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Highlights

Septic arthritis
and osteomyelitis
in children

The science, art and
commerce of
Orthopaedic
implantology

What an MRI Scan
can Reveal
about your Injury

Tuberculosis of spine
and
it's management

Rehabilitation after
total hip and
knee replacements

Artificial Intelligence
and Robotics
in Orthopaedics

Osteoarthritis

Neck pain

Occupational Health
Issues
in Orthopaedics

Sports Injury
Management in the
Indian Scenario

YOUR HEALTH

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to propagate Health Awareness in the Community

“STRONG BONES STRONGER NATION”

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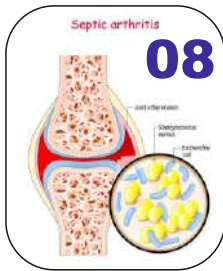


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Dr Chinmay Nath

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World No Tobacco Day 2023: We need food, not tobacco

Editorial

On 31 May 2023, WHO and public health champions around the world will come together to celebrate World No Tobacco Day (WNTD).

This year's theme is We need food, not tobacco. The 2023 global campaign aims to raise awareness about alternative crop production and marketing opportunities for tobacco farmers and encourage them to grow sustainable, nutritious crops. It will also aim to expose the tobacco industry's efforts to interfere with attempts to substitute tobacco growing with sustainable crops, thereby contributing to the global food crisis.

Supporting the creation of alternative livelihoods
The tobacco industry often touts itself as an advocate for the livelihood of tobacco farmers. This is a far cry from the truth. The intensive handling of insecticides and toxic chemicals during the cultivation of tobacco contributes to many farmers and their families suffering from ill health.

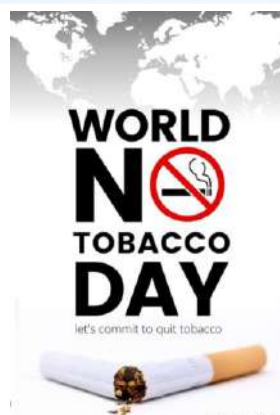


Dr Kakali Sen
Hony. Editor, Your Health



Further, unfair contractual arrangements with tobacco companies keep farmers impoverished, and the child labour that is often woven into tobacco cultivation interferes with the right to education and is a violation of human rights.

The 2023 WNTD campaign calls on governments and policy-makers to step up legislation, develop suitable policies and strategies, and enable market conditions for tobacco farmers to shift to growing food crops that would provide them and their families with a better life.



Your Health of IMA supports all the World No Tobacco Day 2023 movements. It will serve as an opportunity to mobilize governments and policymakers to support farmers to switch to sustainable crops through creating market ecosystems for alternative crops and encourage at least 10000 farmers globally to commit to shifting away from tobacco growing.

From the Desk of Secretary

This month we are having a few very important Health Days we must observe:

2nd May 2023 - World Asthma Day: World Asthma Day is a yearly event that takes place on the first Tuesday of May. In 2023, World Asthma Day observed on May 2. Its aim is to increase awareness and encourage better management and care of asthma on a global scale.

5th May 2023 - World Hand Hygiene Day: Cleaning hands properly can minimise the transmission of infectious diseases and is of paramount importance in daily life. Since 2010, the Department of Health has been echoing the efforts of the World Health Organization in promoting "Hand Hygiene Day" on May 5 every year. During Covid period the main precaution was to wash hand properly and frequently.

8th May 2023 - World Thalassemia Day: Overview: World Thalassemia Day is celebrated annually on the 8th of May, with the aim of commemorating thalassemia patients who died as a result of the disease and encouraging those who are still alive and struggling with it daily.

12th May 2023 - International Nurses Day: Nurses Day honors all people who contribute to the noble profession of nursing. May 12, the birthday of Florence Nightingale was chosen in 1974 as the day of celebration worldwide. She was the founder of modern nursing.

16th May 2023 - National Dengue Day: National Dengue Day is an initiative by the Ministry of Health and Family Welfare, Government of India, to raise awareness about dengue in the country. Dengue Day is celebrated on 16th May each year.

17th May 2023 - World Hypertension Day: World Hypertension Day will be held on 17 May. In 2023, the theme for this important worldwide activity is Measure Your Blood Pressure Accurately, Control It, Live Longer, focusing on combatting low awareness rates worldwide, especially in low to middle income areas, and accurate blood pressure measurement methods.

18th May 2023 - World AIDS Vaccine Day : Every year the



Dr Samarendra Kumar Basu
Hony. Secretary, Your Health

world commemorates World AIDS Vaccine Day on May 18. The day is also known as H.I.V. Vaccine Knowledge Day, a campaign aimed at increasing public awareness about the importance of H.I.V.

20th May 2023 - World Autoimmune Arthritis Day: World Autoimmune Arthritis Day on May 20 was conceived by the International Autoimmune Arthritis Movement (I.A.A.M.) to raise awareness about autoimmune and autoinflammatory diseases that manifest with arthritis.

31st May 2023 - World No Tobacco Day: The theme of World No Tobacco Day 2023 is "We need food, not tobacco" to raise awareness about alternative crop production and marketing opportunities for tobacco farmers and encourage them to grow sustainable, nutritious crops.

We appeal on behalf of Your Health to observe and remember all the above important days in some way.

Guest Editorial

It is an honour for me to write a forward as guest editor for this May 2023 issue of IMA publication YOUR HEALTH which is dedicated to the subject of Orthopaedics.

As our life become faster, more and more people become victims of accidents causing poly-trauma, fractures, dislocation of joints and physical disabilities. On the other hand, with progress of medical science, the average life expectancy of general population is increased considerably. With increasing age, more people are subjected to arthrosis of joints, degenerative spinal problems and osteoporosis. In this scenario, learning orthopaedics is of paramount importance now.

This issue of YOUR HEALTH covers different aspects of prevention and treatment of orthopaedic conditions as well as allied subjects related to orthopaedics. Authors from different part of the country, many of them are stalwarts in their respective subspecialties, have tried to cover different segments of orthopaedics like trauma, accidents, infections, arthritis, spinal problems, paediatric orthopaedics, occupational hazards, rehabilitation as well as newer modalities like sports injury, orthopaedic implants, instruments like robotics and artificial intelligence.

As Orthopaedics is one of the fastest evolving fields of medicine- experts from other specialities, general

practitioners, family physicians and paramedical personnel should have a working knowledge on this subject. Hope everyone will find this issue of the YOUR HEALTH journal as guiding tool for their respective practice related with orthopaedics.

Hope, it will also act as a vehicle for public awareness about orthopaedic diseases and their prevention strategies.



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Message for Your Health



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It gives me immense pleasure to know that one of the pioneers of health awareness publications in the country, "Your Health" is bringing out a special issue based on Orthopaedic science.

Since the last few decades and especially after the covid 19 pandemic changed the perspective of health issues across the world, India has woken up to the challenges with our doctors, scientists and healthcare professionals untiringly focusing on excellence. In the past few years Orthopaedics in West Bengal along with the whole country has taken giant strides in academics, research, newer developments and a comprehensive awareness approach to the society as a whole. In this area West Bengal Orthopaedic Association is playing an enviable role and leading from the forefront.

With the boom in the four-wheeler and two-wheeler market and the rush everywhere, as well as travel both for leisure and work with a mad race against time road traffic accidents has been a major contributor to death, disease and deformities. This accentuates the need

for improved and fast low cost-effective management of accident victims. Training and skill development of everyone involved in the trauma care team both in government and private set ups has been one of the primary focus areas of our association.

Lifestyle changes and increased life expectancy has changed the areas of illness over the last few decades. Obesity and other non-communicable diseases associated with bad living ways have led to a surge of cases with osteoarthritis and degeneration as well as osteoporosis. The latter rightly termed as a 'Silent Killer' has been a source of major concern for present day orthopaedic surgeons. Lack of physical exercises, fast food and ill designed diets, working indoors most of the day and apathy to the condition has made the lives many senior citizens miserable.

Fortunately, our colleagues and fellow surgeons have rapidly developed and propagated the latest skills in joint replacement and spinal surgeries to fight the disease and deformities. We are indeed blessed that the future looks bright as every freshly graduated Orthopaedic surgeon in our state and across the country are well versed in trauma and pelvic acetabular surgery and arthroscopic procedures with fair amount of competence and confidence.

Lot has been done but there is need to grow continuously to keep up the pace in every sector of medical training and upgradation of skills and primarily a holistic approach to the challenges we are facing and likely to face in a newer world.

The theme of the President of Indian Orthopaedic Association this year is 'STRONG BONES BUILD STRONGER NATION.' This summarizes the great optimism in our approach.

Let's work towards a world free of disease, sufferings and deformities.

Septic Arthritis and Osteomyelitis in Children



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Osteomyelitis or Bone infection as it is described generally, is a fairly common infectious process of the body. The infection is always secondary to a systemic infection with the primary being located in the respiratory tract. Bacterial infection is noted in upto to 70% of cases, as seen in synovial fluid & blood CS. The femur and tibia are affected in 70% of septic arthritis. Staphylococcus aureus remains the most common organism.

Recent studies have indicated *Kingella kingae* and *haemophilus influenzae* were the significant etiologic agents causing infection in children less than 2 years of age.

During the last few years, an increasing number of septic arthritis caused by methicillin resistant *S. aureus* (MRSA) was reported.

The incidence of *K. kingae* is also increasingly reported in the etiology of septic arthritis among children less than 3 years of age. Reports from other studies shows *K. kingae* was the most frequent (>40% of cases) cause of septic arthritis in children less than 2 years of age during last decade.

In endemic regions of brucellosis, infections and osteoarticular involvement have been described.

Treatment in Septic arthritis/ osteomyelitis has to be addressed against the most frequent pathogens, but keeping an eye out for the uncommon pathogen. Hip and shoulder septic arthritis in children has to be considered to be an emergency as joints are deeply situated and local signs appear late.

We discuss the treatment of 3 cases here, one a neonate with elbow septic arthritis, another a 3 year old with septic knee and the other one a 10 year old septic arthritis of hip.

1) The neonate presented at 14th day of life with a swelling in her left elbow, not resolved by antibiotics. The physician referred the case after antibiotic therapy for 4 days. The elbow was drained by lateral approach. Antibiotic regimen was continued for 1 month.

2) A 3 year old boy presented with pain in right knee with high grade fever for 2 days. Initial antibiotic regimen was with Amoxycillin & clavulanic acid. Immediate arthrotomy was done evacuating the pus and Antibiotic regimen was continued for 6 weeks.

3) The 10 year old boy presented with limping and persistent pain in the groin region. An MRI was performed to note the presence of Septic arthritis of hip and osteomyelitis of proximal femur. Immediate arthrotomy of the joint was done and the joint lavage was performed. Antibiotic regimen was continued for 3 months.

Conclusion:

Arthrotomy and Cortical decompression remain the cornerstone of management of the septic arthritis and osteomyelitis.

As you must have noted, Antibiotic regimen duration increases with age. Complete remission is possible in these infections as described.



The science, art and commerce of Orthopaedic implantology



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Definition

An Orthopaedic implant is a medical device manufactured to replace a joint or bone or to support a damaged bone. This medical implant is mainly fabricated using stainless steel and titanium alloys for strength and the plastic coating that is done on it acts as an artificial cartilage.

The term Orthopaedic implantology has been coined by us. Previously it was only used to refer to dental implants.

Introduction – The science

Bone is a living tissue with ability to repair itself. Like all tissues in the body, it is subject to injuries, wear and tear as well as deformity. Sometimes, this damage interferes with function, causes disability and/ or

deformity. In some cases, the bone may be diseased or tumorous requiring removal.

The purpose of Orthopaedic implants is several fold. In fractures, the implant supports the damaged bone, maintaining the displaced bone as close to the pre-injury anatomical position as possible.

This allows the bone to heal in this acceptable position so that the muscles and ligaments are positioned and tensioned appropriately, allowing them to return to function quickly. Once the bone unites and consolidates satisfactorily, the implant loses its function and may be removed if necessary.

Apart from fracture surgery almost all other implants are permanently placed inside the body. The reason is that they are “replacement” implants and are inserted after degenerative or diseased bone is excised. This marks the fundamental difference in implants used in trauma surgery and other groups. This is another reason why the quality of non-trauma implants has to be markedly superior in metallurgy and design to implants used in fractures. The indications for orthopaedic implant usage can be broadly classified as below.

Fractures or trauma surgery – a displaced fracture is reduced to its anatomical position. The role of the implant is to retain the fracture fragments in the reduced position. It must be strong enough to withstand the deforming pull and push of the surrounding muscles and ligaments.

Arthroplasty- replacement of joints are usually for damage due to arthritis. Today there are replacements for almost every mobile joint of the body though the popular ones are hip, knee, shoulder and elbow. Some of these implants are full replacements -other partial. Depending on the pathology, the implants may be surface replacement or may replace the body of the entire joint.

Musculo-skeletal tumour surgery- It is often necessary to replace a bone or joint which has been ravaged by a tumour. These replacements can only be done when the spread of tumour is under control.

Sometimes in an impending pathological fracture prophylactic nailing is done to prevent the patient from facing severe pain and distress including the spread of the tumour.

Soft tissue reinforcement in ligament reconstruction -

This includes ligament augmentation devices, buttons, special sutures and artificial ligaments. Usually, they are used in sports surgery mainly around the knee and shoulder.

Miscellaneous- during bony reconstruction while performing an arthrodesis or other forms of musculo-skeletal reconstruction. Ilizarov and other fixators are used in treating difficult deformities.

Commonly used Orthopaedic implants:

This enumerative list is not exhaustive. Please note that each type of implant has many many variations in design. We have only mentioned the generic headings.

Trauma:

- Plates (Figure 1)
- Nails (Figure 2 and 3)
- External fixators including ring fixators
- K-wires, Titanium Elastic Nails (TENS)
- Prostheses

Arthroplasty:

- Prosthesis including cement made from metal alloys and polyethylene.
- Advanced implants for revision surgery

Tumours

- Mega prosthesis
- Nailing for pathological fractures

Miscellaneous

- Artificial ligaments
- different types of grafts including allograft
- Silastic materials

Metallurgy and materials commonly used

- Stainless steel – 316L – mainly for trauma
- Titanium alloys – trauma and arthroplasty
- Cobalt chrome for joint replacement (good for bearing surfaces)
- Polyethylene different grades
- Others- Tantalum, Vitamin E infused polyethylene (to prevent degradation of polyethylene by free radicals), ceramics etc.



Figure 1: Picture of various types of plates used in orthopaedicsurgery

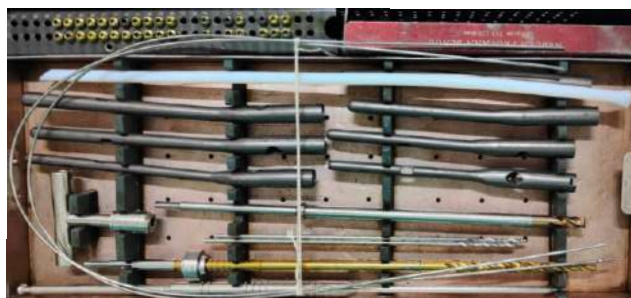


Figure 2: Picture of short and long titanium proximal femoral nails (PFN)



Figure 3: Picture of various sizes of helical blade used in the femoral head along with the PFN

Sterilisation of implants

- Autoclaving
- Gama radiation and pre-packed before usage
- ETO
- Cleaning and Disinfecting by soaking in liquids such as cidex which is (in case of implant getting contaminated)

Careful surgical handling of implants are necessary for good outcomes this is done by :

- Sterility by good surgical technique including

minimum touch, use of specific inserting instruments

- Prevention of scratches by delicate handling and padding
- Patient must be instructed how to not damage implants by incorrect usage
- OT personnel must be instructed how to not damage implants during surgery and sterilising.

Removal of implants

Not all implants are removed. However, there are specific indications for removal:

- Trauma- All K- wires, TBW, Ex- Fix, Circular frames should be removed
- Plates and nails can be removed after the fracture unites (usually after 2 years) in younger patients – risks of refracture must be explained. Also delayed weight bearing and partial weight bearing after removal
- Arthroplasty implants are removed during revision, infection etc

Important directions for removal of implants

- Use appropriate tools for the implant you have to remove. Have backups ready as well as a plan B should your original plan (Plan A) fail.
- Keep a variety of tools available to you.
- Implant removal can be very easy or very difficult.
- Do not fracture the bone or damage neurovascular structures while removing implants.

The art of implantology

Surgery is an art as well as a science. Some surgeons are more skilled than others. Like all skills individual variations in ability will exist and can never be eliminated. However, it is very important that every Orthopaedic surgeon is necessary a safe surgeon. This can be done by following the following protocols:

- Familiarise yourself with the implant after discussing it with knowledgeable people and reading the instructions of the manufacturers.
- Learn the surgical steps of the operation after assisting good surgeons and practising on cadavers.
- Learn the safe surgical corridors of implant insertion so that the implant does not damage vital structures e.g., the course of the radial nerve should be known while doing plating of the

humerus.

- Attend courses and workshops to know the implant of choice for a given surgery.
- Occasionally a surgeon may face a dilemma of choosing between using a known implant or an unknown but apparently superior implant. In such a situation (s)he should choose the path of maximum safety.
- If expecting a problem or uncertainty with a particular implantask a more knowledgeable surgeon to scrub with you.

The commerce of implantology

The global orthopaedic implants market size was valued at USD 33.5 billion in 2022 and is expected to expand at a compound annual growth rate (CAGR) of 6.3% from 2023 to 2030. Naturally there are considerable commercial interests involved in the usage, marketing and promotion of implants.

A surgeon will have to face these commercial forces on a daily basis from his peers, health care institutions as well as from companies. He may be unduly influenced by various workshops, course and conferences. Various implants have different levels of availability, vendor support and price range.

It is vital for the surgeon to keep the science in mind when doing implantology. He should do whatever he thinks is the best for the patient. Sometimes it is not possible to use the best implants in view of affordability. It is however important that (s)he does the best operation for the patient using the best affordable/available implant under the prevailing circumstances.

Conclusion

- The study and knowledge of implants is an essential part of modern Orthopaedics
- Orthopaedic surgeons should have a clear idea about the implants they are using as they are accountable to the patient as well as legally.
- Use good quality implants with appropriate designs.
- Follow the instructions of the manufacturers.
- Make sure your surgical training is adequate.
- If you are a junior do not experiment.

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Observance of World Health Day and the Inaugural Ceremony of Your Health Publication - May 2023 Edition



What an MRI Scan can Reveal about your Injury

The Basics of MRI Scan

An MRI machine is a large tube filled with magnets that uses radio waves and a magnetic field to generate images of structures in the body.

MRI scans can detect injuries that X-rays can't. Furthermore, they can reveal the type of injury and the severity.

Because of these benefits, they can provide key insights and help Doctors determine the most appropriate way to treat a variety of injuries.

Why it can be critical to get an MRI Scan after a car accident

Millions of car accidents occurred in India in 2022 alone and while broken bones are undoubtedly among those injuries — which can be detected by X-Rays — many injuries involve soft tissues and organs, which X-Rays can't detect.

This makes it wise to visit an accident center equipped with an MRI machine. An MRI Scan can allow your Doctor to view bones, joints, and soft tissues, such as your tendons and cartilage.

MRI scans can help determine the age of an injury

Without an MRI Scan, determining the age of an injury can be difficult. An MRI Scan can help a Doctor see if an injury was the result of a recent accident, if it occurred

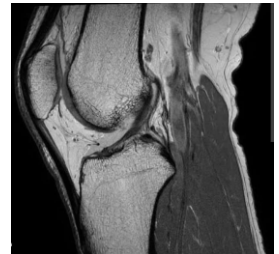


long ago, or if it is a chronic issue.

The radiologist will evaluate the diagnostic image, and will conduct a thorough analysis of the findings. The radiologist will look for signs of acute trauma as well as degenerative changes in the anatomy, which could indicate a more chronic condition.

MRI scans can reveal spinal cord and whiplash injuries

Spine and neck injuries are common ailments sustained from car accidents. Whiplash occurs when the force of the accident causes your head to jolt forcefully forward then backward. An MRI Scan can help diagnose spine and neck injuries, such as whiplash.



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Tuberculosis of spine and its management

Introduction

Spinal Tuberculosis is the most dangerous as well as commonest form of all skeletal tuberculosis. First modern case of spinal tuberculosis was described by Percival Pott in 1779. In recent era, increasing frequency of TB in both developed and developing nations continues to make spinal TB a dreaded health hazard. Neurological complications in spinal TB is gruesome. In the present century, two newer problems have emerged. One is emergence of multi drug resistant TB and another is TB in immune-deficient conditions like AIDS. More accurate imaging modalities like CT and MRI, modern biochemical as well as immunological tests and advances in spinal reconstruction techniques have changed the management and outcome of Pott's disease.

Immunity and Tuberculosis

Delays in presentation and diagnosis are almost universal in the treatment of spinal infection in our country. Immuno suppressed patients tend to have longer delays to presentation. It is important to know the patient's immune state in the HIV/AIDs, diabetes, renal transplant, drug abuse, old age, malnutrition, malignancy, long-term use of anti-rheumatoid agents, steroids and anti-cancer chemotherapeutic agents are also important. Immune system in the elderly patients is generally weak and reactivation of the latent tuberculosis is often reported.

Pathophysiology of spinal tuberculosis

Musculoskeletal tuberculosis arises from haematogenous seeding of the bacilli soon after initial pulmonary infection. Skeletal tuberculosis usually starts as osteomyelitis in growth plates of bones. In the long bones TB originates in the epiphysis and causes tubercle formation in the marrow. The joint synovium responds to the mycobacteria by developing an inflammatory reaction, formation of granulation tissue and pannus that begins to erode and destroy cartilage and eventually bone.

It causes osteonecrosis and collapse of the vertebrae and/or expanding abscess or direct involvement of



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cord and meninges by granulation tissue. Neurological deficits are usually symmetrical and gradual in onset.

Clinical features

Active stage: Back pain is the most frequent symptom of spinal tuberculosis. Generalised clinical symptoms during active phase of the disease are malaise, loss of weight, loss of appetite and evening rise of temperature. The spine is very stiff with localized kyphotic deformity. Paravertebral muscle spasm may be present. During sleep the muscle spasm relaxes permitting movement between the inflamed surfaces causing night cries. A cold abscess may be present clinically. Past or family history of tuberculosis should always raise suspicion of TB.

Healed stage: When the disease has healed, the patient does not look or feel ill. There may be no

weight loss, fever etc. There is no pain or tenderness in the spine and the spasm of the vertebral muscles is absent. Biochemical and haematological parameters may become normal and there is radiological evidence of bone healing.

Diagnosis of spinal TB

Differentiating spinal TB from pyogenic and fungal vertebral osteomyelitis as well as primary and metastatic spinal tumors may be difficult. High index of suspicion is needed from the clinician. These include observation of clinical signs and symptoms and the use of various imaging techniques, smear and/or culture, polymerase chain reaction (PCR) and histological study.

Tuberculin test

The tuberculin skin test (Mantoux) has inherent limitations of sensitivity and specificity.

Laboratory tests

Laboratory tests include: 1) CBC 2) ESR and CRP 3) smear and/or culture 4) histology 5) patient's antibody response and detection of antibody to *M. tuberculosis*; 6) PCR

The diagnostic Gold standard is isolation of *M. tuberculosis* from clinical samples and the typical histology. Culturing *M. tuberculosis* is time consuming. Diagnosis of tuberculosis depends mostly on histological evidence.

Imaging

Imaging techniques such as simple radiographs, bone scan, computed tomography (CT) and magnetic resonance imaging (MRI) are useful but not confirmatory.

Plain X ray

Even in modern era, plain x ray still remains the cornerstone of spinal imaging. It often provides enough information for diagnosis and treatment of spinal tuberculosis.

CT scan

CT demonstrates abnormalities earlier than plain radiography.

MRI

MRI is the neuro-imaging of choice for spinal tuberculosis. It is more sensitive than x-ray and more specific than CT in the diagnosis of spinal tuberculosis. MRI detects neurologic involvement. MRI readily demonstrates involvement of the vertebral bodies, disk destruction, cold abscess, vertebral collapse, and spinal deformities.

Treatment

CHEMOTHERAPY

Antitubercular drugs



Fig 1: C2C3 TB spine treated with without

The treatment of spinal tuberculosis is primarily medical with chemotherapy. Antitubercular treatment should be started as early as possible.

Most (82–95%) of the patients of spinal tuberculosis respond very well to medical treatment only. The treatment response is apparent in the form of pain relief, improvement of general condition, appetite and neurological deficit.

Histopathological confirmation of the diagnosis by biopsy is desired before starting chemotherapy. Culture of the aspirated material and drug sensitivity test (DST) will identify organisms resistant to one or more anti-tubercular drugs. Combination of drugs is essential to prevent the emergence of resistant strains. To facilitate continuous treatment, DOTS (Directly Observed Treatment Short course) therapy has evolved which ensures uninterrupted supply of medication.

There was confusion among the clinicians about the total duration of treatment. World Health Organization (WHO) now recommends a category-based treatment for tuberculosis. Spinal tuberculosis falls under category-1 of the WHO treatment category. The category-1 antitubercular treatment regimen is divided into two phases: an intensive (initial) phase and a continuation phase. In the first 2-month intensive phase, antitubercular therapy includes a combination of four first-line drugs:

isoniazid, rifampicin, streptomycin, and pyrazinamide. In continuation phase, two drugs (isoniazid and rifampicin) are given. WHO recommends 9 months of treatment for tuberculosis of bones or joints.

SUPPORTIVE MEASURES

General supportive measures, together with prolonged bed rest, plaster cast and bracing were used in TB spine before the era of antituberculous chemotherapy.



Fig 2: Spinal brace

SURGERY

Although chemotherapy is the mainstay in the management of tuberculous spondylitis, surgery still plays an important role.

Potential benefits of surgery were less kyphosis, immediate relief of compression of neural tissue, quicker relief of pain, higher percentage of bony fusion, less relapse and earlier return to previous activities,

Surgical Approach

Surgical approach is determined by the site of the lesion, extent of kyphosis, patient's condition and surgeon's preference.

As the vertebral bodies are destroyed in most of the cases, an anterior approach is ideal for thorough debridement and reconstruction. Traditionally, in the thoracic and thoracolumbar spine, the approach can be through thoracotomy or thoracoabdominal approach or indirectly by anterolateral approach. The subaxial cervical spine from C2 to T1 or T2 can be exposed by the standard Smith-Robinson approach. Trans-oral or retropharyngeal approaches may be necessary for lesions of C1 and C2.

Recently, lesions of thoracic, thoracolumbar and



Fig 3: Transthoracic



Fig 4: T6-T7 TB- Posterior approach

lumbar spine are being debrided, extirpated and reconstructed through posterior approach alone via transpedicular route.

Mainstay of surgical treatment of spinal TB are-

- Thorough debridement.
- Instrumentation: Stabilization of spine with pedicle, screws, rods, plates, screws and reconstruction with cages.
- Reconstruction of anterior column: With tricortical iliac crest bone graft, rib graft excised during thoracotomy or titanium cages filled with cancellous bone.

Conclusion

Tuberculosis of spine is one of the most destructive form of extra-pulmonary TB. Both the diagnosis and management of spinal TB need extra effort and recruitment of most complex and modern amenities. Though many cases can be managed with multidrug anti-tubercular chemotherapy, rest and bracing, a sizable number of patients- especially those with complications- require surgical treatment.

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Rehabilitation After Total Hip and Knee Replacements

Rehabilitation after total hip replacement (THR)

Total hip replacement (THR) or hip arthroplasty (THA) is prosthetic replacement of proximal femur and acetabulum. Hemi-arthroplasty replaces proximal femur leaving the native acetabulum intact.

Actually rehabilitation should be started before operation with patient education; strengthening of hip, knee, spinal muscles.

Muscles needed for crutch walking also to be strengthened. Rehabilitation after THR ideally be done by shared decision of patient, care giver, PMR specialist, surgeon, physiotherapist, occupational therapist, rehab nurse and social worker functioning as a team. The goals are:

1. Restoration of maximum range of motion (ROM) with in precaution limit
2. Reduction of pain
3. Improvement of muscle strength of hip, knee and spine
4. To promote ambulation and functional independence of ADL (activities of daily living).



Gravity eliminated active exercises on a patient of THR



Strengthening exercises of hip flexors on a patient of THR

Rehab can be divided into two phases:

Initial postoperative phase (day 1 to day 4 or hospital discharge)

Rehab programme focuses on-

1. Education on hip precaution regarding dislocation
 2. ROM exercises with in precaution limit
 3. Isometric exercises of glutei, quadriceps, hamstring and ankle muscles.
 4. Early mobilization with use of assisted devices
 5. Weight bearing as tolerated (WBAT) and gait training on level surfaces with walker or crutches.
- Hip precautions vary by surgical approach and surgeon's



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preference. Some precautions of posterior approach are:

- Don't flex hip beyond 90°
- No internal rotation
- No abduction
- Use trochanter roll
- Keep knee in extension and abduction
- Use high chair for toilet activities.

Pharmacotherapy for DVT prophylaxis and control of pain and infection are routinely advised.

At the end of this phase patient should walk 150 feet with gait aid maintaining hip precautions and can perform basic ADL activities.

Home care rehab phase (from hospital discharge to 6 weeks)

Recommended exercises are performed under supervision of therapist maintaining dislocation precautions.

1. Strengthening of muscles of operated leg
2. ROM and stretching exercises
3. Proprioceptive exercises- weight shifting exercises and single leg stance

4. Endurance training
5. Gait training with goal to wean all assistive devices at the end of this phase with permission of surgeon. It is estimated that 4 to 6 months are required to return to preoperative level of activities. Patients with comorbidities may need more time.

Rehabilitation after total knee replacement (TKR)

Total knee replacement (TKR) involves removal and replacement of both tibial and femoral weight bearing surfaces of knee. Preoperative strengthening of quadriceps, hamstring and crutch walking muscles should be encouraged. Postoperative rehabilitation divided into four phases.

Phase One (1 to 7 day/ hospital discharge)

1. Gentle ROM exercise of knee- flexion & extension
2. Ankle pumps
3. Strengthening exercises of quadriceps, hamstring and glutei
4. Transfer and walking training with help of knee immobilizer
5. Gait training with walker or axillary crutch
6. Basic ADL activities training with adaptive equipment
7. Trochanter roll to maintain hip in neutral position and provide knee in extension
8. Ice may be applied after each session

Phase Two (Hospital discharge to 4 week- home care rehab)



Isometric quadriceps exercises on a patient of TKR



Light weight theraband Exercise

1. Continue all phase one exercises
2. Prone knee flexion
3. NMES (neuromuscular electrical stimulation) to quadriceps if muscle recruitment is poor
4. Low resistance dynamic exercise by stationery bicycle
5. Proprioceptive exercises like weight shifting and single limb stance
6. Gait training and stair training with the help of appropriate device

Phase Three (Week 4 to 8 - outpatient rehab)

1. Continue phase one and two exercises
2. Increase dynamic resistive exercise regime
3. Proprioceptive and endurance exercise
4. Patient may advised to use single handed device or no assistive device for walking at the end of this phase

Phase Four (Week 8 to 12 - independent programme)

1. Continue daily ROM exercises, strengthening, stretching, proprioceptive and endurance exercises - 5 days in a week
2. Patient may return to preoperative exercise regime and recreation activities
3. He/ she may return to low impact athletic activities.
4. Sports specific training exercise may be started.

Some potential complications of TKR are loosening of implant, periprosthetic fracture, patellofemoral complications, infections, DVT, common peroneal nerve palsy. They should be kept in mind during rehab programme.



SLR and Hamstring strengthening exercise

Artificial Intelligence and Robotics in Orthopaedics



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Abstract

The spread of Artificial Intelligence (AI) in almost every sphere of life, especially recently, is progressing in an astonishingly accelerated way. Even without realizing, people use some form of AI in their daily activities. Medical science is no exception. In fact, the huge data (big Data) generated every minute from the medical and surgical management in 'modern' medicine is suited for Machine learning (ML) and AI for finding correlations, formulate guidelines, prognostications and predictions.

Robotics, already in use since 1960's has been enhanced by AI to evolve into smart and connected machines. International conferences on AI and Robotics are held regularly the world over, participated by scientists and industrialists of different disciplines. Their concerted effort (guided by business and economic principles too) has been contributing in development of a paradigm shift.

Application of AI and robotics in orthopaedic speciality of modern medicine is happening, but at a slower pace

than some other specialities. This article explores the various uses of the two interrelated branches of science and technology in orthopaedics.

Abbreviations

AI	Artificial Intelligence
ANN	Artificial Neural Networks
BD	Big Data
DL	Deep Learning
DVT	Deep Venous Thrombosis
EMR	Electronic Medical Record
GCT	Giant Cell Tumor
GPT	Generative Pre-trained Transformer
MIS	Minimally invasive Surgery
ML	Machine Learning
NLP	Natural Language Processing
PGHD	Patient Generated Health Data
PROM	Patient Reported Outcome Measures
RAS	Robot Assisted surgery
TKR	Total Knee Replacement

Introduction

The thought/dream of intelligent machines performing mundane, laborious or hazardous jobs started thousands of years back. Evidence of this thought were found in mythology and history of different civilisations. The 'Bhuta vahana yantra's', allegedly guarding the remains of Gautama Buddha, in the Ajatashatru regime (5th century BC), were akin to robots. The infamous Pandora (who opened, not a box, but a jar) was a created being, not a born one. Today we call these machines Robots, originating from a Slavic word Robota, meaning bonded labourers. Karel Čapek used the term ROBOT in a 1920 play which was then translated for the English audience in 1922. In the play, a scientist built a factory of making human-like machines, and another imparted human-like thinking ability in those robots. It was a satire against mechanizing the human factory workers in the backdrop of industrial revolution, but both Robotics and AI were incorporated in the play.

Al-Jazari's robots (13th century AD, in what is now Turkey) performed musical performances, and they were programmable by shifting a few levers (Some call him the father of robotics). The genius Leonardo Da

Vinci built an automaton of a knight in late 15th century which could move its arms, sit down and get up. The most-used robot in the field of abdominal surgery, has been aptly named after him. Nowadays, there are many types of such robots taking part in different branches of surgery.

Robots are being used in many different areas of human civilization. They go for firefighting; take samples from covid suspects; do the assembly job in making your car because they do not get tired by doing the same task over and over and over; they were sent to Afghanistan by USA for surveillance; and they also clean carpet in home (because the owner doesn't have the time or inclination). Integration of computer vision, tactile feedback, augmented reality and virtual reality is also happening fast.

AI is included nowadays in so many activities of our daily life that we are not even aware of most of it. If you book a car via Uber, or search in Google, you actually use AI. The promotional texts / pictures / video advertisements in your inbox that annoy or help you (depending upon your need) is part of the result of AI, generated from your past orders or even the products you surf on the net or your social media activities. The items you encounter first when you open Amazon or Netflix are the result of data mining and AI. Your email app, powered with AI, 'sense' promotional emails and sends them to spam and trash folders. If you are a seller, on the other hand, you will not hesitate to pay for the AI that provides you the marketing strategy. "Data is the new Oil".

At the same time, the AI can help people get proper treatment and save lives.

Basics of Artificial Intelligence and Robotics

Intelligence have been defined in many ways. Part of its meaning from the Merriam Webster dictionary:

the ability to learn or understand or to deal with new or trying situations: REASON, and its use
the ability to apply knowledge to manipulate one's environment or to think abstractly.

Human intelligence has the capability of learning (acquire and process previously unknown / un-encountered data), Reasoning (by manipulating the

info), understanding (the result of the manipulation) and separating data from belief.

AI does not necessarily mean we are losing our intelligence. But the human intelligence can only do so much. A grocer can calculate the cost of the items in his mind or on paper. As the number of customers and items grow, a calculator becomes the fastest way because he can do only so many accurate calculations per second. In a departmental store, with multiple salespersons, even individual calculators won't do because all the sales persons have to sum up their individual totals. They need an integrated system where a central computer collects the sale details so that it can instantly calculate the stock position of the store and place orders.

It's just a computing job and no intelligence is needed from it. Imagine a bigger scenario: the store is part of pan-India chain, all are connected to a computer with much larger capacity, because data is huge. It can be programmed to analyse which area of the country consumes, say, more urad daal and order more for that region. Conversely, it can also analyse, which regions are lagging behind in urad daal sale, and whether it will benefit the owner to promote urad daal (with attractive discounts) in those particular regions. This job of analysing large amount of data is beyond the brain capacity of a single or a group of intelligent human beings. It needs AI.

Picasso once told that computers were useless to him because they could only provide answers. Probably, today's computer applications would be of use to him, because they can formulate questions from the answers, and can generate new answers from those questions. Classical computing is algorithm based. Suppose the program has a simple equation: $A = B(1+CD/100)+30$. If we tell it that $B=100$, $C=8$ and $D=5$, it provides the answer: $A=170$. Of no use to Picasso... it just provided an answer. What if it is reversed? The computer is given the output 170, and the inputs 100, 8 and 5 and then asked to FORMULATE the question (how 100, 8 and 5 can become 170)? Easy till now because the data is simple. Picasso could solve it while painting.

Imagine a situation to a level beyond the genius of Picasso, or even, say, Einstein. FasTag data showed an average daily collection of Rs 134 crores in December

2022. This meant approximately 1 crore vehicles crossed toll gates that month. AI may come up with questions like: Which of the toll plazas are to be upgraded to accommodate more toll gates to reduce congestion? AI can 'solve' that question too.

Computers can do the following much faster than us: complex calculations, comparisons, pick up patterns and correlations and then applying this for scientific predictions. They do not get tired, bored or make silly mistakes in calculations. On the other hand, they cannot have mental feelings and understanding what they are doing. Alexa can listen to our spoken words and respond, but without understanding.

Components of AI in brief:

BD: Expanding volume of data can be processed by improving the storage memory, the RAM and the processing power. Upto a limit. Beyond that, data cannot be handled just by more memory or processor power, and needs a different kind of computing. This data (beyond the limit) is called big data. BD may come in real-time (such as the per-operative commentary from the surgeon), so, processing has to be extremely quick. BD may come in structured (easy to compute) form such as the hemoglobin level of all the pregnant ladies in a state, or in unstructured form such as patient records containing handwritten notes, images and their reports.

“Too big, too fast, too diverse”.

ML: Machine learning uses past data (experience) to tackle present challenge. No need to 'reinvent the wheel' every time. This 'learning' allows the system to handle unforeseen events (such as a new furniture in the room to move around, for a robotic vacuum cleaner, or an abnormal tendon for a surgeon). It essentially trains itself from real-time data. More data used in the input = more 'experience' = can face bigger challenges (like an experienced surgeon vs a new trainee). Just as a student practice a specific math over and over to be proficient, the computer algorithm has to go through many cycles (called epoch's) of training till it passes the tests.

Large textbooks are used by doctors (4000+page books are common in orthopaedics). Human beings can memorize only a small part of it. In contrast, computers do not forget (probably because they do not have to think about income, the family and court cases!) Well-trained machines quickly come to a

solution.

NLP: Deals with how the computers can be made to recognise and write/speak natural, human language. You type (or say to Siri) a natural sentence like 'what smartphone should I buy in 2023' in Google or 'explain the role of proteins in our diet' in OpenAI's chatGPT, and the AI takes over to generate answers.

Robots, in use since 1960's, have been infused with AI recently. They have been given ability to communicate and to handle unforeseen events. Online giants like Amazon, in their warehouse, have robots capable of taking the order from the control computer. The order itself is created by a human customer, or AI-driven. They move to the appropriate shelves, read the barcode to confirm, then pick the item up for pre-delivery checkup.

European commission EC has defined robots as 'AI in action in the physical world'.

The laws of robotics were formulated by Isaac Asimov, the best-known sci-fi author. They are :

- 1 A robot may not injure a human being or, through inaction, allow a human being to come to harm.
- 2 A robot must obey the orders given to it by human beings except where such orders would conflict with the First Law.

- 3 A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws”.

Later, he added a 'zeroth' rule “A robot may not harm humanity, or, by inaction, allow humanity to come to harm”.

Subsequent development of robotics followed and was inspired by those 'law's.

Autonomy of the robot: robots may be operated remotely (all the instructions are sent to it from a location outside it) or it can be fully autonomous (all the instructions stored inside the robot). They can be just assistant to the operator (like the hill-assist in a car); or they can have partial automation (akin to auto braking in some cars); or fully automated (analogy: self-driven car).

Different forms of robots.

Commonest : robot arm with capacity to hold instruments. Cannot move from place to place. Used in car factories, and in operating rooms to assist the surgeon.

Another category can go from place to place with

wheels (robo-vacuum cleaners), rotors, and even legs and wings. Drones are special type of such robots.

The third type of robots are a cross of the two above: they can move and have robo-arms. Two-legged ones are most popular in movies, but least common in real life, because, they have to spend energy continuously in sensors and motors for balancing, just to remain upright. this needs a heavy and costly battery.

Applications in Orthopaedics

AI and robotics in the design, manufacture and R&D of implants and instruments are kept out of purview of this article.

Four main reasons of AI in orthopaedics: expanding volume of patient data, variety of the data (as stated earlier), up-going patient's expectations and the professional hunt for perfection.

Image processing: X-ray, CT and MRI are the main images in orthopaedics. A program was created by Lodwick (1963) to detect some bone tumours (including GCT and Ewing's sarcoma) with 80 to 100% accuracy, simply from x-rays. Gearrets et al. used AI to predict BMD from xray images (cost-saver).

AI has been increasingly applied to enhance the accuracy of diagnosing fractures and bone diseases.

Orthopedic / Radiology departments of some hospitals have setup ML labs.

Large database of images is needed to train the computers (ML). MURA (MUskuloskeletal Radiology) was such a project with 40000+ X-ray images, and FastMRI is another one, with MRI images. AI is used to rapidly triage patients depending on the severity of their skeletal injuries, in a mass accident. NLP can be used to extract fracture info from the reports. Radiologist-to radiologist differences can be minimized using AI based abnormality detection. This has already been applied to diagnosis of rotator cuff problems in the shoulder. AI can recognize components used in knee replacement, from x-ray images. Periprosthetic fractures, infections and loosening are detected from x-ray images with 88 to 100% accuracy.

Medical management: Medicines are often prescribed in orthopaedics. Aged patients sometimes use various medicines before consulting an orthopaedician. Nobody can remember all the drug interactions and side effects. Complex correlation of different parameters is difficult even for human experts. AI

helps to decide safe yet effective medical management for orthopaedic patients. In major trauma and surgeries, lab investigation results can alter over time. AI can detect those to guide medical treatment and prognosticate. This decision support can save limbs / life.

Prediction of risk: AI can guide the orthopaedician here. The clinical data, genome data, medical images and lab test data all are processed by AI. AI can predict chances of success or failure of a certain method of treatment or a certain complication (like DVT after a TKR), in a GIVEN patient. Suppose we tell the patient that in such cases, 82% get well. But the patient wants to know what is the chance that HE (or SHE) would be in the 82% or the 18% group.

Patient monitoring and rehabilitation: A system of patient reported outcome measure (PROM) is already in place. AI can collect data from it and monitor the progress, then suggest home based or hospital-based solutions. Complications are detected quickly and accurately to allow prompt treatment. Patient satisfaction (or the lack of it) in thousands of knee replacement cases were analyzed by AI (because multiple factors could determine satisfaction). Different types of sensors (wearable computers, of which smart Halter monitor is an example) generate PGHD. AI is the ideal tool to bring together EMR and PGHD / PROM.

AI based patient monitoring is very helpful in the operating room. The computer can integrate the outputs of several gadgets (anaesthesia console, tourniquet, arthropump, electrosurgical unit, neuromonitoring system and C-arm to name a few) in real-time and alert / take action in case something untoward is GOING TO happen.

Orthopaedic, education and research: AI can provide virtual training for trainees and teachers. Real world simulation with VR is harmless to the patients and portable. The big data form the results of tests after training can be used by AI, to formulate teaching protocols.

OpenAI has already helping students to create contents. So much so, the teachers sometime get annoyed whether the content written by a student is, in fact, copied from openAI !

AI is already in work for the researchers when they search google for references and materials. Analysis of

Multivariate data especially of large volume, are best suited for AI.

The term Robotics in Orthopaedics brings to the mind a vision of a robot performing a surgery on spine or a damaged joint. Those are only part of the current scenario. There are four basic types of robots in medical (including orthopaedic) context:

Surgical: Performs or Guides /assists the surgeon

Physically assistive: Supports user through physical interactions (e. g smart prostheses)

Socially active: Assists by social interactions

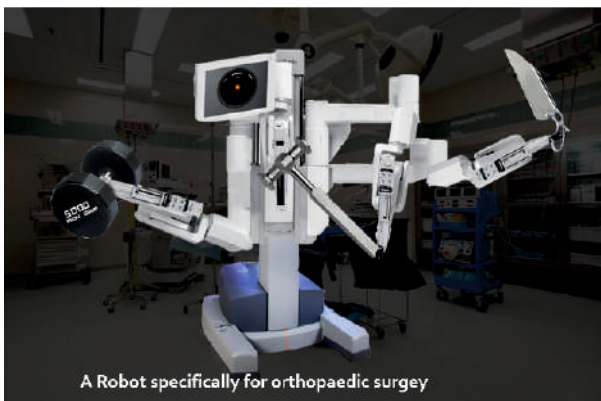
Healthcare service robots: Assists the smooth running of large hospitals

Davies defined surgical robot as “computer-controlled manipulators with artificial sensing that can be reprogrammed to move and position tools to carry out a range of surgical tasks.” The micro-robots (microbots) used in vascular surgery and orthopaedics are not robots in that sense, so will not be discussed here. Robotic surgical instruments such as robotized microscopes and tables are not surgical robots either.

Physically assistive robots are also called exoskeletons' are wearable robo dresses that assist user to move the limbs.

Dynamic foot in artificial limb can sense the texture, dryness or wetness, slope and curvature of the surface under it, and modifies power and traction when negotiating slopes, uneven grounds (like our body does this without us even being aware of it).

A battlefield robot with multiple arms performs as scrub and circulating nurses. The system has been shown to perform shunts in major vessels, and bowel resection anastomosis via tele-operating surgeons sitting in a safe remote location.



A Robot specifically for orthopaedic surgery

Robots in surgery: Surgeons have been using robots for

forty years now. Some branches (laparoscopic surgery, neurosurgery, spine surgery, arthroplasty) have taken up robotics faster than the others.

The advantages are: more accuracy and precision, less tremor and more dexterity of the surgeon's hands and zero fatigue and lower incidences of errors. Clinical benefits are: Less tissue damage, faster surgery (after the learning phase is over) therefore less chances of infection, less length – of -stay in hospital.

Cost and implementation and learning curve of the surgeon are the two main problems. The robots can inflict injury or even death if the system malfunctions.

Surgical robots come in various shapes, sizes and specifications. Some are designed for only a specific type of surgery others are more versatile.

The robot needs to have as much image information about the target object as possible. The reference frame in the space (around the patient) are registered in the machine. Preoperative planning is then put in, and the algorithms take over. Navigation guidance, C-arm guidance and even USG guidance have been used for this. The robotic arm is controlled by the machine



(remotely in some systems, or in the active physical presence of the surgeon).



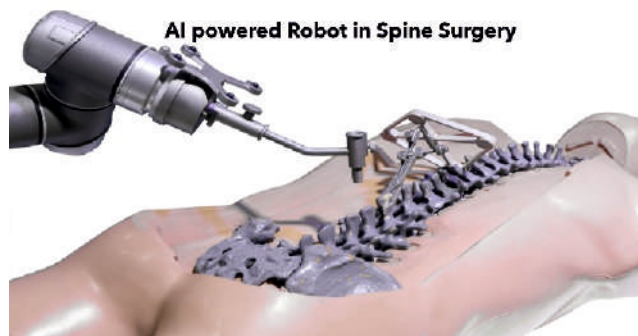
Some of the systems need preoperative CT scans for planning, some are 'imageless'. For bone shaping, some use burrs, some others use saw.

Some orthopaedic surgical uses of AI enabled robots nowadays are:

- Pedicle screw placement in spine
- Transarticular screw fixation in cervical spine
- Preparing the bone ends in Complex primary and revision hip & knee replacements
- Complex osteotomies
- Osteonecrosis of femoral neck: Precise placement of vascular fibular graft
- MIS in pelvi-acetabular fractures

- Interlocking nailing
- Percutaneous fixation of femoral neck fractures
- Hip arthroscopy

Augmented reality and virtual reality are being incorporated in AI robotic surgery for better surgeon



experience, 'naturalness' and ease. Several other areas of robotics are being explored, some of which are:

- Bone biopsy
- Injections in specific locations

A battlefield robot with multiple arms to function as scrub and circulating nurses. The system has been shown to perform shunts in major vessels, and bowel resection anastomosis via tele-operating surgeons sitting in a safe remote location.

Minimally invasive reduction of fractures while the surgeon sits in a 3D VR environment

Brachial plexus injury repair by the da Vinci® system (this system is popular among laparoscopic surgeons)

Till now, establishment cost is the major deterrent, even in 'rich' nations. A da Vinci system was priced at about INR 16 crores before the pandemic. Moreover, the annual maintenance was around twenty lakhs, plus the consumables per surgery could go up to INR 70 thousands. If the costs come down, more and more patients will be benefited from AI and robotics in orthopaedics.

No Tobacco 2023 Quiz

1. Are Electronic Cigarettes, often referred to as e-cigs, a safer alternative to regular tobacco products?
2. More than% of adult smokers started before the age of 18.
3. Tobacco is prepared from which part of tobacco plant?
4. Smoking in public places is prohibited in India in the year of....
5. Which Indian state became the first state to ban smoking in public places?
6. Which Indian city become 1st Indian city to be "smoke free"?
7. According WHO one person dies every seconds due to Tobacco...
8. India's position in Tobacco production is
9. What is COTPA?
10. Which is the first country to ban tobacco smoking in public places?

Answer of the question for the World Health Day 2023 Edition of Your Health April Publication

1. Plasmodium falciparum, 2. Germany,
3. Jeremy Farrar 4. Measles, 5. Health For All,
6. Smallpox Virus, 7. July 22, 1949, 8. Geneva, Switzerland,
9. 7 or more hours per night for Adult
10. Soumya Swaminathan

The winners of the Quiz for Your Health Publication April 2023 Edition are:

**Dr. Subhashish Mudi
Medical Officer**

Please send your answers to yourhealthoffice@gmail.com within 31st May, 2023. Attractive prizes are there. Please mention your name, designation, phone number while sending the answer.

Osteoarthritis



Dr. Indrajit Sardar
Snr. Consultant Orthopaedics Surgeon
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Osteoarthritis is a common form of arthritis that affects millions of people in India. According to a study published in the Indian Journal of Medical Research, the prevalence of osteoarthritis in India is about 22% in individuals aged 50 years and above.

Most of the patients wanting treatment complain of pain in joints due to osteoarthritis.

The condition is more common in women than men and is more prevalent in urban areas than rural areas. Risk factors for osteoarthritis in India include age, obesity, physical inactivity, and a family history of the condition.

Excessive pressure across weight bearing joints or repetitive activity over joints causes articular cartilage destruction and osteoarthritis.

The most commonly affected joints are the knee, hip, and hand joints. Symptoms of osteoarthritis include joint pain, stiffness, swelling, and decreased range of motion. Treatment options include lifestyle modifications, physical therapy, pain management, and joint replacement surgery in severe cases.

Awareness about osteoarthritis and its management is essential in India, especially with the increasing aging population and the rise in obesity rates.

Preventive measures such as maintaining a healthy weight, regular exercise, and a balanced diet can help reduce the risk of developing osteoarthritis.

1. Lifestyle changes: Losing weight, exercising regularly, and avoiding activities that put excessive strain on the knee joint can help reduce pain and improve mobility. One of the best activities to avoid is squatting, sitting on low stools, frequent stair climbing, standing for long periods etc.

2. Medications: Over-the-counter pain relievers such as acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs) can help relieve pain and inflammation. There has been a lot of interest in a group of medicines like DMOADs or Disease Modifying Osteoarthritis Drugs. These includes drugs like Glucosamine in single 1500 mg doses on an empty stomach. This gives some relief in selected early cases. Other drugs to come into focus are Type2 Collagens with combination with other food supplements.

Disease-modifying osteoarthritis drugs (DMOADs) are medications that aim to slow down the progression of osteoarthritis (OA) by targeting the underlying disease processes. Several drugs are being developed and tested in clinical trials. Usage of Curcumin, Rosewood extract, Eggshell extracts are being propagated but requires more data.



Other methods include

A) Intra-articular injections of hyaluronic acid, which is a natural lubricant in the joint.

B). Platelet-rich plasma (PRP) injections, which involves taking a small amount of a patient's blood, processing it to concentrate the platelets, and then



injecting it into the joint to diminish pain and increase cartilage regeneration.

C) Chondroitin sulfate and glucosamine supplements, which

are natural substances found in the body that are important for joint health.

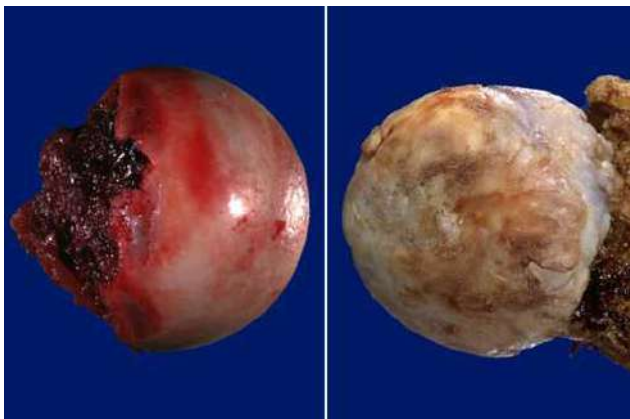
D) Disease-modifying anti-rheumatic drugs (DMARDs), which are medications that are used to treat rheumatoid arthritis but may also be effective in treating OA.

E) Anti-nerve growth factor (NGF) antibodies, which are drugs that block the action of NGF, a protein that plays a role in pain signaling.

It is important to note that while these drugs show promise in early studies, more research is needed to determine their safety and effectiveness in treating OA. Other Prescription medications such as corticosteroids and hyaluronic acid injections can also be used. However these are limited time measures and needs to be repeated with efficacy diminishing with repeated use,

3. Physical therapy: Exercises and stretches can help improve strength and flexibility in the knee joint, reducing pain and improving mobility. Here the static Quadriceps developing exercises are the most effective.

4. Assistive devices: Using a cane or brace can help



reduce pressure on the knee joint and provide support. Knee supports and valgus insoles in footwear also lessen pressure in the deformed knee joints.

5. Surgery: In severe cases, surgery may be necessary. Options include arthroscopy, osteotomy, and joint replacement surgery.

Arthroscopic debridement of the knee joints fell into disrepute but still has some limited applications. Removal of destroyed cartilage surfaces and replacing them with healthy cartilage cells or Autologous Cartilage implantation has had some success.



Osteotomies in younger age group of patients, changes the lines of weight transmission and prevents cartilage destruction in areas of persistent weight transmission.

Joint Replacement options are now in great demand and has brought immense relief in patients with arthritis principally in the knee and hip and more recently in shoulder and elbow. Elbow replacement has gained great popularity in Kolkata and India thanks to the development of Prof, Baksi's prosthesis. Finger joint replacements have been done with success in the hand. Ankle Replacement however has had limited success as Ankle Arthrodesis has a more durable result. Now Joint Replacement of the knees can be partial or total and can be done manually which is the most popular, though Computer assisted or Robotics have limited usage.

It's important to consult with a healthcare professional to determine the best treatment plan for each individual case.



Neck Pain

Neck pain is one of the most common musculoskeletal disorders affecting both young working people and elderly people. The disability due to neck pain can vary from minor pain to severe disability including neurological problems. There is a significant variation in the incidence of neck pain between different studies, with the reported 1 year incidence of neck pain ranging from 10.4% to 21.3%, with a higher incidence noted in office and computer workers. The neck pain not only affects the individuals, but also their families, communities and business groups as it affects the young and working group of people more commonly. Whenever a patient presents with neck pain it is important to evaluate the patient in detail and make a plan considering the fact that neck pain can recur and become chronic pain.

Before understanding the evaluation of neck pain, one should have knowledge of common conditions that affect the cervical spine. They can be broadly divided into 3 categories.

1. Nonspecific neck pain: Usually characterized by axial neck pain, seen in young individuals, most of the times it is self-limiting. The causes could be due to muscle pain due to nerve irritation, muscle fatigue, degenerative disc disorders of cervical spine (including cervical spondylosis, Diffuse disc bulge, facet arthritis etc.) pain arising due to ligaments, fascia etc.
2. Cervical radiculopathy: Most commonly seen due to herniation of disc compressing on roots, in elderly people, progressive degenerative disc disease of spine can lead to compression of cervical cord leading to cervical myelopathy.
3. More specific disorders like infection, inflammatory disorders, metastasis, fractures etc. These need detailed evaluation and investigation at the earlier. Fortunately, in a typical secondary care setting, these are very rare, but one should not miss these problems. Red flag signs are group of signs which will help us to suspect these disorders. In addition to disorders of spine one should be aware of referred pain due to more severe conditions like ruptured aneurysm, lesions causing diaphragmatic irritation etc.

In addition to above 3 categories of causes, there is another distinct cause for neck pain. They include various psychological and behavioral factors.

Evaluation of patient with neck pain:

To understand the cause of neck pain one needs a detailed history of patient. Physical examination complements the history in establishing the diagnosis and also helps in establishing severity of neurological involvement and level of lesion. Imaging and other investigations will help in making diagnosis in case of specific disorders and help in planning the treatment. However, their utility in nonspecific disorders is limited to rule out more specific causes of neck pain.

History taking: Detailed history with regard to pain and associated symptoms like neurological symptoms should be taken. The available history should be correlated with the age of patient. For e.g., in younger



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patients, mechanical pain, degenerative disc disease, infection and trauma are common conditions, while in elderly people cervical spondylosis, cervical myelopathy, osteoporotic fractures, metastasis should be considered. Occupation of patient may help in giving some clues. For e.g., farmers are more prone to brucellosis, people working in fluorosis endemic areas are more prone for spinal fluorosis. Patients who are known for prolonged computer use are prone for mechanical neck pain, patients who lift heavy weights are more prone for cervical degenerative disc disorders.

Onset and progress of pain: Cervical degenerative disorders usually have insidious onset and prolonged course. Traumatic disorders usually have sudden onset and unless there are stability and neurological issues, pain will improve over a period of time. Infections will have acute onset and progressive worsening. Severity of pain is another important point to be elicited in history. Although severity of pain is subjective, relationship to their activity level will help the physician to make some judgement. Usually, patients with nonspecific mechanical pain will have mild to moderate severity and still will be able to do most of their day-to-day work. However, pain due to pathological fracture or infections will be acute and severe affecting the day-to-day work.

Nature of pain: A predominant radicular pain (radiating along the course of nerve root) without other major findings usually is due to a disc herniation in a young patient. If localized pain or axial pain is the major problem then one should think of mechanical neck pain or more serious conditions like infections, fractures, metastasis depending on severity and other associated findings. Sometime pain from viscera and other organs can refer to neck and shoulder. They include pain from diaphragmatic irritation, ruptured aortic aneurysms etc. Night pain is usually seen in infections, pain associated with early morning stiffness can be a pointer to inflammatory disorders. Patients having pain with gait disturbances may be having cervical myelopathy.

Response to treatment and disability related to pain may help in planning the treatment. In addition, one should give importance to associated symptoms like constitutional symptoms (infection), weight loss and appetite (metastasis), associated involvement of other

joints (inflammatory disorders)

Neurological symptoms can be missed unless the physician probes with leading questions when there are subtle neurological symptoms. Patient may have gait disturbances, urinary symptoms, frequent falls, inability to hold foot wear, inability to cut the vegetables or do overhead activities. Walking on pins and needles sensation is another pointer to neurological involvement. Patients with more specific disorders can present with sudden onset of major neurological deficits.

At the end of history, physician should make a note of red flag signs. When red flag signs are present one should investigate the patient thoroughly for more serious diseases. These include constitutional symptoms, weight loss, history of IV abuse, extremes of age, history of cancer, patients on steroids and immunosuppressive drugs, history of sudden onset of major neurological deficit especially neck pain with lower limb weakness, and any chronic pain which is not subsiding even after 6 weeks of conservative treatment. In addition, one should probe for psychological and behavioral causes like work related stress, history of depression, any stressful issues in family, certain beliefs and attitudes, aggressive behavior etc. These are called yellow flag signs.

Examination:

Local signs in neck like any swelling in anterior aspect of neck (cold abscess), paraspinal spasm and loss of cervical lordosis, any deformity including short neck (Fig. 1), low hair line, scapular levels should be identified. Provocative maneuver like spurling's maneuver (axial compression given on top of head by examiner with head in neutral position will elicit radicular pain, if negative, neck can be extended and rotated to affected side and test is repeated), Lhermitte's sign (sudden flexion of neck will lead to electric shock like sensation, usually seen in compression of cervical cord) can be elicited. However, all these maneuvers should not be elicited in the presence of pathological fracture and red flag signs.

Neurological examination includes detailed sensory examination, motor examination and reflexes. One should know the anatomical basis of neurological examination. There are 7 cervical vertebrae but 8 cervical spine segments with 8 roots. C1 root exits

above C1 arch, while C8 root exits between C7-T1 neural foramina. In cervical spine roots take a direct exit from cord, hence exiting roots are compressed in disc herniation. In any cervical spine lesions, upper motor neurons of lower limb are affected along with bowel and bladder while both upper and lower motor neurons of upper limb is affected, hence the signs may be a combination of upper motor and lower motor neuron signs in upper limb (root at the affected level will have LMN lesion, while below the affected level, there will be UMN lesion). Similarly cervical cord has multiple tracts and anatomical knowledge of the same will help in differentiating different cord injury patterns. The dorsal column carries position sense, proprioception, and vibration, lateral spinothalamic tract carries pain and temperature and anterior spinothalamic tracts carry crude touch and pressure sensation. The spinothalamic tract usually carry sensation from opposite side of limb as they cross one or two segments after entering spinal cord, while dorsal column caters to same side as they are yet to cross. Similarly motor tracts are situated anteriorly and supply the same side. Accordingly, one can classify incomplete cord injuries as follows.

1. Anterior cord syndrome: predominantly motor tracts are involved, sensory intact.
2. Posterior cord syndrome: predominantly dorsal column is involved with loss of balance and proprioception.
3. Central cord syndrome: Predominantly motor tracts of upper limb are involved as upper limb neurons are located more medially, with intact lower limb and varying degrees of sensory involvement.
4. Brown Sequard syndrome (Hemi section of cord): Involves ipsilateral upper motor neuron deficits below the lesion, contralateral pain and temperature starting from 2-3 levels below the lesion, ipsilateral position and vibration sense involvement below the level of lesion, lower motor neuron signs at the level of lesion on the same side, pain and temperature of the level of lesion extending to 2-3 levels on the same side. One should also elicit reflexes, plantar response will be extensor with exaggerated reflexes in case of upper

motor lesions, ankle clonus also will be present in severe cases.

Examination is incomplete without examination of other systems like lungs, cardiovascular system, other joints, abdomen. Many causes for referred pain can be elicited with abdominal and chest examination. Similarly in case of metastasis, primary lesions can be identified with detailed examination. Sometimes cold abscess from tuberculosis can track up to anterior aspect of neck or upper chest.

After the detailed evaluation one should have a plan for investigations. X ray will provide some indirect evidence of degenerative disc disease, but should be obtained to rule out major pathologies. One should look for the alignment, density of bone, any soft tissue shadows, canal dimensions, presence of osteophytes, disc space, contour of vertebral bodies (Fig.2). MRI is the investigation of choice as it will help in identifying not only bony pathologies, but also disc pathologies (Fig.3), soft tissue pathologies and involvement of spinal cord. However, it may not be a good idea to get MRI done for every case. While MRI in case of presence of red flag signs is necessary (Fig.4), in case of nonspecific mechanical pain, one can try a course of non-operative treatment, monitor the patient and then consider MRI. Other investigations like CT including myelography, PET scan, ultrasound of neck, nerve conduction study, etc. have their own specific indications.

Once a diagnosis is established, a treatment plan has to be done. Generally, patients with mechanical pain are treated with conservative treatment. This includes varying periods of rest, physical therapy including IFT, traction, hot packs etc., physiotherapy to strengthen neck muscles. Prolonged period of rest is not ideal as this will lead to more muscle atrophy and poor rehabilitation. While there are varying types of collars are available in market (Fig.5), they have limited benefits in nonspecific mechanical neck pain, and most of them do not have much effect on control of neck rotation except placebo effect. A Philadelphia collar can control some sagittal motion although does not prevent lateral and axial motion. Braces like SOMI brace, Minerva brace are required for control of some lateral and axial motion. Pharmacotherapy includes

non-steroid anti-inflammatory drugs for short periods, Gabapentinoids like gabapentin and pregabalin for chronic neck pain and in refractory cases, drugs like antidepressants are also used.

When a diagnosis of cervical radiculopathy is made, again conservative treatment is the mainstay unless there are gross neurological deficits due to massive disc herniation (Fig.6). The principles of conservative treatment remain same as that for nonspecific neck pain. However if symptoms persist even after 6 weeks of conservative treatment or there is a gross neurological deficits, one should consider discectomy with release of compression. Discectomy can be done anteriorly (anterior discectomy and fusion of adjacent segments) or posteriorly (foraminotomy and discectomy). In elderly patients presenting with myelopathy and deficits, one should consider early surgery, otherwise neurological recovery cannot be predicted. The patients also should be warned about possible complications like worsening of deficits following surgery. The surgery usually can be done anteriorly (discectomy/corpectomy, decompression and fusion) or posteriorly (Laminectomy/Laminoplasty).

Patients who have myelopathy due to ossified posterior longitudinal ligament at multiple levels will have poor prognosis and are more prone for complications, a CT done earlier will help to identify these cases (Fig.7).

Patients with red flag signs should be immediately evaluated with MRI and treatment is directed at the cause.

In India, two conditions merit discussion. In case of infection, treatment is aimed at establishing microbiological diagnosis (through biopsy), appropriate antimicrobial treatment and surgical treatment in case of cord compression or instability of cervical spine due to destruction of vertebral body. Tuberculosis is the most common cause in Indian scenario and recent guidelines suggest minimum one year of antitubercular treatment. In case of metastasis, one should carefully evaluate for identification of primary, biopsy from primary site, staging of tumor and expected life expectancy will help in deciding the treatment rather than

aggressive surgery after presentation. However, when patient presents with sudden onset of neurological deficits, there is a role for immediate surgery to decompress the spine, stabilize the spine and collect material for the biopsy. With the availability of PET scan at many places, PET scan and identification of primary has become the preferred method to approach these problems.

To summaries, a detailed evaluation of patient presenting with neck pain is essential. Most of the times, conservative management is sufficient for the treatment, but one should not miss red flag signs. There are new innovations in the management of chronic neck pain in the form newer gadgets like fancy collars, newer physical modalities of treatment, but all of them have similar affects and in fact use of collars actually can worsen the condition. In select cases especially in patients with cervical radiculopathy with deficits, cervical myelopathy, in patients with more severe underlying pathology leading to instability of spinal column as well as involvement of neural elements, surgery should be considered.



Fig.1 Short neck with congenital anomaly (Klippelfielsyndrome)

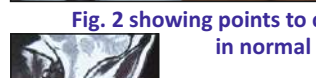


Fig. 2 showing points to check in normal x ray.



Fig. 3 showing compression of cord both anteriorly and posteriorly by MRI in cervical myelopathy



Fig.4 Need for detailed evaluation with advanced imaging in case of red flag signs.



Fig. 5 different types of brace



Fig. 6 Showing Huge paracentral disc protrusion in a young patient.

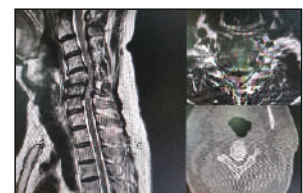


Fig.7 Showing CT as a useful investigation for identifying ossification of PLL (red arrow)

Occupational Health Issues in Orthopaedics



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INTRODUCTION

An occupational disease or industrial disease is any chronic ailment that occurs as a result of work or occupational activity. It is an aspect of occupational safety and health. An occupational disease is typically identified when it is shown that it is more prevalent in a given body of workers than in the general population or in other worker populations. The first such disease to be recognised, squamous-cell carcinoma of the scrotum, was identified in chimney sweep boys by Sir Percival Pott in 1775.

SOME COMMON QUESTIONS

what are occupational hazards in orthopaedic surgeons?

Orthopaedic surgery is a field that can place the surgeons at increased risk of infection, exposure to radiation, chemicals, noise, surgical smoke, and musculoskeletal injuries.

What are two common types of occupational injuries?

Top 5 most common workplace injuries and how to avoid them.

Trips, slips and falls.

Being struck by or caught In moving machinery.
Vehicle related accidents.

Fire and explosions.

Repetitive stress and over-exertion Injuries

What are components of occupational health?

It includes health and safety policies, systems, standards, records. It also involves incorporating your health and safety activities and program into your other business processes. Having an effective management system improves your ability to continuously identify hazards and control risks in your workplace.

What is the most common cause of occupational injuries?

Top Work-related causes of injury

- Exposure to electricity.
- Exposure to radiation and noise.
- Exposure to temperature extremes.
- Exposure to air and water pressure change.
- Exposure to other harmful substances.
- Exposure to oxygen deficiency.
- Exposure to traumatic or stressful event.

What are the most common occupational injuries?

To be forewarned is to be forearmed, so here are ten of the most common accidents and injuries in the workplace-

- Slips, trips and falls.
- Muscle strains.
- Being hit by falling objects.
- Repetitive strain injury.
- Crashes and collisions.
- Cuts and lacerations.
- Inhaling toxic fumes.
- Exposure to loud noise.

What are musculoskeletal disorders in occupational health?

Work-related musculoskeletal disorders (WMSDs) are a group of painful disorders of muscles, tendons and nerves. Carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and tension neck syndrome are common examples of WMSD.

What is occupational safety and health problem?
Safety and health in the workplace — otherwise

known as occupational safety and health (OSH) — is the “discipline dealing with the prevention of work-related injuries and diseases, as well as the protection and promotion of the health of workers”, according to the International Labour Organization (ILO).

SURGEONS AND OCCUPATIONAL HAZARDS

No occupation is without its hazards, and surgical specialties are no exception. Occupational injuries and hazards related to surgery are not well studied.

(Choi et al.) evaluated the cancer risk based on the compounds commonly found in surgical smoke and reported that the cancer risk was greater than negligible for two carcinogenic compounds—1,2-dichloroethane and benzene.² They concluded that while surgical smoke is not an immediate health hazard, its long-term health risks to operating room personnel are yet to be elucidated. However, there are no clinical studies to date evaluating the effect of surgical smoke on cancer risk in surgeons.

Furthermore, there is a lack of adequate training in mitigating the risks and occupational hazards associated with surgical specialties. Surgeons are at increased risk of infection due to needle stick injuries. Occupational exposure to hepatitis B virus (HBV) has been shown to result in a sero-positivity rate as high as 10–28% among surgeons. While this transmission risk is lower for human immunodeficiency virus (HIV), the consequences of sero-conversion are no less devastating for the surgeon. The risk of glove perforation due to needle stick injuries is nearly twofold higher among surgical trainees than attending physicians. It highlights the need for increased awareness of this occupational hazard and better training in mitigating this risk.

ORTHOPAEDIC SURGERY AND OCCUPATIONAL HAZARDS

Orthopaedic surgery is a field that can place the surgeons at increased risk of infection, exposure to radiation, chemicals, noise, surgical smoke, and musculoskeletal injuries. While it is universally acknowledged that orthopaedic surgery presents a potentially hazardous work environment, there is

sparse literature quantifying those risks. Prevalence of musculoskeletal (MSK) overuse disorders and other conditions among orthopaedic surgeons, especially those performing total hip (THA) or total knee arthroplasty (TKA), and report the factors placing these surgeons at higher risk for occupational health hazards.

Orthopaedic surgeons face higher risks due to noise, radiation, chemicals, blood borne pathogen etc. than other medical and surgical specialists. We can avoid these by following evolving guidelines and take basic preventive measures. In cases where sharps are used, hands-free technique is recommended. Surgeons should be cautioned against noises generated by drills (mean 90 dB), trapped suction tip "whistles" in tissue (up to 96 dB) etc., by updating equipments, change from pneumatic to battery powered tools, regular hearing tests and hearing protection. Effects of radiation exposure in procedures requiring C-Arm fluoroscope lead to dermatitis, skin cancer, bone marrow suppression, thyroid gland changes, cataract, congenital defects in the employees' offspring, cardiovascular risk etc. Radiation can be minimized by using ALARA principles, lead apron, use of the mini c-arm in case of small body parts and by avoiding horizontal fluoroscopy whenever possible. Radiation at 18 inches from primary beam was only 0.1%.

Arthroscopic surgery allows only fewer degrees of freedom in movement, leading to higher muscle effort these can be minimized by following principles of ergonomics e.g., standing posture that allows the body frequent position changes, short breaks for stretching. There is an established guideline for "Resident Surgeon Work Duty Hours" to avoid burnout and stresses due to loaded shifts.

CONCLUSION

Physicians are exposed to occupational hazards of which they are often unaware. Orthopaedic surgery has a particularly hazardous work environment in which surgeons are at increased risk for exposure to infection, radiation, smoke, chemicals, excessive noise, musculoskeletal injuries, as well as emotional and psychological disturbances. Understanding these risks and the precautions that can be taken to avoid them will help protect orthopaedic surgeons from potential harm.

Sports Injury Management in the Indian Scenario

The sports industry:

The sports industry in India has been growing rapidly in recent years, with increased investment and interest in sports at both the professional and grassroots levels, and increasing support from the government in this respect. While this growth has been positive for the industry and the economy, it has also led to a rise in the incidence of sports injuries in the country.

Sports in India has been growing in competitiveness and professionalism. With the increased investment and sponsorship, sports teams and leagues are under enormous pressure to perform, leading to greater physical demands on athletes. When not augmented by a wonderful support team involving the sports surgeon/ physician, sports physiotherapist, sports psychologist and sports nutritionist, this can lead to overuse injuries, fatigue, and acute injuries, such as ligament tears, cartilage injuries and fractures.

Sports medicine and surgery: Over the years, India has made huge advances in the management of sports injuries, on par with international standards.

It is now possible to treat debilitating injuries like ligament tears/ multiligament injuries of joints and



Availability of cadaver training programs has made it possible to obtain training for complex arthroscopy surgeries. The author is seen serving as faculty for cadaver-based training of shoulder arthroscopy for young orthopedic surgeons

cartilage injuries early and prevent loss of function and enable return to sports. Increased availability of training programmes in India has made arthroscopic surgery available to the masses.

Advances in Sports medicine and surgery

Arthroscopy: Arthroscopy is a minimally invasive surgery that is widely used in the treatment of sports injuries such as ACL and other ligament tears, meniscus tears, rotator cuff injuries and cartilage injuries.

The use of small incisions for the treatment reduces

Arthroscopic ACL reconstruction has been a boon for many professional and recreational athletes to return to sports and regular physical activity. Latest techniques have allowed early rehabilitation and full range of motion and hence early return to sports



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Shoulder arthroscopy can be used for the treatment of various shoulder pathologies including recurrent shoulder dislocation, rotator cuff tears, arthritis, frozen shoulder, etc. When performed by an experienced surgeon and supported by adequate rehabilitation, the postoperative function can be near-normal and patients can even return to preoperative levels of sports activity

Ankle arthroscopy can be used for various treatments in the ankle including loose body removal, cartilage reconstruction or cartilage transplantation, etc. In this patient, ankle arthroscopy is performed for correction of anterior ankle impingement



Cartilage damage of the elbow can lead to loose body formation and stiffness. Elbow arthroscopy was performed for this 45 year female patient for loose body removal and capsular release. Her elbow movement improved and pain reduced significantly.



the risk of infection, bleeding, and scarring and helps early recovery.

Regenerative medicine: One of the significant advances in sports injury treatment in India is the use of regenerative medicine. This approach involves the use of stem cells to repair and regenerate damaged tissues. Regenerative medicine has shown promising results in the treatment of sports injuries such as ligament tears, tendonitis, and cartilage damage. The treatment involves the extraction of stem cells from the patient's body and injecting them into the affected area. This technique has proven to be effective in

promoting healing and reducing the recovery time.

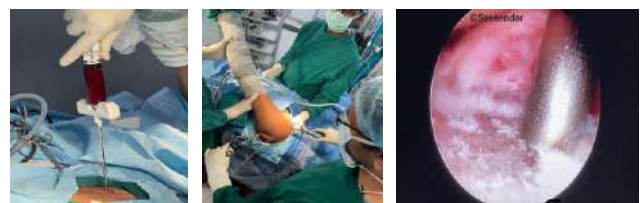
Biological augmentation involves the use of biological materials such as growth factors, stem cells, and platelet-rich plasma (PRP) to enhance the healing process. These materials can be injected into the affected area to promote tissue regeneration and reduce inflammation. Biological augmentation is being used in sports surgery to treat injuries such as tendonitis, ligament tears, and cartilage damage.

Nanotechnology: Nanotechnology is being used in sports surgery to develop new materials for implants and surgical instruments. Nanoparticles can be used to create stronger, lighter, and more durable materials, which can improve the longevity of implants and reduce the risk of complications. Nanotechnology is also being used to develop new drug delivery systems, which can target specific areas of the body and reduce the risk of side effects.

3D Printing: 3D printing is a revolutionary technology



Platelet-rich plasma (PRP) injection has found lot of indications in Orthopaedics. This professional international cricket player suffered from recalcitrant Tennis elbow. His condition improved well with PRP injection and rehabilitation



The authors performed the first BMAC-based cartilage reconstruction surgery of the shoulder in India for a professional player with significant cartilage damage of the shoulder joint

that is being used in sports surgery to create custom implants, surgical instruments, and models of the affected body part. Surgeons can use 3D printing to create patient-specific surgical guides, which can improve the accuracy of surgical procedures and reduce the risk of complications. While this technology is still developing in the field of sports medicine, India is on the forefront of this development.

Robotic Surgery: Robotic surgery is a minimally invasive surgical technique that uses robotic arms to perform surgery. The surgeon controls the robotic arms using a console, which provides a magnified 3D view of the surgical site. This technique can be used in sports surgery to perform procedures such as ACL reconstruction, meniscus repair, and rotator cuff repair.

Nanotechnology: Nanotechnology is being used in sports surgery to develop new materials for implants and surgical instruments. Nanoparticles can be used to create stronger, lighter, and more durable materials, which can improve the longevity of implants and reduce the risk of complications. Nanotechnology is also being used to develop new drug delivery systems, which can target specific areas of the body and reduce the risk of side effects.

Virtual Reality: Virtual reality technology is being used in sports surgery to simulate surgical procedures and train surgeons. Surgeons can use virtual reality to practice surgical procedures before performing them on patients, which can improve their skills and reduce the risk of complications.

In conclusion, sports surgery is a rapidly evolving field, and the latest treatment advances are focused on improving the accuracy of surgical procedures, reducing the risk of complications, and promoting

tissue regeneration. These advances are helping to improve the outcomes of sports injury treatment and are making it possible for athletes to return to their sport more quickly and safely. As technology continues to advance, we can expect to see even more innovative treatment options in sports surgery

Recent advances in sports injury rehabilitation

In recent years, there have been significant advances in sports injury rehabilitation, allowing athletes to recover from injuries more quickly and effectively than ever before. These advances have been made possible through a combination of new technologies, improved techniques, and improvements in regeneration techniques.

One of the most promising recent advances in sports injury rehabilitation is the use of stem cell therapy, which can reduce pain, inflammation, and help to regenerate damaged tissue, leading to faster recovery times.

Another exciting area of sports injury rehabilitation is the use of virtual reality (VR) technology. This technology can help athletes to train while recovering from injuries, allowing them to maintain their fitness and keep their skills sharp. Additionally, VR can be used to simulate specific scenarios that may have caused an injury, allowing athletes to practice avoiding those situations in the future.

Additionally, there has been a growing focus on personalized rehabilitation programs that are tailored to the specific needs of each individual athlete. These programs take into account the athlete's unique biomechanics, injury history, and other factors to create a rehabilitation plan that is most effective for their specific injury and body type. This approach has been shown to lead to faster recovery times and better long-term outcomes.



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