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MEDICAL NEWS

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FOCUS : ORTHOPAEDIC

- Knee Preservation Osteotomy
- Ankle Instability
- Enhanced Recovery After Surgery for Total Knee Replacement (ERAS TKR)
- Minimally Invasive Spine Surgery

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Knee Preservation Osteotomy

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INTRODUCTION

There is growing concern over the increased prevalence of knee arthritis in the younger population. This could largely be attributed to the more active lifestyles people currently prefer, as well as the rise in popularity of vigorous sporting activities enjoyed by adolescents.

For these patients, the current treatment option is largely limited to arthroplasty, which is costly and has a finite lifespan. Knee preservation osteotomy surgery can be a viable and more cost-effective option for the younger population in dealing with this emerging issue.

Knee osteotomy has gained increasing popularity since the introduction of new techniques and implants in the early 2000s. This knee preservation operation improves function, quality of life, and the rate of return to sporting activities.

PREVALENCE OF KNEE ARTHRITIS IN SINGAPORE

In 2007, the Ministry of Health's (MOH) National Health Surveillance Survey found that about 10% of Singaporean adults aged between 18 and 60 are reported to be suffering from arthritis or chronic joint problems.[1]

Looking to 2020 and beyond, this figure is set to increase significantly due to our active lifestyles and demands.

WHY KNEE PRESERVATION OSTEOTOMY?

In recent years in Europe, South Korea and Japan, there has been a surge in knee preservation osteotomy surgeries utilising improved techniques and implants.

In Singapore General Hospital (SGH), we are adopting and modifying best practices available to suit our local population, in particular:

Techniques

With computer-aided planning, we are able to plan the surgery precisely in terms of the location and amount of correction needed to achieve optimal knee alignment and function.

Better understanding of the philosophy of knee preservation enables us to create stronger and safer constructs, hence allowing patients to recover faster to premorbid status.

Implants

New smaller and stronger implants from Europe enable us to perform the osteotomies in a minimally invasive manner, resulting in less pain and disability postoperatively, and faster recovery.

Benefits

With these vastly improved techniques and implants, patients can expect to:

a. **Stay in the hospital** for **1 to 2 days**

b. **Return to work** within **2 to 3 months**

c. **Return to sports and make a full recovery** within **3 to 6 months**, depending on the extent of preoperative arthritis and amount of correction performed

Other benefits of joint preservation knee surgeries include:

Firstly, the cost of osteotomy surgeries is about **20 to 30% cheaper** than that of arthroplasty with equivalent outcomes. Moreover, arthroplasty has a limited lifespan of about 15 to 20 years, therefore making joint preservation surgeries more cost-effective in the long run.

Secondly, knee osteotomy can **delay or stop the progression of knee arthritis** in the younger population, and allow patients to return to an active and vigorous lifestyle.

Thirdly, **knee arthroplasty in young patients will lead to early revision** due to wear and tear of the prosthetic joint, from higher activity levels and longer life expectancies. If the patient requires further revisions in future, it would be costlier in terms of longer hospital stays and utilising more expensive arthroplasty implants.

THE JOINT PRESERVATION OSTEOTOMY SERVICE IN SGH

Anticipating this increasing prevalence of knee arthritis in the younger population, SGH's Department of Orthopaedic Surgery established the "Joint Preservation Osteotomy Service" in July 2019 to tackle this emerging condition.

Setting up a dedicated joint preservation osteotomy service helps to raise awareness amongst the public and healthcare providers that there is a viable option in tackling an arthritic knee.

Increased Efficiencies

With this service, our surgeons are able to create an efficient perioperative workflow, **thus reducing hospitalisation stays and costs, and enabling patients to regain their premorbid functionality faster.**

This includes standardised preoperative assessments and investigations, and postoperative management and care.

Improved Outcomes

A critical outcome of knee osteotomy is **survivorship,** which is defined as the duration that the osteotomy remains in situ without conversion to knee arthroplasty. Focusing on medial opening high tibia osteotomy, which is a newer technique that SGH currently adopts, studies[2] show that:

a. **At 5 years,** survival range varies from **94 to 99%**

b. **At 10 years,** survival range varies from **84 to 92%**

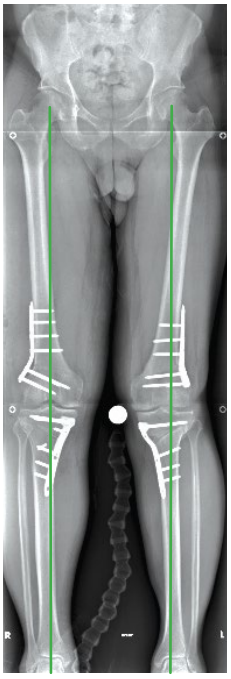
With these promising survival rates, knee osteotomies can substantially improve the outcomes of the knee joint, and ultimately patients' quality of life.

CASE STUDY

To treat his symptomatic arthritic knees, a male patient in his 50s opted for knee preservation osteotomy surgery.

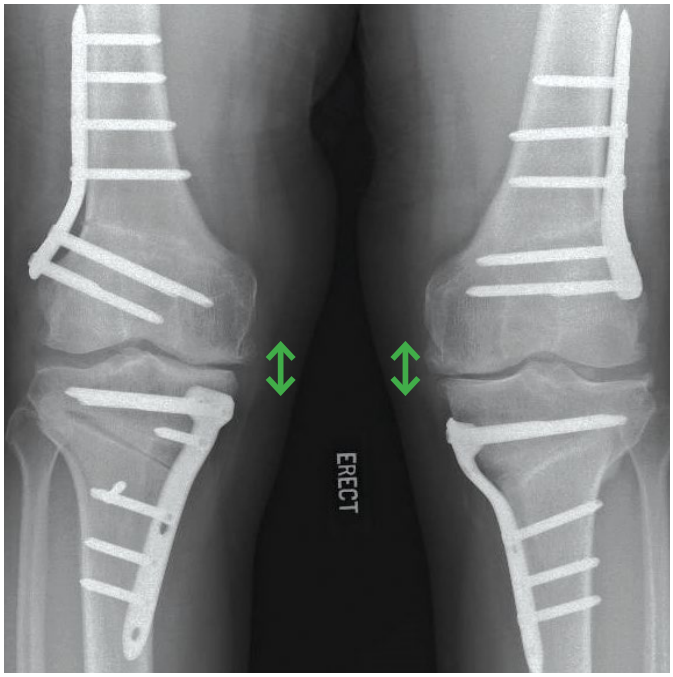
Preoperative

Mechanical axis medial to knee joint, collapsing medial joint space.



Mechanical axis through the healthy lateral compartment.

Postoperative



Medial joint space increased due to shift in weight-bearing axis to lateral compartment.

CONCLUSION

With improved techniques and implants, knee osteotomies represent an excellent surgical joint preservation option for arthritic knees with good long-term survivorship results.

Dr Lee Kong Hwee is a Consultant with the Department of Orthopaedic Surgery at Singapore General Hospital (SGH). He sub-specialises in knee surgeries, with particular interest in knee preservation, such as complex osteotomies and ligament surgeries.

In 2018, he did his HMDP knee preservation fellowship in London with Professor Adrian Wilson, who is a renowned pioneer in knee osteotomy. Under the mentorship of Prof Wilson, Dr Lee learned numerous novel techniques in knee joint preservation, which gives his patients more options in treating their knee conditions.

Medical professionals who would like more information about this procedure, please contact Dr Lee at 9666 2237 or lee.kong.hwee@singhealth.com.sg.

GPs can call for appointments through the GP Referral Hotline at 6326 6060 or scan the QR code for more information about the department.

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Enhanced Recovery After Surgery for Total Knee Replacement (ERAS TKR)

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INTRODUCTION

Total knee replacement (TKR) has proven to be an effective treatment modality for end-stage osteoarthritis, relieving pain and improving patients' functional abilities. With an ageing and increasingly obese population, the number of people with end-stage osteoarthritis requiring TKR is expected to rise. In North America, the number of TKRs performed per annum is expected to increase by 673% in 2030, compared to the 2005 figures (Kurtz et al. 2007).

Locally in Singapore General Hospital, we see an increase of 100 TKRs per annum, with over 2,000 performed in 2019.

LENGTH OF HOSPITAL STAY AFTER TKR

Chronic debilitating diseases such as knee osteoarthritis often represent a significant healthcare cost.

Two of the most effective ways to reduce the increasing healthcare cost associated with rising demand for TKR are to shorten the length of hospital stay and to minimise perioperative complications (Lovald et al. 2014).

There has been a trend towards earlier and safer patient discharges following TKR in the last two decades. The average length of a hospital stay has decreased from nine to four days at most hospitals in Singapore.

In recent years, there has been a push for enhanced recovery after surgery (ERAS) for TKR patients.

In August 2019, Singapore General Hospital (SGH) became the first hospital in Asia to launch an ERAS TKR clinical pathway, with carefully-selected patients safely discharged on postoperative day one (POD1) under the care of the Department of Orthopaedic Surgery.

This is achieved without putting the patients at increased risk for perioperative complications and a higher 30-day readmission rate.

IMPORTANT COMPONENTS OF ERAS TKR CLINICAL PATHWAY

Learning Points

Important components for a successful ERAS TKR clinical pathway include:

1. Preoperative patient stratification and selecting suitable patients
2. Proper preoperative counselling, with adequate information available for patients and their families
3. Optimisation of chronic diseases and preoperative medications
4. Perioperative physiotherapy, including preoperative and on POD0
5. Perioperative pain management, including good surgical technique with minimal soft tissue dissections
6. Optimal perioperative blood management
7. Perioperative intravenous fluid and nausea management
8. Avoiding the use of postoperative drain and in-dwelling urinary catheter (IDC)

1. CRITERIA FOR ERAS TKR CLINICAL PATHWAY

Our criteria for ERAS TKR clinical pathway include patients scheduled for unilateral TKR with good family support, especially during the immediate postoperative period.

They will be assessed by the physiotherapist preoperatively and must be deemed to have good rehabilitation potential.

Exclusion criteria include TKR performed for knee fracture, patients with poorly controlled (HbA1c >8.0%) diabetes mellitus, bleeding disorders, ASA greater than II, poorly-controlled cardiac or pulmonary comorbidities, chronic opioid use, functional neurologic impairments predisposing the patient to poorer rehabilitation potential, reduced preoperative cognitive capacity and preoperative voiding difficulties (Meneghini et al. 2017; Kort et al. 2017; Kerkhoffs et al. 2012).

2. PROPER PREOPERATIVE COUNSELLING

We recommend proper preoperative counselling, and involving family support in the care of the patient during the immediate postoperative period.

This can significantly reduce the need for transfer to a community hospital after TKR. A local study showed that additional time spent inpatient at subacute community hospitals for inpatient physiotherapy does not confer better functional outcomes or quality of life to the patients in the long term, when compared to home discharge with outpatient physiotherapy (Chan et al. 2018).

Preoperative education is also effective at preventing and reducing anxiety for both the patient and their family members. Pamphlets containing information on TKR can be given to patients to bring home to read before the actual surgery date.

3. OPTIMISATION OF CHRONIC DISEASES AND PREOPERATIVE MEDICATIONS

Opioids and diabetic medications are the two most significant preoperative medications that predict longer inpatient hospital stays, more complications and a higher readmission rate after TKR (Rozell et al. 2017; Zarling et al. 2017).

We recommend referral to a Pain Team specialist and weaning off opioids prior to TKR, as well as optimising glycaemic control to reduce the length of hospital stay and perioperative complication rate.

- **Smoking cessation** for six to eight weeks prior to TKR decreases the risk of infection, haematoma formation and wound complications (Ng et al. 2013).
- Those with a history of **alcohol abuse** should abstain for at least one month before surgery. They should also be screened for **liver disease and malnutrition.**

4. PERIOPERATIVE PHYSIOTHERAPY

Perioperative physiotherapy is a critical component that influences the outcomes after TKR. It also plays an integral role in the patient's length of hospital stay.

This begins with **preoperative physiotherapy**, which allows patients to familiarise themselves with the exercise regimes that are expected of them after surgery, especially gait training with crutches, quad sticks or walking frames.

Our **postoperative physiotherapy** protocol includes:

POD0: Self-assisted passive knee range of motion (ROM) exercises, isometric quadriceps strengthening exercises, unassisted straight leg raise exercises, standing and ambulating with assistive device, continuous passive motion (CPM) for ROM as per pain tolerance and cryotherapy on the operated knee.

POD1: Repeat ROM and strengthening exercises, and begin stair climbing exercises.

5. PERIOPERATIVE PAIN MANAGEMENT

Good surgical technique that minimises soft tissue dissections during surgery, and the use of periarticular injection during TKR, has revolutionised postoperative pain management.

Randomised controlled trials have shown that it is as effective as patient-controlled analgesia (PCA) and femoral block, while avoiding the side effects of intravenous morphine and the unwanted increased risk of fall with femoral block (Song et al. 2016; Carli et al. 2010).

We routinely use **periarticular injection without PCA.** Our preferred cocktail for periarticular injection is marcaine with adrenaline, ketorolac, morphine, shincort and vancomycin if the patient has no contraindication. We inject into the medial parapatellar muscles where the arthrotomy is performed, as well as the periosteum and synovium to prevent adhesions, making sure that we make multiple passes with the needle, covering a wide area in the knee.

Periarticular injection during surgery should be coupled with multimodal pain management involving various analgesics with different mechanisms of action for pain relief (Gaffney et al. 2017; Lamplot et al. 2014). These include paracetamol, etoricoxib and gabapentin. Hence, we are able to achieve a synergistic effect with these analgesics and use a lower dose of each of them.

6. PERIOPERATIVE BLOOD MANAGEMENT

The need for pack cell transfusion can delay physiotherapy on POD0 and POD1. Patients may suffer from symptoms of anaemia preventing them from participating in their physiotherapy.

Therefore, we are of the opinion that the perioperative transfusion rate should be less than 1% in routine TKR.

A local study done at SGH found that for *patients 70 years old and above*, a preoperative serum haemoglobin level of more than 12.4 g/dL has a 99.3% negative predictive value for the need for perioperative transfusion.

Similarly, for *patients under 70 years old*, a preoperative serum haemoglobin level of more than 12.1 g/dL has a 99.5% negative predictive value for perioperative transfusion (Yeh et al. 2016).

For TKR patients with preoperative haemoglobin levels below these thresholds of 12.4 g/dL and 12.1 g/Dl, preoperative oral iron replacement is an option.

For *severely anaemic patients*, preoperative intravenous iron replacement and/or erythropoietic agents can be considered.

We routinely give intraoperative tranexamic acid to reduce perioperative blood loss during TKR (Chen et al. 2016; Shin et al. 2017).

Other methods to reduce perioperative blood loss in a multimodal approach include the use of hypotensive anaesthesia, intraoperative cell saver, as well as regional anaesthesia over general anaesthesia especially for bilateral TKR patients. Regional anaesthesia is associated with lesser perioperative blood loss and a 49% reduction in 30-day complication rate (Zhu et al. 2015).

7. INTRAVENOUS FLUID AND NAUSEA MANAGEMENT

Patients undergoing TKR should be kept well-hydrated. Dehydration is associated with postoperative complications including urinary retention, acute kidney injury and postural hypotension, all of which will hinder postoperative physiotherapy and increase the length of hospital stay.

Postoperative nausea is a common side effect of general anaesthesia, especially in younger women. Pre-emptive antiemetic medications used at SGH include ondansetron and metoclopramide, which are routinely ordered perioperatively. These two medications have a synergistic effect when given together to treat nausea, due to their different mechanisms of action. Ondansetron acts via the central nervous system while metoclopramide acts by increasing gastric outflow.

8. AVOIDING THE USE OF DRAIN AND IDC

Proponents of the use of a drain during TKR feel that it will reduce intra-articular haematoma formation and serous leakage at the wound site, thereby reducing postoperative swelling and infection rate.

However, a study done at SGH comparing 575 TKRs with the use of a drain versus 902 TKRs without a drain found that the use of drain does not reduce the 30-day complication and readmission rates.

Neither does it reduce the incidence of additional surgical procedure performed on the same knee within two years after TKR. Of note, the use of a drain is associated with greater perioperative total blood loss (Chen et al. 2016).

While the use of a drain was the standard practice for many surgeons a decade ago, the Department of Orthopaedic Surgery at SGH has since moved away from it for routine TKRs.

We believe that the drain will impede immediate postoperative physiotherapy. We have not encountered a significant increase in wound complications since we stopped using drain in our practice.

We also advise against the routine insertion of an in-dwelling urinary catheter (IDC) in the operating room before TKR. To minimise the risk of postoperative urinary retention, we recommend avoiding prolonged surgery duration, as well as early mobilisation after TKR and adequate fluid hydration perioperatively to avoid acute kidney injury.

OUTCOMES OF ERAS TKR

Deng et al. performed a systematic review and meta-analysis of ERAS, including 25 studies looking at TKR and/or total hip replacement (THR) outcomes. They concluded that ERAS significantly reduced the mortality rate, blood transfusion rate, incidence of perioperative complications and length of hospital stay for patients undergoing TKR or THR. However, ERAS did not have a significant impact on postoperative ROM and 30-day readmission rate (Deng et al. 2018).

CASE STUDY

BACKGROUND

The patient was a 64-year-old female with worsening mechanical left knee pain for three years. Her pain was associated with worsening deformity of her left knee. Her symptoms had progressively limited her ability to ambulate over the past three years and she was mostly homebound. Her quality of life had declined significantly.

She also had hypertension, diabetes mellitus and osteoporosis on bisphosphonate treatment. Her main caregivers were her maid and husband. She was using mostly oral etoricoxib and topical ketoprofen gel to relieve her left knee pain.

On clinical examination, the ROM of her left knee was 15 to 110 degrees. There was medial and lateral joint line tenderness, and patella grind test was positive.

PREOPERATION

Her preoperative serum haemoglobin was 12.2 g/dL, while a preoperative radiograph revealed a 22-degree varus deformity of her left knee.

She fulfilled our criteria for ERAS TKR clinical pathway.

1. Preoperatively, she had been reviewed by a physiotherapist who introduced her to ambulation using a quad stick (which she required immediately after TKR) and educated her on what exercises to do perioperatively.
2. She was also referred to an endocrinologist specialist to optimise her glycaemic control prior to her surgery.
3. She was then scheduled in the morning on the operating room list, to allow better control of her serum glucose levels postoperatively prior to discharge, and thereby minimising the risk of perioperative complications (Ng et al. 2013).

INTRAOPERATION

She had her left TKR performed under regional anaesthesia, with an 11 cm midline skin incision via a medial parapatellar approach (Khakha et al. 2014). Bone cuts were made using conventional instrumentation.

She received fixed bearing, cruciate-retaining and cemented implants. The decision had been made to add a cemented stem to the tibial base plate, in view of her osteoporosis and severe preoperative varus deformity of the knee.

For analgesia, we routinely give a periarticular cocktail injection consisting of marcaine with adrenaline, ketorolac, morphine, shincort and vancomycin if patient has no contraindication. We do not use PCA.

The subcutaneous layer and skin were closed with dissolvable Stratafix™ suture and reinforced with tissue glue Dermabond® Prineo®. No drain or IDC was used.

Intraoperatively, she was given 1L of intravenous saline drip. Postoperatively, another 1L of intravenous saline drip was given over the next 23 hours. Pre-emptive antiemetic medications were also started, including ondansetron 4 mg Q8H and metoclopramide 10 mg Q8H.

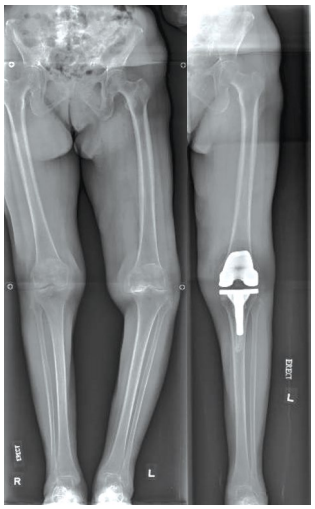


Figure 1 Pre- and postoperative radiographs

POSTOPERATION

Postoperative serum haemoglobin checks are not routinely ordered, except for preoperative anaemic patients or patients presenting with anaemic symptoms postoperatively.

Postoperatively, she was attended to by a physiotherapist on POD0 afternoon after the effect of her regional anaesthesia had worn off, and again on POD1 morning before discharge.

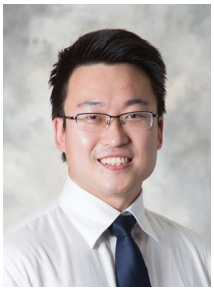
Our patient met our hospital discharge criteria:

- She was able to flex her left knee till 110 degrees at 18 hours after her TKR, as well as ambulate and climb stairs independently with the help of a quad stick.
- She was reviewed again in an outpatient clinic by a physiotherapist at one week after her surgery.

Figure 2 Knee flexion at 18 hours after TKR

CONCLUSION

1. Two of the most effective ways to reduce healthcare cost are to:
   - Shorten the length of hospital stay
   - Minimise perioperative complications after TKR
2. Important components for a successful ERAS TKR clinical pathway include:
   - The selection of suitable patients
   - Proper preoperative counselling and patient education
   - Optimisation of chronic diseases and preoperative medications
   - Perioperative physiotherapy
   - Good perioperative pain, blood, fluids and nausea management



Dr Jerry Chen currently works in the Department of Orthopaedic Surgery at Singapore General Hospital (SGH). He graduated with a Bachelor of Medicine, Bachelor of Surgery (MBBS) from Yong Loo Lin School of Medicine in 2010 and obtained his Fellowship of the Royal College of Surgeons (FRCS Orth) from Edinburgh in 2018. During his training years, he was awarded the Best Resident Award and Inspiring Resident Educator Award. He also published more than 45 scientific papers during his residency years and received over $500,000 of grant funding. Dr Jerry Chen's clinical interests include hip and knee surgeries, minimally invasive surgery and ERAS clinical pathways.

Medical professionals who would like more information about this procedure, please contact Dr Chen at 9368 1926 or jerry.delphi.chen.y.q@singhealth.com.sg.

GPs can call for appointments through the GP Referral Hotline at 6326 6060 or scan the QR code for more information about the department.

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Minimally Invasive Spine Surgery
– A Paradigm Shift in Technique, Treatment and Outcomes

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INTRODUCTION

A quiet revolution in the treatment of spinal disorders has been taking place behind the scenes over the past 10 to 15 years. Parallel advancements in spine surgery such as the introduction of microneurosurgical techniques, together with computer navigation/robotics, improved microscope/endoscope optics, implant biomechanics and intraoperative neuromonitoring have allowed for safe and effective spine surgery to be carried out with minimal downtime and complications for the patient.

Spine surgery has in fact evolved into a sub-specialty in its own right, mastered by surgeons who may have either had an orthopaedic or, increasingly now, a neurosurgical background.

INDICATIONS FOR SURGICAL CONSULT

While spine surgery may have evolved rapidly, the indications for such surgery remain steadfast. The usual red flags should be screened for all patients presenting to the family doctor with back pain and leg pain.

Cauda equina syndrome, whose symptoms and signs can be subtle in the beginning, has to be earnestly looked for. Bilateral sciatica, absent lower limb reflexes and saddle/perineal anaesthesia are warning signs, and patients who present such symptoms should be referred promptly before frank urinary retention sets in.

Similarly, a **deterioration in neurological function** corresponding to the cervical or thoracic spinal levels should also be referred to a spine surgeon for urgent workup.

A group that is often missed is those presenting with **rapidly deteriorating cervical myelopathy,** whose initial symptoms of hand numbness, finger dexterity issues and mild gait instability are often overlooked in the primary care setting.

At the other end of the spectrum are those presenting with the following **chronic symptoms which should prompt a referral for a surgical consult:**

- Back pain or radicular pain not responding to conservative treatment measures
- Decreasing claudication distance
- Progressive deformity
- Development of a neurological deficit such as a foot drop

Continued conservative treatment in such instances may result in irreversible neurological damage and a poor outcome even after surgical intervention.

THE ADVANTAGES OF MINIMALLY INVASIVE SPINE SURGERIES

The goals of spine surgery whether open or minimally invasive are the same.

The aim in most cases is to achieve **decompression of the neural elements,** and if required, **stabilisation and fusion of the involved spinal segment** while paying attention to the overall alignment of the patient's spine.

Some patients, especially those who are younger with minimal facet degeneration on imaging, are candidates for a disc replacement procedure which is most often carried out in the cervical spine. This helps to treat the degenerate or herniated disc while maintaining motion of the spinal segment.

Both lumbar spinal decompressions and lumbar spinal fusions can be carried out through minimally invasive techniques.

The main difference between traditional open spine surgery and the newer minimally invasive techniques lies not in the cosmetic appearance and size of the incision, although that is often also significantly reduced, but in the preservation of the erector spinae group of muscles specifically the multifidus muscle. These are the natural stabilisers of the spine and minimal disruption to them results in much better postoperative outcomes.

MIS FOR DECOMPRESSION AND FUSION

Minimally invasive surgical techniques, such as the MIS TLIF (minimally invasive transforaminal lumbar interbody fusion) and MIS LLIF (minimally invasive lateral lumbar interbody fusion) techniques, allow for both decompression and fusion of the spinal segment with minimal disruption to the normal anatomy.

MIS FOR DECOMPRESSION WITHOUT FUSION

Other MIS decompression techniques without fusion include microdiscectomy, endoscopic discectomy, interlaminar decompression, MIS foraminotomy and endoscopic foraminotomy.

The aim is often either to remove the herniated disc or decompress the painful nerve root that is impinged, most often by a thickened ligamentum flavum or hypertrophied facet.

The surgical goal is often achieved through the use of a microscope or endoscope, working through ports and sleeves no larger than 1-2 cm in diameter. These surgical techniques have a steep learning curve to surmount, but once mastered, offer a splendid solution to the patient's spinal problem.

ENHANCED RECOVERY AFTER SURGERY

Both MIS decompression and fusion lend themselves readily to the concept of enhanced recovery after surgery (ERAS).

This is a multimodal perioperative care pathway designed to achieve early recovery for patients undergoing major surgery.

1. In our practice using techniques such as endoscopic discectomies and MIS TLIF, blood loss is markedly minimised. Intraoperative or postoperative blood product transfusions are almost never required and surgical site infections are exceedingly rare.

2. There is no requirement for the placement of postoperative drains and there is no requirement for postoperative patient-controlled analgesia (PCA).

3. In our practice, we routinely employ intraoperative neuromonitoring such as motor evoked potentials, free-running electromyography (EMG) and somatosensory evoked potentials for patients undergoing elective spinal surgery. This has helped reduce the risk of inadvertent neural injury to near zero.

4. All our patients who have had minimally invasive spine surgeries including one- or two-level spinal fusions undergo same day (postoperative day zero [POD0]) mobilisation with the physiotherapist within two to four hours postoperatively.

5. Oral short-acting opioid analgesics are given only for the first 24-48 hours postoperatively, and early discharge is encouraged with a return to normal physical activities by six weeks.

CONCLUSION

In summary, minimally invasive spine surgery is here to stay and is continually evolving. Although the initial experience with these techniques over the years has been mainly with surgery of the degenerate spine, there is now growing evidence of the effectiveness in its use for metastatic spinal tumour surgery as well as in spinal trauma.

Dr Dinesh Shree Kumar is the current Director for the Spine Surgery Service in Changi General Hospital (CGH), which is part of the Integrated Spinal Service consisting of both neurosurgeons and orthopaedic surgeons. Dr Kumar's interests include minimally invasive spine surgery with computer navigation, and he introduced the O-arm with stealth station navigation in CGH.

Medical professionals who would like more information about this procedure, please contact Dr Kumar at 8123 1183.

GPs can call for appointments through the GP Referral Hotline at 6788 3003 or scan the QR code for more information about the department.

Ankle Instability

– Diagnosis and Management of Acute and Chronic Ankle Sprains

Dr Kinjal Mehta, *Senior Consultant,*
Department of Orthopaedic Surgery, Changi General Hospital

A 25-year-old gentleman comes to your clinic with right ankle pain and swelling after an injury two days prior. He was playing soccer and twisted his ankle. He experienced pain and swelling after the incident. He is able to weight-bear on the affected leg. On examination, he has swelling and tenderness over the lateral aspect of his ankle.

This is a common scenario in GP clinics; the patient has an ankle sprain. With the prevalence of both acute ankle sprains and chronic ankle instability, timely diagnosis and referral is important for effective management.

INTRODUCTION

The ankle joint is one of the most commonly injured joints in sports activities and ankle sprain is the most common type of ankle injury[1]. An incidence rate of 2.15 per 1,000 person years has been reported in the USA[2]. Ankle sprains commonly occur during sporting activities especially basketball, football and soccer[2]. They are more common among teenagers, and people in their 20s and 30s.

FUNCTIONAL ANATOMY

The ankle joint consists of the tibial plafond, medial malleolus, lateral malleolus and talus. The main motion of the ankle joint is dorsiflexion and plantar flexion. The talar dome is wider anteriorly than posteriorly. Hence, the ankle joint is more stable in dorsiflexion than plantar flexion. The lateral ankle ligaments are most commonly involved in ankle sprains.

The lateral ankle ligaments consist of the **anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL)** and **posterior talofibular ligament (PTFL)**.

- **The anterior talofibular ligament (ATFL)** originates on the anteroinferior border of the fibula and extends to the neck of the talus. It resists anterior translation of the talus in the mortise and is the primary restraint to inversion in plantar flexion.
- **The calcaneofibular ligament (CFL)** originates on the fibula and inserts onto the calcaneus. It is the primary restraint to inversion in neutral or dorsiflexed position.
- **The posterior talofibular ligament (PTFL)** originates on the posterior border of the fibula and inserts on the posterior tubercle of talus. It is the strongest lateral ankle ligament. PTFL limits posterior talar displacement in ankle dorsiflexion.

The most commonly injured ligament is ATFL, followed by CFL and then PTFL. In most patients, PTFL is intact.

CHRONIC ANKLE INSTABILITY

About 30% of patients with acute ankle sprains end up with lateral ankle instability[3]. Patients with recurrent sprains, a high-grade sprain, ligamentous laxity, lower limb weakness or postural imbalance are more prone to developing chronic ankle instability.

CLINICAL PRESENTATION

1. Acute Ankle Sprains

In acute ankle sprains, patients present with pain and swelling over the lateral aspect of ankle after a twisting injury.

On physical examination, tenderness would be palpated on the lateral aspect of the ankle. There should not be any bony tenderness.

The range of motion of the ankle should not be limited. Pain may limit some movement but passive movement should be full.

In the acute setting (one to two weeks) post-injury, physical examination may be difficult due to pain and swelling. The Achilles tendon should be examined to exclude acute Achilles tendon ruptures.

Ottawa ankle rules should be followed to determine if the patient requires x-rays and referral to the emergency department .

2. Chronic Ankle Instability

Patients with chronic ankle instability would present with recurrent ankle inversion injuries (sprains).

Patients would usually **describe their symptoms** as "ankle giving way" or "ankle feeling loose". Initially, instability is felt on uneven ground. However, the condition may progress resulting in instability while walking on flat ground.

During an episode of acute sprain, pain and swelling may be present. There should not be any pain or swelling between episodes of sprains.

Physical examination of patients with chronic ankle instability may reveal tenderness on palpation of lateral ankle ligaments.

The anterior drawer stress test and talar tilt test may be positive in patients with chronic ankle instability.

The *anterior drawer test* looks for anterior subluxation of the talus. ATFL can be tested by performing the anterior drawer test in 20 degrees of plantar flexion and comparing it with the uninjured side *(Figure 1)*.

Figure 1
Anterior drawer test

The *talar tilt test* is performed by inverting the calcaneus with the foot at 90 degrees. Excessive inversion of calcaneus as compared to the uninjured side indicates injury to CFL *(Figure 2)*.

Figure 2
Talar tilt test

Patients with ankle instability may have concomitant osteochondral lesion of talus, peroneal tendon pathology or deltoid ligament injury.

CLASSIFICATION OF ANKLE SPRAINS

Ankle sprains can be graded I-III depending on its severity. Symptoms of swelling, bruising and tenderness increase as the grade of ankle sprain increases. Patients with grade II or III ankle sprains are more likely to have chronic ankle instability.

Grade	Ligament Disruption	Swelling, Ecchymosis, Tenderness	Pain on Weight-bearing
I	None	Minimal	None
II	Stretch without rupture	Moderate	Mild
III	Complete rupture	Severe	Severe

MANAGEMENT

1. Acute Ankle Sprains

Acute ankle sprains are managed using "RICE" (rest, ice, compression and elevation) therapy. Patients are advised to rest and may be given a few days off work depending on their occupation.

- Icing the injured ankle will help to decrease symptoms and swelling.
- Applying a bandage may also aid in relieving symptoms.
- Elevating the injured ankle will help to decrease acute swelling.
- The patient may consider wearing a protective brace for comfort. Range of motion exercises should be started from the time of injury.

2. Chronic Ankle Instability

30% of patients with acute ankle sprains may end up with recurrent sprains and chronic lateral ankle instability. Chronic ankle instability is managed with nonoperative measures initially.

- Physiotherapy with emphasis on neuromuscular training exercises may result in improvement of symptoms. Peroneal strengthening and balance training using wobble boards are some of the exercises undertaken. Initially isometric exercises are undertaken; these are progressed to dynamic resistive exercises using resistance bands.
- Ankle guards or taping especially during sporting activities may help patients manage their symptoms.
- Lifestyle changes and activity modifications would also help in controlling symptoms.
- Analgesia and non-steroidal anti-inflammatory drugs would help to relieve symptoms after a sprain.
- Symptoms may be less pronounced if weight loss is undertaken in overweight individuals.

REFERRAL TO ORTHOPAEDIC DEPARTMENT

Patients should be referred to the emergency department if a fracture is suspected or imaging is required based on the Ottawa rules.

Patients with lateral ankle instability should be referred to the orthopaedic department. Initial management would involve nonoperative measures followed by **imaging** and **surgical management.**

IMAGING AND SURGICAL MANAGEMENT

Imaging

Stress x-rays using the anterior drawer test or talar tilt test can be performed.

Stress x-rays of the uninjured ankle are also required for comparison. **An ultrasound scan** of the ankle ligaments allows real-time assessment of the integrity and laxity of ligaments. A major drawback of ultrasound scans is its operator dependency.

Magnetic resonance imaging (MRI) is usually performed for patients presenting with lateral ankle instability. MRI is useful in evaluating ligament integrity, thickness and bony attachment. MRI can also show concomitant intra- and periarticular pathologies such as osteochondral lesions of talus, tendon injury or ankle impingement.

Surgical Management

Surgery is indicated in patients with persistent symptomatic lateral ankle ligament instability after failure of nonoperative treatment.

Surgical management can be divided into anatomic reconstruction and non-anatomic reconstruction of lateral ankle ligaments. Non-anatomic reconstructions (e.g. Chrisman-Snook reconstruction) have fallen out of favour due to complications such as subtalar joint stiffness.

Modified Brostrum-Gould reconstruction is currently considered the "gold standard" operative treatment for lateral ankle instability. Surgery involves anatomical reconstruction of the native ligaments with reinforcement of the inferior extensor retinaculum. Suture anchors may be used to attach ligament to bone.

Anatomical reconstruction with autograft or allograft is usually for patients with insufficient ligament remnants, failed previous lateral ankle ligament reconstruction, high body mass index (BMI) or generalised ligamentous laxity. Ankle arthroscopy may be performed at the time of surgery to address intra-articular pathologies.

Postoperative patients would require six weeks of protected weight-bearing followed by gradual return to activity in a physical therapy programme.

Dr Kinjal Mehta is a Senior Consultant orthopaedic surgeon and Director of Foot & Ankle Surgery with the Department of Orthopaedic Surgery at Changi General Hospital (CGH). She graduated from the National University of Singapore and did her orthopaedic surgery training in Singapore. Dr Kinjal underwent foot and ankle fellowship training in Canada and has an interest in foot and ankle sports injuries, deformities and trauma. She is also active in teaching medical undergraduates and orthopaedic residents, and attends conferences on a regular basis to present her research.

Medical professionals who would like more information about these conditions, please contact Dr Kinjal Mehta at kinjal.vidyut.mehta@singhealth.com.sg.

GPs can call for appointments through the GP Referral Hotline at 6788 3033 or scan the QR code for more information about the department.

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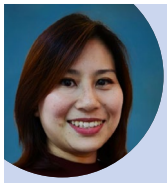

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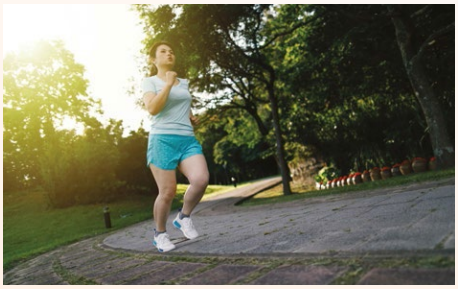

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