could not wait to dig in. Suddenly there was a god-awful shriek coming from the ceiling. The fire alarm had gone off! I sprang into action as quickly as an anaesthetist would respond to a code blue. I threw open all the windows and doors, dragged a chair under the fire alarm, grabbed a pillow from the couch and perched on the chair frantically fanning away at the fire alarm trying to dissipate the smoke like a parakeet flapping its clipped wings. Soon I heard sirens outside the apartment block and I knew it was too late. Hanging my head in shame, I trailed out of my apartment to meet the firemen who were clumping up the stairs in their heavy boots. Every single apartment door I could see was open and their irate inhabitants were standing outside their apartments hoping to see who the culprit was. Three huge firemen appeared and unhappily I lead them to my apartment. Expecting them to thump me over the head, they glanced somewhere above my unit door and said, “It’s not you mate. You’re alright.” They then looked further down the corridor and spotted a small red light situated directly above the door of another unit and proceeded to thump on that door to check on, chide and fine the errant resident. Meanwhile I slinked, red-faced but relieved back into my apartment.

Eventually things started becoming more regular. I had finally managed to find a suitable apartment to rent. It was perfect for its proximity to St Vincent’s Hospital where I did my fellowship, but was pretty much infested with cockroaches due to its previous inhabitants who seemed to have a shocking lack of hygiene. After cleaning the apartment a few times over and fumigating it with a D.I.Y. insecticide, it turned out to be rather pleasant.

Meanwhile, work had commenced. My 2 mentors in Sydney were Dr Simon Tan and Dr Warren Kuo. Both were high volume Sports surgeons whose cases comprised approximately 70% shoulder work and 30% Sports cases including knee ligament reconstructions, meniscal work etc. I spent most days in the operating theatres alternating between St Vincent’s Hospital, St Luke’s Hospital and Nepean Hospital. This experience was an eye opener. I was surprised that on days when we only had a single theatre running, we could comfortably get through 7 cases and still be sure that we get out of theatre in time for Simon to attend his basketball training or spend quality time with his family. On days when we had 2 operating theatres running, we could get through up to 13 cases. Simon and Warren were slick surgeons who made complex cases look childishly simple. Turn over between cases proceeded at breakneck speed. Everybody worked together to ensure delay between cases was minimized. When the attendant was busy, Simon would even be swilling the theatre floor with a pail of water and mop. There was a strong sense of camaraderie in the theatre and Simon and Warren, though highly skilled and successful,
were always kind, polite and approachable. Even when things went wrong in the theatre, never once did they ever lose passed their cool. The system seemed to be well oiled and ran efficiently. Patients who required blocks had the blocks administered in the induction area. This was not a room per se but rather simply a large area where patients were separated by curtains. Each operating room was run by a single anaesthetist. Often while a preceding surgery was nearing its end, the anaesthetist would leave simple intra-operative monitoring to his highly trained and experienced anaesthetic nurse while he leaves to administer the block for the next patient. He would return as the surgical procedure was completed to ensure the patient was well and stable. The patient would then be transferred, while still under anaesthesia to the recovery area where he could be extubated. This drastically cut down the waiting time in-between cases.

I was exposed to a multitude of cases. These ranged from Sports conditions afflicting the knee, shoulder and elbow joints to arthroplasties of the shoulder joint. The misconception I had prior to visiting Australia for my fellowship was that Australians were not keen on hard work and were only concerned about chilling out at the bar. It did not take long for me to realize how ignorant I had been. Simon and Warren valued their work-life balance, but that certainly did not imply that they were lazy. Through some of our conversations, I found out that Simon got out of bed every day at 5am. He would spend an hour working out in his home gym, prepare his lunch (which invariably consisted of a simple bun with some lettuce, cheese and a single slice of ham) and get to office by 6.45am. He would be working constantly throughout the day, either zipping in between cases in the operating theatre or seeing patients in the clinics and having a quick 15 min lunch in-between patients while looking through his emails and calling patients who needed updating. But his work would end at latest by 6pm every day. Evening and weekends were strictly reserved for social activities, sports or family.

In a flash and before I knew it, my time in Sydney was up. It was a bittersweet time for me as I had met a very special girl during my fellowship and knowing that we would soon be separated by thousands of miles was rather sad. But life is such (and there is always Facetime!). After returning to Singapore for a short 2 weeks, I was again on an airplane, this time bound for France.
My mentor in Nice was Professor Pascal Boileau who practiced at L’Archet 2 Hospital, Nice, France. This was a huge privilege as Prof Boileau is one of the biggest names in the world of Shoulder surgery. I was rather apprehensive as I had no idea how nice or nasty Prof Boileau was. In addition, although I had taken 6 months worth of French language lessons prior to this fellowship, I found out that I had zero aptitude for language and my smattering of bad French was to be of minimal use. A friend of mine also deemed fit to add to my anxiety by telling me that “the problem with France is there are too many French”!

Once again, my fears turned out to be unfounded. Prof Boileau was gracious and accommodating. He spoke excellent English and was always open to discussion even when I politely questioned some of his surgical procedures. He never took alternate views as a personal affront (as some clinicians have a habit to do), but was always able to counter those views with evidence. He was also honest, open and certainly did not see himself as a shoulder expert who could do no wrong. When faced with
questions to which he had no good answer, he would openly admit that he did not know. In fact, he even presented data from a multicenter trial in which he was involved in previously and acknowledged that results showed his outcome being the poorest because of a mistake in principle which had been made previously. This prompted him to change his practice and drastically improve his own results. This only made me respect him even more because it showed me that despite his prominence, he had not been corrupted by his fame and power and was still seeking knowledge and chasing better results.

Prof Boileau was a machine. We spent 2 and a half days in the operating theatre every week. He would run 2 operating lists concurrently each time and he would go through 10 cases each day. His work consisted of mainly shoulder cases and on some days, he would do 4 to 5 shoulder arthroplasty cases. It was not uncommon to see 3 primary total or reverse shoulders and 2 revision reverse shoulders in a day. He often said a reverse shoulder arthroplasty should be a 45 minute procedure, and indeed in his hands, it often was. On clinic days, he would see approximately 40 to 45 patients in a day. Although we would scoff at these numbers (we easily see 60 to 70 patients in a day in NUH), I soon found out why his number of consults in a day was relatively low. He saw and examined each and every patient personally. It did not matter whether it was a private or subsidized patient, or whether the patient was a rich sheikh or a slum dweller. He often told his fellows and MOs that we must always treat our patients well because patients were our best teachers. Work every day ended at 7.30 to 8.30 pm. L'Archet 2 Hospital was perched atop a small hill, which was served by a single bus service. The bus service ended at 9pm and I often found myself having to trudge down the hill when work ended late.

L'Archet Hospital was a far cry from our spanking new facilities at NUH. The hospital was run down and old. X-rays were still printed out on films and the computers were capricious and unreliable. Toilets flooded ever so often. Even the toilet roll holder was broken, but my Asian ingenuity kicked in and I fixed it with the handle of a used suture anchor applicator. But L'Archet Hospital was proof that world-class facilities were not a prerequisite for world-class work. The quality of work churned out by Prof Boileau and his (overworked) team was certainly world-class. It was 3 months of fast and furious learning. I saw cases I never would have seen here in Singapore. My stint in Nice completely changed the way I approached shoulder pathology.

My short fellowship abroad was a life changing invaluable experience. It is a unique privilege and I am most grateful to Prof Wong, Prof Kumar and Chyn Hong for giving me the opportunity to take a whole year off for this fellowship. But although many would ask, “Where did you do your fellowship?” as a credential to prove yourself as a worthy specialist/doctor, I feel my fellowship began in May 2010 when I joined the Shoulder and Elbow service under Prof Kumar. Which other Professor and senior consultant would patiently hold a retractor for his trainees to operate while he watches like a hawk, or point out cute female medical officers to his then single associate consultant in a failed bid to get him hitched, or lead by example by unfailingly being early for every single morning teaching session or pay from his own pocket for his more impoverished patients?

My real fellowship began in May 2010 and is still in progress.
REPORT BY
UOHC CLINICAL FELLows
Hip and Knee Surgery Fellowship

**Fellow** : Dr Siddharth Shah  
**Supervisor** : Professor Sharmal Das De  
**Period** : March 2012 - September 2012

“I received the necessary exposure and training in the subspecialty and I am quite confident of pursuing it as a career in my country. My knowledge and skills in the subspecialty have improved manifold.”

“Time spent in the operating theatres, outpatient clinics and the wards was appropriately distributed.”

“Excellent teacher, excellent clinician, excellent knowledge of the subject. Prof Das De possesses several qualities which I wish to imbibe.”

**Supervisor** : Associate Professor Wilson Wang  
**Period** : September 2012 - March 2013

“There was clinical exposure to a variety of cases.”

“I received supervision and was able to learn from a highly-skilled and methodical supervisor.”

“I was exposed to the latest technological advances in the subspecialty.”

“Courteous and compassionate supervisor who was also knowledgeable and updated about recent advances in the subspecialty.”

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**Fellow** : Dr Chockalingam Baskar  
**Supervisor** : Professor Sharmal Das De  
**Period** : February 2013 - July 2013

“I feel that it is one of the best places to get trained especially for budding orthopaedic surgeons like me.”

“Prof Das De is an amazing teacher, surgeon and person who helped me a lot.”
Fellow : Dr Cabucana Nixon Javier  
Supervisor : Dr Lingaraj Krishna  
Period : June 2013 - December 2013

"An excellent training program."

"I gained clinical exposure and excellent surgical exposure."

"Dr Lingaraj is an excellent teacher...step-by-step teaching provided during surgical exposure."

"I received excellent supervision in clinics, OT and in doing my research paper."

Fellow : Brahmbhatt Ashishkumar Dinkarrav  
Supervisor : Professor Shamal Das De  
Period : July 2013 - January 2014

"Prof Das De and Prof Premkumar were very good teachers."

"Prof Das De is an excellent teacher and a very good person. I can not only learn about joint replacement from him but also other aspects of orthopaedics."

"Adequate clinical exposure and very good hands-on exposure under direct supervision of Prof Das De."

University Spine Centre

Fellow : Dr Yang Changwei (William Dearstyne Fellow)  
Supervisor : Associate Professor Gabriel Liu  
Period : December 2012 - June 2013

"Prof Liu is very kind and I could observe a variety of spinal surgeries."

"Excellent supervisor...Very experienced in spinal surgery."

Fellow : Dr Deore Tushar Jibhau  
Supervisor : Professor Wong Hee Kit  
Period : March 2013 - September 2013

"It was a really good and specifically-oriented training programme."

"I learnt a lot of new surgical techniques."

"Prof Wong was a mentor with a very good exhibition and teaching of clinical and surgical skills...Deeply involved in the teaching and training of his students."
Sports Medical Fellowship

Fellow : Dr Villarico Alfred Dublan
Supervisor : Professor V P Kumar
Period : July 2012 - January 2013

“Excellent training programme… There was a systematic way of doing things.”

“Prof Kumar explained treatment and management options very well.”

Fellow : Dr Krishna Kumar Ramachandran
Supervisor : Professor V P Kumar
Period : January 2013 - July 2013

“Good combination of theory and practical.”

“Prof Kumar was excellent at verbalising the practical aspects of surgery in a calm and stress-free environment.”

“Constant supervision during every operative procedure.”

Paediatrics Orthopaedics Fellowship

Fellow : Dr Dr Vattipalli Ravi Chandra
Supervisor : Associate Professor James Hui
Period : July 2012 – January 2013

“There were good research opportunities and ample clinical material.”

“A/Prof James Hui was highly academic and very friendly. He was also inspiring and accommodating.”

Fellow : Dr Rosalyn Flores Paraiso
Supervisor : Associate Professor James Hui
Period : January 2013 – July 2013

“Good emphasis on the academic aspect of the specialty.”

“A/Prof James Hui is very approachable…Taught adequately and addressed both clinical knowledge and skills.”
Foot & Ankle Surgery Fellowship

Fellow : Dr Shuvendu Prosad Roy
Supervisor : Dr Tan Ken Jin
Period : February 2012 – July 2012

“I graded this overall assessment of training program good because it provided me with adequate clinical exposure both in clinics and operating theatres which helped me to improve my skills and made me confident. Also, the academic and research programme enriched my career objective.”

“Adequate clinical exposure…Excellent supervisor…I will recommend this training programme to others.”

Supervisor : Professor Shamal Das De
Period : August 2012 – January 2012

“Excellent training programme…Within available infrastructure of the department, I got fair exposure to surgical training and inspiration on academic work from my supervisor. It was a great experience for me to rediscover myself as an orthopaedic surgeon.”

“Adequate time spent on training…Adequate clinical exposure…I would recommend this training programme to others.”

“Excellent supervisor…Prof Das De is an excellent, enlightened person and teacher. For those who want to be a teacher, he should be their idol.”

“Adequate level of supervision…Proactive nature of the supervisor helped me to be more interactive.”

Fellow : Dr Paz Jovito Ramil Ballester
Supervisor : Dr Tan Ken Jin
Period : August 2012 – January 2013

“I had a fair share of Foot & Ankle cases that I have never seen before. These cases will contribute to my Orthopaedic knowledge.”

“Excellent supervisor…Dr Tan was extremely professional in his line of work. He gave me enough time to study on my own and also provided me with the information that I need.”

“Adequate level of supervision…My supervisor guided me in all the things that I did in the hospital. The clinical fellowship training programme was just appropriate for me. I was satisfied with what the programme offered. It has improved my career as an orthopaedic surgeon.”
Fellow : Dr Kushal Nag  
Supervisor : Dr Tan Ken Jin  

“It was a good mix of clinical work, didactic lectures theatrical study.”

“Amount of time spent on training was more than adequate. I was exposed to a wide variety of cases.”

“There was a good balance of exposure to clinics and operations.”

“I could not have asked for a better supervisor. He is one of the top 3 teachers in my life.”

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Diabetic Foot Surgery Fellowship

Fellow : Dr Ruedas Joseph Burt Juanillo  
Supervisor : Associate Professor Aziz Nather  
Period : January 2013 – July 2013

“I found the program excellent since I was exposed to a lot of cases as well as a number of surgical procedures.”

“Prof Aziz is a good teacher…He gives you the freedom to formulate your own treatment plan whilst supporting you every step of the way.”
Our Cluster Retreat
Organised by University Orthopaedics, Hand & Reconstructive Microsurgery Cluster
4 January 2014

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

It was finally time for our annual University Orthopaedics, Hand & Reconstructive Microsurgery Cluster Retreat on 4 January 2014. Staff members ranging from doctors, nurses, researchers to administrators streamed into the familiar NUHS Tower Block Seminar room to begin our day. Headed by Professor Wong Hee Kit, we started off our new year by setting the future direction for the department and discussing challenges that may possibly arise this coming year. Through mass and small-group discussions, we tackled in detail our UOHC Flagship Programmes for the year. Staff members also put our brains together and contributed to our shared vision for the department in hope of yet another good year.

Break-out group discussion sessions on defining UOHC Flagship programmes.
After a morning of brainstorming, we proceeded to recharge at O’Learys Sports Bar & Grill restaurant located at the Singapore Flyer. The scrumptious Boston style lunch recharged us from the first half of the day. Chatter and laughter echoed through the restaurant as we enjoyed our meal. It is indeed true that good food is best relished with good company!

Post-lunch, we marched on to prepare for the main challenge of our day – dragon boating! Staff members were split into four different dragon boats by facilitators from “Dragon Boat Innovate” to compete in a friendly match at the Marina Bay Channel. Everyone rowed hard as each of us gave our best in hope that our boat will emerge victorious.

Ultimately, the boat led by Prof Naresh came out first! At the end of the day, everyone was given a medal for the great sportsmanship displayed during the match. Even though only one boat won the ultimate prize, everyone completed the race and emerged as winners!
What was important was not winning the race but the process of working together in a team to strengthen the camaraderie and bond between fellow colleagues, marking the end of a perfect day!

*Everyone still in high spirits after a tiring but fun and fulfilling day!*
Annual Charity Run
Organised by Residents from University Orthopaedics,
Hand & Reconstructive Microsurgery Cluster
26 November 2013

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

On 26 November 2013, staff members from the University Orthopaedics, Hand & Reconstructive Microsurgery Cluster which included doctors, nurses, radiographers, physiotherapists as well as administrative and research personnel came together as a family for our annual charity run. This time, kudos goes to Dr Kevin Yik and Dr Tan Keng Soon for heading the team behind the success of this event! This charity run has been an annual affair ever since 2012 as it has proven to be successful in bonding staff members over a good cause. During this event, whilst enjoying the time spent with colleagues, many also pledged money towards the effort. As such, the collective effort of both organizers and participants led to its success yet again! We managed to raise a sum of about forty thousand dollars. This will go to the NUH Patient Care Charity Fund which pays for the medical care of needy patients in NUH. Our Chief Executive of NUHS, Professor Benjamin Ong presented a momento to Professor Wong Hee Kit, Chair UOHC for the efforts of UOHC in raising funds for NUH Patient Care Charity Fund. In addition, Professor Ong also presented a prize to Nurse Manager Norazlina of Ward 52 for winning the lucky draw.

Let us continue to strive on with such enthusiasm and care for our patients!
INSTRUCTIONS TO RESIDENTS
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:

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

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

2) 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.

3) Please prepare the abstract using the following structured format:

4) Objective
   a. Methodology
   b. Results
   c. 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


