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A newsletter by the University Orthopaedics, Hand & Reconstructive Microsurgery Cluster, NUHS

Musculoskeletal Oncology in General Practice

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Introduction

The field of musculoskeletal oncology is a highly specialised branch of orthopedic surgery. It involves the care and rehabilitation of adult and children patients afflicted by tumours and tumorous conditions of the bones, joints and soft tissues. These tumours can be benign (eg. giant cell tumors, osteoid osteomas, enchondromas) or malignant which in turn can be primary (eg. osteosarcomas, Ewing's sarcoma and chondrosarcomas in the bone and soft tissue sarcomas like liposarcomas and rhabdomyosarcomas) or secondary (metastasis from remote sites like the lung, breast and prostate). In addition, a group of patients, especially in the paediatric group, will present with tumour-like conditions (eg. fibrous dysplasia, multiple hereditary exostosis). Management encompasses all aspects of local and systemic control of disease and requires a multidisciplinary approach comprising the talents of orthopaedist, paediatric and adult medical oncologists, general surgeons, plastic and hand surgeons, radiologists, radiation oncologists and musculoskeletal pathologist. Research in this area typically revolves around the traditional oncologic models based on therapeutic and molecular etiology but has, in addition, the aspects of functional issues and issues of social re-integration.

Epidemiology

This is one of the few specialties that encompass both paediatric and adult disease. Based on American figures, there were only 2,051 of all types of bone sarcomas and 7,672 cases of soft tissue sarcomas in the year 2000 when the population was estimated at 281,421,906. 26.8% of bone sarcomas occurred in the paediatric age group. This roughly corresponds to an annual incidence of 30 cases of bone sarcomas and 120 cases of soft tissue sarcomas annually in Singapore alone. In addition, patients with metastatic disease will often require the care of the musculoskeletal oncologist for the management of metastatic disease. The population incidence of cancer is about 0.5%. This roughly translates to 21,200 patients in Singapore (with an assumed population of 4.24 million). It has been estimated that about 60% of patients with cancer will develop bone involvement. In addition, a further 150 or so patients per year develop bone and soft tissue sarcomas that can benefit from similar intervention programmes. Hence, the estimated target population that could be covered by this programme is 12,720 patients per year.

Primary Health Care and Musculoskeletal Oncology

With this known incidence of musculoskeletal oncology disease, it becomes apparent that as a primary healthcare physician the main worry is in missing a diagnosis. In this regard it is useful to approach these ailments systematically. The common clinical scenarios are metastatic disease, soft tissue sarcomas and bony lesions. At final analysis, the physician must be satisfied that the lesion falls into only one of two categories-latent or aggressive. The main red flags to evaluation are the following (Table 1)

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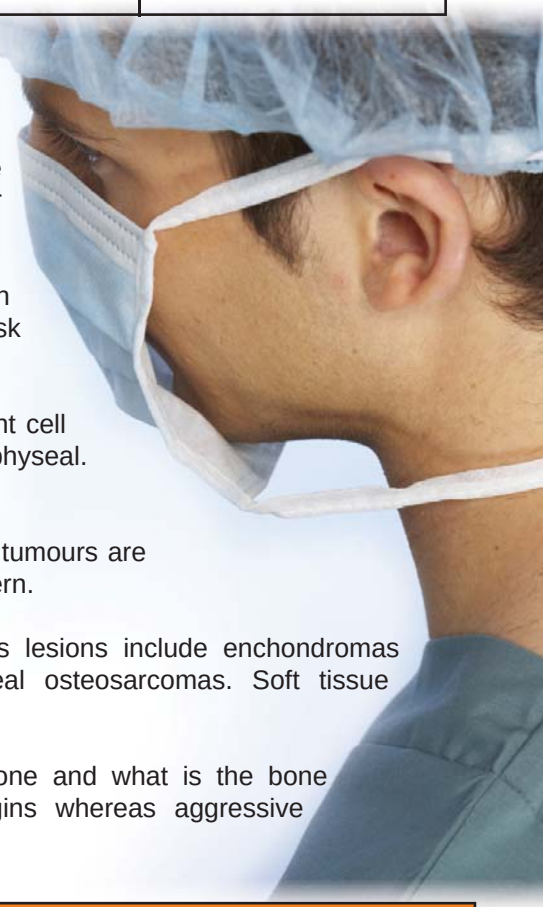
TABLE 1 Red flags in clinical evaluation (Who should you X-ray?)

Presenting History - Age - Pain - Unrelenting - Disturbs sleep - Can be mechanical or organic (cf mechanical causes of pain which are usually only mechanical	- Systemic upset - LOA, LOW - SOB - Bladder, bowel disturbance Family History - Syndromes - "General cancer load" oncologic predispositions tend to cluster in certain families	Past history - Syndromes - Cancer History Physical examination - General physical examination - Springing sign - Spine - Masses	- Cutaneous stigmata - Café - au - lait - Capillary malformations - Limb inequality

Bony tumours



Perhaps the most vacillating of problems, up to 40% of patients having x-rays for unrelated conditions may show unexpected tumorous lesions in the bone. The general physician needs to be able to identify lesions that are of low risk and refer on the cases of high risk. Five questions must be answered in this regard.

1. How old is the patient? Children in the second decade, women in the third to fourth decade and adults in the sixth decade are at risk of disease (Figure 1).

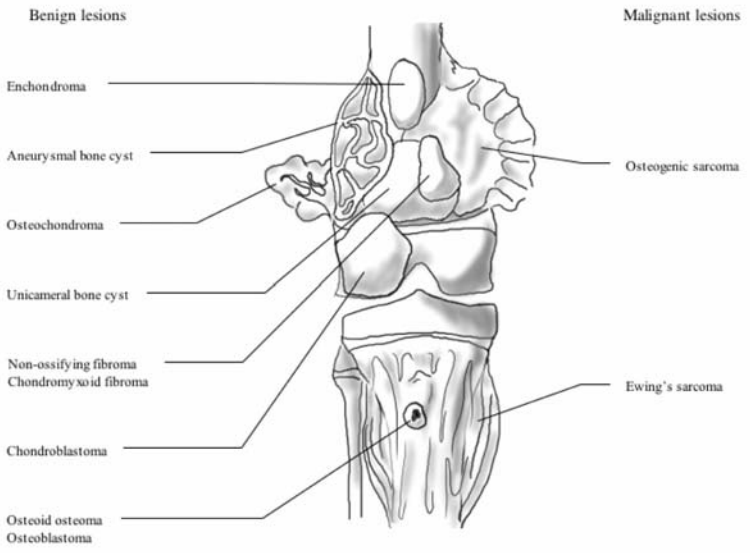
2. Which part of the bone is the lesion at? Epiphyseal lesions are usually giant cell tumours in adults or chondroblastomas in children. Many tumours are diaphyseal. Enchondromas and osteoid osteomas tend to be diaphyseal.

3. What is the nature? Osteoblastic tumours are predominantly sclerotic. Lytic tumours are often fibrous. Enchondromas and chondrosarcomas often have a mixed pattern.

4. Where is the lesion in relation to the bony compartments? Intraosseous lesions include enchondromas and chondrosarcomas. Surface lesions include exostoses and parosteal osteosarcomas. Soft tissue lesions can invade bone.

5. What is the margin of the lesion (or what is the lesion doing to the bone and what is the bone doing to the lesion)? Benign lesions tend to have well defined margins whereas aggressive lesions including metastatic disease have ill - defined margins.

Figure 1 : Patient age and radiological appearance are diagnostic in majority of patients



Age	Benign tumors	Malignant tumors	Tumor-like conditions
Birth to 5 years	Eosinophillic granuloma	Leukaemia	Osteomyelitis
		Metastatic neuroblastoma	Non-accidental injury
5 to 15 years	Unicameral bone cyst	Ewing's sarcoma	Fibrous dysplasia
	Osteochondroma	Osteogenic sarcoma	Osteomyelitis
	Aneurysmal bone cyst		Osteofibrous dysplasia
	Osteoid osteoma		Stress fracture
	Enchondroma		
	Non-ossifying fibroma		
	Chondromyxoid fibroma		
	Chondroblastoma		
15 to 20 years	Unicameral bone cyst	Osteogenic sarcoma	Fibrous dysplasia
	Osteochondroma	Ewing's sarcoma	Stress fracture
	Osteoid osteoma		
	Aneurysmal bone cyst		
	Nonossifying fibroma		
	Giant cell tumor		
	Enchondroma		
	Chondroblastoma		
	Chondromyxoid fibroma		

Metastatic disease

The common clinical scenario here is of a patient with a known primary (eg. breast, lung or prostate cancer) who now presents skeletal involvement. The main aim in these patients is pain relief and such cases can be referred for treatment in an elective setting. Certain conditions however require urgent attention. The first is the patient with spinal disease who has bladder and bowel symptoms. This may be a harbinger of cauda equine syndrome and the patient would need acute orthopaedic intervention. Similarly patients with hip involvement need urgent care as broken hips in cancerous patients can cause a significantly reduced life span (Figure 2). In addition, patients with metastatic disease are prone to the effects of hypercalcemia and may be develop psychosis, abdominal pains and bone pains. The treatment in this case involves hypersalination, diuresis and bisphosphonate therapy in the inpatient setting.

Figure 2:
Recent advances in technique now allow for very high levels of function in metastasis to the bone. This patient had become bedbound after metastasis to the right hip. The pelvis was reconstructed and the patient walked out of hospital

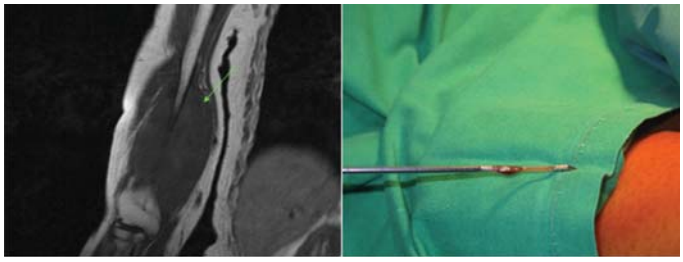


Figure 3:
We in NUH now have the ability to perform tru-cut biopsies in the clinic saving the patient an additional surgical procedure prior to definitive surgery

Soft tissue sarcomas

While it is difficult to make recommendations based on size (since even very large sarcomas start small), in general rapidly growing tumours above 5 cm in diameter are a cause for concern. At present all patients with large tumours in the National University Hospital undergo MRI and CT scans of the chest prior to biopsy which is done as an outpatient procedure in the clinic (Figure 3). If confirmed to be malignant these are resected. If benign they are observed for progress and excised if progression is confirmed.

Approach and Expertise

Our Musculoskeletal Oncology service is the largest and most comprehensive service of its kind in Singapore. With two full-time orthopedic oncologists and five spine surgeons on staff and various ancillary staff we are able to handle most of the challenges that the field offers. A unique challenge is in the handling of paediatric patients in whom these conditions are more common. The National University Hospital remains the only general hospital in Singapore that is able to handle both paediatric and adult patients with full-time in-house staff.

Advances In the Surgical Management of Osteoporotic Fractures

Assoc Prof Hee Hwan Tak
Senior Consultant and Deputy Head, University Spine Centre
University Orthopaedics, Hand & Reconstructive Microsurgery Cluster

With an aging population around the world, osteoporotic vertebral compression fractures are increasingly common. Peak bone mass is obtained by age 35, after which all individuals lose a small amount each year. Half of all women older than 65 have radiographic evidence of osteoporosis, and 90% are affected by age 75. The most serious consequence of osteoporosis is the occurrence of pathologic fracture. In the past, osteoporotic compression fractures were often treated with benign neglect, whereas much attention had been paid to the management of osteoporotic hip fractures. The irony is that the numbers of osteoporotic compression fractures per year in the United States far exceed the number of osteoporotic hip fractures.

Complications of osteoporotic fractures include spinal cord compression, urinary retention, and ileus. Other complications reported include chronic pain and pulmonary compromise. There is a 9% loss of predicted forced vital capacity with each vertebral fracture. These patients can suffer considerable physical, functional, and psychosocial impairments manifesting as depression and insomnia. One study showed that osteoporotic compression fractures are associated with 30% age-adjusted increase in mortality.

Traditional treatment of osteoporotic compression fractures include bed rest, analgesics, brace, and gradual mobilization. Unfortunately many patients still have intractable pain and are unable to return to their activities

of daily living. This is understandable because medical management fails to restore or prevent worsening of spinal alignment, and the immobility status of the patients can further lead to other complications e.g. atelectasis, pneumonia, decubitus ulcers, deep vein thrombosis, pulmonary embolism, urinary tract infection, and worsening osteoporosis. It is a known fact that one week of prolonged recumbency will result in 10% loss of bone mass.

Surgery has been the traditional treatment of choice in osteoporotic compression fractures if the patient fails non-surgical treatment. Surgical approaches may vary from anterior only decompression and instrumentation, posterior only decompression and instrumentation, and combined anterior-posterior surgery (either staged or same day). Indications for surgical intervention are usually reserved for gross spinal deformity or impending neurological deficit. Caution is exercised when recommending surgery because of the adverse risk/benefit ratio in the elderly/cancer population with poor bone stock and co-morbidities.

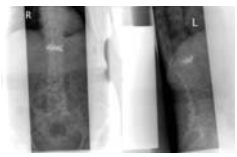


Figure illustrating the AP and lateral views of the lumber spine of a patient who had vertebroplasty at the T12 vertebra.

Vertebroplasty describes a surgical technique using bone graft, cement, or metal implants to modify or reconstruct damaged or destroyed vertebra. This was traditionally done via open surgery. Percutaneous vertebroplasty was first performed by Galibert and Deramond in 1984. They injected PMMA into a C2 vertebra that had been destroyed by an aggressive hamangioma. Dusquenel subsequently used this technique to treat compression fractures associated with osteoporosis and malignancy. In 1993, the technique of percutaneous vertebroplasty was introduced in the United States by Dion and colleagues. They reported 85 to 90% significant pain relief for painful osteoporotic compression fractures. Percutaneous vertebroplasty has since grown in popularity to become the standard of care for painful osteoporotic compression fractures of the spine. Kyphoplasty is a modification of vertebroplasty whereby a balloon catheter is initially inserted into the vertebral body to create a void, to be filled with cement later. In this article, I will describe the technique of vertebroplasty.

Vertebroplasty is usually performed under local anesthesia and sedation, with close monitoring of the patients' parameters by the anaesthesiologist. Prophylactic antibiotic (1 gram of cefazolin) is routinely given since this procedure involves injecting foreign material (PMMA) into the body. The operative field is subsequently cleaned and draped in a sterile fashion. Localisation of the pedicles is performed with the aid of the fluoroscopy. Local anaesthesia is subsequently given from the skin, subcutaneous layer, and the periosteum of the bone at the bone entry site. A 0.5 cm paramedian incision is made on either side of the spine, for insertion of the 11 gauge trocar-cannula system. The needle is centered at the 10 o'clock over the left pedicle and 2 o'clock over the right pedicle on the AP view with the help of a long needle holder, thus avoiding radiation to the surgeon's hands. One may have to start the entry point slightly more superior so that the needle is able to traverse the vertebral body without penetrating the fractured and collapsed superior end plate. The needle should also be medialised through the cylinder of the pedicle to reach the middle of the vertebra. Once a footprint is obtained by the needle in the pedicle, and the position is considered ideal on the AP view, advancement of the needle will be done under the guidance of the lateral fluoroscopy. In osteoporotic bone, penetrating the bony cortex and advancing the needle into the vertebral body is easy. The tip of the needle should lie beyond the midpoint of the vertebral body on the lateral view. The ideal endpoint is the junction between the anterior and middle thirds of the vertebral body, since this area is relatively devoid of venous plexuses.

Venogram is used next to identifiy potential leak sites (particularly into the spinal canal via the epidural venous plexus), which if present, may warrant adjustment of the needle position. The commonly used agents are omnipaque 300. Cement is prepared when the position of the needles is ideal and there is no significant extravasation on venography. Cement with barium is used so that injection can be monitored in real time to detect any extravasation.

One should inject the cement when it is no longer in a liquid consistency to minimise the risk of extravasation. The cement injection should be monitored real time or small amounts and the result verified before further cement injection takes place. This is done under the guidance of lateral C-arm image. I usually work through one cannula first before moving to the second cannula. This preserves a route for subsequent injection should a leak be discovered. Moving to the second cannula will complete the vertebral fill without further leak as the original leak will be occluded by the initial cement, which will have hardened. The amount of cement required to produce pain relief is still uncertain. One study performed in vitro showed that prefracture stiffness and strength can be restored by 2.5 to 4 ml of cement in the thoracic vertebra, and 6 to 8 ml in the lumbar vertebra. This amounts to 50 to 70% fill of the residual volume of the compressed vertebra. Significant strength restoration can be provided with a unipedicular approach if the cement filling crosses the midline of the vertebra.

Advances In Orthopaedic Trauma Management

– Minimally Invasive Treatment and Osteoporotic fractures

Dr Fareed Kagda - Consultant, Division of Orthopaedic Trauma
University Orthopaedics, Hand & Reconstructive Microsurgery Cluster

The Orthopaedic Trauma Division was set up in 2003 to improve the care of patients with complex fractures and to manage the increasing numbers of elderly patients with osteoporotic hip fractures. The management of the sequelae of these fractures, the correction of deformity as well as management of limb length discrepancy is part and parcel of the daily work of the Orthopaedic Trauma Division.

The team comprises of three consultants: - Adjunct Associate Professor Khong Kok Sun, who is acknowledged as one of the top orthopaedic trauma surgeons in the country and is well known both for his work in trauma regionally and internationally. Dr Joseph Thambiah is the Head of the division and senior consultant. He is primarily a spine surgeon who manages elective spine work, but this highly skilled orthopaedic surgeon also manages all general orthopaedic trauma, including complex intra-articular fractures and spinal trauma. Dr Fareed Kagda is the newest member of the team. He is a fellowship trained orthopaedic trauma surgeon who trained in Switzerland and Germany in the management of complex pelvic and acetabular trauma, minimally invasive / key-hole surgery for fractures as well as correction of deformities and limb lengthening.

Minimally Invasive Plate Osteosynthesis (MIPO) is the current "buzz word" in orthopaedic trauma. With new, less-invasive, techniques such as key-hole surgery computerised pre-operative planning and computer navigated trauma surgery, many fractures can be treated with much lower risk of complications. With key-hole incisions, surgery is less painful, healing is faster and earlier movement and rehabilitation may be achieved.

Fig 1. Intramedullary flexible nailing of left clavicle.

Many different fracture types may be treated by MIPO surgery. Clavicle fractures are often treated with a sling, with several weeks of pain, and often heal with deformity. These fractures may now be treated by minimally invasive techniques that allow pain free arm mobilisation within a few days and early use of the arm. Patients can usually lift up their affected arm the day after surgery!

Fracture of the humerus have also been traditionally treated conservatively with a "u-slab" and collar and cuff resulting in healing with a deformity and both shoulder and elbow stiffness, not to mention patient discomfort (in our local weather) and pain in the cast. Minimally invasive plating of the humerus uses small incisions to fix the fracture, allowing similar healing to that in a cast but better alignment (less deformity) with early mobilisation and rehabilitation.

With the population getting older and osteoporosis almost endemic, these types of fragility fractures are treated in our Division using new techniques and implants such as "locked plates" and "helical screws". Newer implants, inserted in a minimally invasive method, are designed to hold better in osteoporotic bones and are stronger and less likely to "cut out" from the soft bone. This, again, allows earlier mobilisation and rehabilitation and more natural healing of such fractures, allowing more of our elderly patients to walk after their fractures. The team has also fine tuned

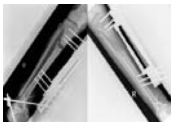
Fig 2: Comminuted, displaced fracture mid-shaft of left humerus treated with MIPO plating. Patient with 90 degrees forward flexion of shoulder on 1st post-op day and discharged home.

the management of these patients ensuring that their osteoporosis is treated and that they are referred to general practitioners to continue anti-osteoporotic treatment to prevent future fractures on their discharge from hospital.

Fig 3: Osteoporotic supracondylar fracture of the femur treated by LISS (Less Invasive Stabilising System) using a minimally invasive method with excellent results

Patients who have short limbs, bones that do not heal after fractures and deformed limbs are also managed by modern methods. We can 'grow' bone or lengthen them by Ilizarov methods or "callotaxis" – elongation of callus which eventually forms bone. We also have minimally invasive methods to harvest bone graft from the intramedullary canal of the femur and tibia – what used to be the most painful part of bone grafting procedures for non-healing bones – this new methods minimises the pain, morbidity and allows for earlier discharge from the hospital.

Fig 4: Bone lengthened by using an external fixator



Orthopaedic trauma (i.e. fractures) have long been thought to be simple and left to junior staff to manage. With new technology and implants, "key-hole" or minimally invasive techniques we can now confidently say that most fractures can be treated earlier, with less complications, better healing and early return to normal lifestyle and activities. Rarely do patients have to suffer the discomfort and inconvenience of plaster casts and even fractures traditionally treated by non-operative methods can today be treated safely by minimally invasive methods. Methods to re-grow or lengthen bone and key-hole methods to harvest bone to treat fractures that fail to unite are also part of the enhanced and advanced services the division provides.

Clinical Excellence
at Your Service

I am pleased to inform you that the University Spine Centre was officially opened on 17 June 2008 by Ministry of Health's Director of Medical Services, Professor K Satku and our key leaders of the National University Health System. As a one-stop centre offering advanced clinical facilities, our aim is to provide an integrated process flow pleasing for our patients. The outcome of patients undergoing various treatment methods and surgeries are consolidated with the aim to improve care delivery.

As a major referral centre for spinal disorders in Asia, our spine specialists are dedicated to the study and treatment of spinal disorders in the Asian population. In March 2008 our spine specialists had completed a 2 ½ yr study by examining the lower back scans of 5,000 random patients. This is the first large scale study in Asia. Such studies help our spine specialists make progress in their treatment plans.

The opening of the University Spine Centre signifies not just the opening of a patient-centric facility for our Spine patients, it also marks the start of new healthcare approach for us at the University Orthopaedics, Hand & Reconstructive Microsurgery Cluster, where patient care will be based on evidence and clinical excellence.

Ms Cherry Khoo, Manager, Operations & Administration
University Orthopaedics, Hand & Reconstructive Microsurgery Cluster

NUH Charity Spinner Challenge 30 Oct 2008
In aid of Children's Cancer Foundation, University Orthopaedics, Hand & Reconstructive Microsurgical Cluster is proud to have participate in the NUH Spinner Challenge. We received spontaneous participation from our cluster chair, Prof Wong Hee Kit, together with doctors and nurses on the bike to raise funds for the children!

From Left to Right: Mr Chua Song Khim (Chief Executive Officer of NUH, Jul 01-Jul 08), Prof Tan Chorh Chuan (Chief Executive of NUHS, Jan 08-Nov 08), Prof Wong Hee Kit, Prof K Satku (Guest-of-Honour), Prof John Wong (Deputy Chief Executive of NUHS), Associate Prof Benjamin Ong (Chief Executive of NUHS)

EXSA Award 2008

University Orthopaedics, Hand Reconstructive & Microsurgery Cluster would like to extend our heartiest congratulations to staff from our Wards and Specialist Outpatient Clinics on receiving the EXSA Award for their excellence service . Acting CEO, Mr Joe Sim presented the award to staff at the Specialist Outpatient Clinics

Star Award: Sharon Au Sook Kwan (SOC)
Gold Award: Salina Sumon (SOC)
Silver Award: <u>SOC</u>
Kent Kok Kian Lan, Hafizah Bte Abdul Latif , Meenachi D/O Sivalingam, Lynn Wee Lay Leng, Siti Nuraishah Binte Juma'at, Joanne Oh, Saminah Bte Samat
<u>Ward</u>
Rahimah Bahri, Eileen Nah, Chai Hairu, Crisanta Tenebro, Ng Hoon Kwang

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Operating Hours	Mondays to Fridays: 8.30am – 5.30pm			
	Saturdays / Sundays / Public Holidays Closed			