
**CURRICULUM / STATUTES & REGULATIONS
FOR
5 YEARS DEGREE PROGRAMME
IN
ORTHOPAEDICS
(MS Orthopaedics)**



UNIVERSITY OF HEALTH SCIENCES, LAHORE

STATUTES

Nomenclature Of The Proposed Course

The name of degree programme shall be MS Orthopaedics. This name is well recognized and established for the last many decades worldwide.

Course Title:

MS Orthopaedics

Training Centers

Departments of Orthopaedics (accredited by UHS) in affiliated institutes of University of Health Sciences Lahore.

Duration of Course

The duration of MS Orthopaedics course shall be five (5) years with structured training in a recognized department under the guidance of an approved supervisor.

After admission in MS Orthopaedics Programme the resident will spend first 6 Months in the relevant Department of Orthopaedics as **Induction period** during which resident will get orientation about the chosen discipline and will also participate in the **mandatory workshops** (Appendix E). The research project shall be designed and the **synopsis** be prepared during this period

On completion of Induction period the resident shall start training to learn Basic Principles of General Surgery for 18 Months.

During this period the Research Synopsis shall be got approved by the AS&RB of the university. At the end of 2nd Calendar year the candidate shall take up Intermediate Examination.

During 3rd, 4th & 5th years, of the Program, there shall be two components of the training.

- 1) Clinical Training in Orthopaedics
- 2) Research and Thesis writing

The candidate will undergo clinical training in the discipline to achieve the educational objectives (knowledge & Skills) alongwith rotation in the relevant

fields during the 4th & 5th years of the programme. The clinical training shall be competency based. There shall generic and specialty specific competencies and shall be assessed by continuous Internal Assessment. (Appendix F&G).

The Research & Thesis Component shall be completed over the five years duration of the course. The Candidate will spend total time equivalent to one calendar year on research during the training. Research can be done as one block or it can be done as regular periodic rotations over five years as long as total research time is equivalent to one calendar year.

Admission Criteria

Applications for admission to MS Training Programs will be invited through advertisement in print and electronic media mentioning closing date of applications and date of Entry Examination.

Eligibility: The applicant on the last date of submission of applications for admission must possess the:

- i) Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical & Dental Council.
- ii) Certificate of one year's House Job experience in institutions recognized by Pakistan Medical & Dental Council Is essential at the time of interview. The applicant is required to submit Hope Certificate from the concerned Medical Superintendent that the House Job shall be completed before the Interview.
- iii) Valid certificate of permanent or provisional registration with Pakistan

Medical & Dental Council.

Registration and Enrollment

- As per policy of Pakistan Medical & Dental Council the number of PG Trainees/ Students per supervisor shall be maximum 05 per annum for all PG programmes including minor programmes (if any).
- Beds to trainee ratio at the approved teaching site shall be at least 5 beds per trainee.
- The University will approve supervisors for MS courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with UHS as per prescribed Registration Regulation.

Accreditation Related Issues Of The Institution

A). Faculty

Properly qualified teaching staff in accordance with the requirements of Pakistan Medical and Dental Council (PMDC)

B). Adequate Space

Including class-rooms (with audiovisual aids), demonstration rooms, computer lab and clinical pathology lab etc.

C). Library

Departmental library should have latest editions of recommended books, reference books and latest journals (National and International).

- Accreditation of Orthopaedics training program can be suspended on temporary or permanent basis by the University, if the program does not comply with requirements for residents training as laid out in this curriculum.
- Program should be presented to the University along with a plan for implementation of curriculum for training of residents.

- Programs should have documentation of residents training activities and evaluation on monthly basis.
- To ensure a uniform and standardized quality of training and availability of the training facilities, the University reserves the right to make surprise visits of the training program for monitoring purposes and may take appropriate action if deemed necessary.

AIMS AND OBJECTIVES OF THE COURSE

AIM

The aim of five years MS programme in Orthopaedics is to train residents to acquire the competency of a specialist in the field so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

GENERAL OBJECTIVES

MS Orthopaedics training should enable a student to:

1. Access and apply relevant knowledge to clinical practice:
 - Maintain currency of knowledge
 - Apply scientific knowledge in practice
 - Appropriate to patient need and context
 - Critically evaluate new technology
2. Safely and effectively performs appropriate surgical procedures:
 - Consistently demonstrate sound surgical skills
 - Demonstrate procedural knowledge and technical skill at a level appropriate to the level of training
 - Demonstrate manual dexterity required to carry out procedures
 - Adapt their skills in the context of each patient and procedure
 - Maintain and acquire new skills
 - Approach and carries out procedures with due attention to safety of patient, self and others
 - Critically analyze their own clinical performance for continuous improvement
3. Design and implement effective management plans:
 - Recognize the clinical features, accurately diagnose and manage Orthopaedic problems
 - Formulate a well-reasoned provisional diagnosis and management plan based on a thorough history and examination
 - Formulate a differential diagnosis based on investigative findings

- Manage patients in ways that demonstrate sensitivity to their physical, social, cultural and psychological needs
- Recognize disorders of the nervous system and differentiate those amenable to surgical treatment
- Effectively manage the care of patients with Orthopaedic-trauma including multiple system trauma
- Effectively recognize and manage complications
- Accurately identify the benefits, risks and mechanisms of action of current and evolving treatment modalities
- Indicate alternatives in the process of interpreting investigations and in decision-making
- Manage complexity and uncertainty
- Consider all issues relevant to the patient
- Identify risk
- Assess and implement a risk management plan
- Critically evaluate and integrate new technologies and techniques.

4. Organize diagnostic testing, imaging and consultation as needed:

- Select medically appropriate investigative tools and monitoring techniques in a cost-effective and useful manner
- Appraise and interpret appropriate diagnostic imaging and investigations according to patients' needs
- Critically evaluates the advantages and disadvantages of different investigative modalities

5. Communicate effectively:

- Communicate appropriate information to patients (and their family) about procedures, potentialities and risks associated with surgery in ways that encourage their participation in informed decision making
- Communicate with the patient (and their family) the treatment options including benefits and risks of each
- Communicate with and co-ordinate health management teams to achieve an optimal surgical environment
- Initiate the resolution of misunderstandings or disputes

- Modify communication to accommodate cultural and linguistic sensitivities of the patient

6. Recognize the value of knowledge and research and its application to clinical practice:

- Assume responsibility for self-directed learning
- Critically appraise new trends in Orthopaedics
- Facilitate the learning of others.

7. Appreciate ethical issues associated with Orthopaedics:

- Consistently apply ethical principles
- Identify ethical expectations that impact on medico-legal issues
- Recognize the current legal aspects of informed consent and confidentiality
- Be accountable for the management of their patients.

8. Professionalism by:

- Employing a critically reflective approach to Orthopaedics
- Adhering with current regulations concerning workplace harassment

- Regularly carrying out self and peer reviewed audit
- Acknowledging and have insight into their own limitations
- Acknowledging and learning from mistakes

9. Work in collaboration with members of an interdisciplinary team where appropriate:

- Collaborate with other professionals in the selection and use of various types of treatments assessing and weighing the indications and contraindications associated with each type
- Develop a care plan for a patient in collaboration with members of an interdisciplinary team
- Employ a consultative approach with colleagues and other professionals
- Recognize the need to refer patients to other professionals.

10. Management and Leadership

- Effective use of resources to balance patient care and system resources
- Identify and differentiate between system resources and patient needs
- Prioritize needs and demands dealing with limited system resources.
- Manage and lead clinical teams
- Recognize the importance of different types of expertise which contribute to the effective functioning of clinical team.
- Maintain clinically relevant and accurate contemporaneous records

11. Health advocacy:

- Promote health maintenance of patients
- Advocate for appropriate health resource allocation

- Promote health maintenance of colleagues and self scholar and teacher

SPECIFIC LEARNING OUTCOMES

On completion of the training programme, Orthopaedics trainees pursuing an academic pathway will be expected to have demonstrated competence in all aspects of the published syllabus. The specific training component would be targeted for establishing clearly defined standards of knowledge and skills required to practice Orthopaedics at secondary and tertiary care level with proficiency in the Basic and applied clinical sciences, Basic Orthopaedic surgical care, Orthopaedic intensive care, Emergency medicine and Complementary surgical disciplines. Following competencies are expected from the resident;

Didactic Education:

Trauma:

1. Diagnose and describe common fractures using terms like comminuted, open, closed, spiral, impacted, angulated, displaced, segmental, transverse, or oblique.
2. Describe an open fracture and its management, including the use of debridement, primary closure, and delayed primary closure.
3. Diagnose common injuries such as Colles' fracture, anterior dislocation of the shoulder, and hip fractures, given appropriate historical, physical examination, and radiographic data.
4. Describe the physiologic process of fracture healing and discuss the importance of factors such as blood supply, contact of fracture fragments, immobilization, and soft-tissue interposition.

5. Discuss the complications of severe fracture of the spine, pelvis, and major long bones, including neurologic deficit, genitourinary injury, blood loss, avascular necrosis, Volkmann's ischemic contracture, and compartment syndromes.
6. Describe the appropriate diagnostic and first aid measures to be taken regarding the musculoskeletal system in cases of trauma.
7. Define various modes of treatment for closed fractures, including closed reduction, open reduction, traction, splinting, circumferential casting, external fixation, and internal fixation.
8. Describe the differences in treatment, complications, anatomy, and physiology in children's fractures compared to adults.

Spinal Disorders:

1. Discuss the management of low-back pain, degenerative joint disease of the spine, and the syndrome of the herniated lumbar or cervical disc.
2. Diagnose acute low-back strain, herniated cervical or lumbar disc with nerve root irritation (specific roots and disc levels), and degenerative joint disease of the spine, given appropriate historical, physical, radiographic, and laboratory data.

Infections of Bones and Joints:

1. Discuss the pathology, physiology and natural history of hematogenous osteomyelitis, chronic osteomyelitis and septic arthritis.

2. Discuss the therapeutic management of hematogenous osteomyelitis, chronic osteomyelitis and septic arthritis and the complications of these diseases.

Pediatric Orthopaedics:

1. Define the terms varus, valgus, equinus, calcaneus, genu, pes, talus, dislocation, subluxation, and anteversion.
2. Diagnose common mal-alignments of the lower extremities in children, including increased femoral anteversion, tibial torsion, metatarsus adductus, and clubfoot, given necessary historical, physical, and radiographic data.
3. Diagnose congenital dislocation of the hip, Legg-Calvé-Perthes disease, slipped capital femoral epiphysis, and idiopathic scoliosis, given necessary historical, physical, and radiographic data.

Inflammatory, Degenerative, and Traumatic Disorders of Musculoskeletal Soft Tissue:

1. Diagnose common disorders of soft tissue, including tendinitis and bursitis of the shoulder, lateral humeral epicondylitis, and bursitis about the greater trochanter and knee, given the appropriate historical, physical, radiographic and laboratory data.
2. Discuss the diagnostic criteria differentiating degenerative arthritis from rheumatoid arthritis.

3. Discuss osteotomy, arthrodesis and arthroplasty as they apply to the treatment of arthritis.

Clinical Knowledge:

1. **Cognitive knowledge:** Describe embryology, applied anatomy, physiology, pathology, clinical features, diagnostic procedures and the therapeutics including preventive methods, (medical/surgical) pertaining to musculo-skeletal system.
2. **Clinical decision making ability & management expertise:** Diagnose conditions from history taking, clinical evaluation and investigations and develop expertise to manage medically as well as surgically the commonly encountered, disorders and disease in different areas as follows:
 - a. ***Pediatric orthopaedics-*** The student should be exposed to all aspects of congenital and developmental disorders such as CTEV (club-Foot), developmental dysplasia of hip, congenital deficiency of limbs, Perthe's disease and infections, and also to acquire adequate knowledge about the principles of management of these disorders in 6 months rotation.
 - b. ***Orthopaedic oncology-*** The resident is expected to be familiar with the tumours encountered in orthopaedic practice. The recent trends towards limb salvage procedures and the advances in chemotherapy need to be familiar to him.
 - c. ***Management of Trauma-*** Trauma in this country is one of the main causes of morbidity and mortality in our demographic statistics. The student is expected to be fully conversant with trauma in its entirety. In any type of posting after qualification the orthopaedic surgeon would be exposed to all

varieties of acute trauma. Hence, it is his responsibility to be able to recognize, assess and manage it including the medico legal aspects.

- d. **Sports Medicine-** A lot of importance is being given to sports medicine especially in view of the susceptibility of the athlete to injury and his failure to tide over them. Sports medicine not only encompasses diagnostic and therapeutic aspects of athletic injuries but also their prevention, training schedules of personnel & their selection.
- e. **Physical Medicine and Rehabilitation-** The student is expected to be familiar with this in all its aspects. Adequate exposure in the workshop manufacturing orthotics and prosthetics is mandatory, as is the assessment of the orthopedically handicapped.
- f. **Orthopedic Neurology-** The student should be exposed to all kinds of nerve injuries as regards their recognition & management cerebral palsy and acquired neurologic conditions such as post polio residual paralysis also need to be emphasized in their entirety.
- g. **Spine Surgery-** The student is expected to be familiar with various kinds of spinal disorders such as scoliosis, kypho-scoliosis, spinal trauma, PIVD, infections (tuberculosis and pyogenic), & tumours as regards their clinical presentations and management.
- h. **Basic sciences in Orthopaedics-** This deals with some of the fundamentals in orthopaedics such as the structure and function of bone cartilage etc, and their metabolic process. In addition the student learns about implants in orthopaedics and their metallurgy.

- i. **Radiology-** Acquire knowledge about radiology/imaging and to interpret different radiological procedures and imaging in musculo-skeletal disorders. There should be collaboration with Radiology department for such activities.
- j. **Psychologic and social aspect-** Some elementary knowledge in clinical Psychology and social, work management is to be acquired for management of patients, especially those terminally ill and disabled-persons and interacting with their relatives.

3. **Teaching:** Acquire ability to teach an MBBS student in simple and straightforward language about the common orthopaedic ailment/disorders especially about their signs/symptoms for diagnosis with their general principles of therapy.

4. **Preventive Aspect:** Acquire knowledge about prevention of some conditions especially in children such as poliomyelitis, congenital deformities, cerebral palsy and common orthopaedic malignancies.

5. **Identification of a special areas within the subject:** To further develop higher skills within the specialty in a specialized area such as Arthroplasty, Neurology, Arthroscopy oncology, spine surgery, hand surgery and Rheumatology, identify some area of interest during the residency and do fellowship/ senior residency programme in one of such areas.

6. **Research Experience:**

All residents in the categorical program are required to complete an academic outcomes-based research project during their training. This project can consist

of original bench top laboratory research, clinical research or a combination of both. The research work shall be compiled in the form of a thesis which is to be submitted for evaluation by each resident before end of the training. The designated Faculty will organize and mentor the residents through the process, as well as journal clubs to teach critical appraisal of the literature

Clinical Skills to be Learnt

Demonstrate the following clinical skills with proficiency:

- History of Orthopaedics
- Professional Values, Student – Teacher relationship.
- Laws of Biomechanics
- Orientation of Out-patient, In patient, Accident & Emergency, Operation Theatre and learning resources.
- History taking, date extraction and recording, documentation and presentation.
- Examination of swelling, wounds, deformities.
- Examination of Joints with special reference to measurement of range of movements.

- Examination of Muscle power, tone and function.
- Examination of sensory and motor nerves.
- Interpretation of X-ray, CT scan, Ultra sound, MRI and Bone Scans.
- Application and removal of Splints and POP casts.
- Application of Traction.
- Administration of Injections / Aspirations.

- Understanding of Common Medicines used in the department.
- Application and removal of sutures and dressings.
- Writing investigation requests, calls to other departments, patient progress notes, patient shifting instructions, discharge certificates and Death Reports.
- Pre operative preparation, per operative conduction and post operative care of patients.
- Ward Management.

Procedural Skills to be Learnt

Demonstrate the role of the orthopaedic surgeon as it relates to orthopedic procedures

1. Fracture management

- Types of fractures
- Bone healing
- Closed reduction/casting
- External fixation
- Open reduction/internal fixation
- Prosthetic replacement
- Treatment of non-union

2. Shoulder Procedures

- Arthroscopy
- Rotator cuff repair
- Humeral head arthroplasty
- Total shoulder replacement

3. Upper limb Procedures

- Elbow arthroplasty
- Total elbow replacement
- Total wrist replacement

4. Hip Procedures

- Fixation of femoral head fractures
- Total hips arthroplasty

5. Lower Limb Procedures

- Epiphydesis
- Fractures

6. Knee Procedures

- Arthroscopy
- Meniscectomy
- Anterior collateral ligament repair
- Total knee replacement

7. Orthopedic Instruments:

- Assembly and disassembly of power instruments.
- Use of the pneumatic tourniquet.
 - Disarticulation
 - Osteotomy
 - Tendon procedures

8. Ankle/Foot Procedures

- Arthroscopy
- Arthrodesis
- Malleolar fracture
- Total ankle replacement

- Triple arthrodesis
- Bunionectomy
- Correction of hammer toe

9. Miscellaneous

- Amputation
- Disarticulation
- Osteotomy
- Tendon procedures

A Resident, pursuing MS Orthopaedics Degree course is expected to perform major and minor surgical procedures independently as well as under supervision of a faculty member/senior resident.

1. Resident should be able to perform many major procedures *independently* such as (few examples):
 - Closed reduction of fractures
 - External fixation of compound fractures
 - Debridement of crush injuries
 - Amputations
 - Internal fixation of common simple fractures
 - Polio surgery such as TA lengthening, Steindler's procedure etc
 - Intra-articular injections
 - Steroid injections for various painful conditions
 - Sequestrectomy in chronic osteomyelitis
 - Corrective plaster of Paris (POP) casts for club foot & other congenital deformities

- Biopsy from a mass
2. Resident should be able to do the following operations under supervision/guidance of senior colleagues/ faculty member (few examples):
- Internal fixation of simple fractures such as fracture of both bones of forearm, supracondylar fracture humerus, malleolar fractures, femur shaft fractures, per trochanteric fractures etc.
 - Polio surgery such as Jones procedure, Campbell's procedure, triple arthrodesis, Lambrinudi procedure etc.
 - Club foot surgery such as postero-medial soft tissue release, Dillwyn-Evan's procedure, triple arthrodesis, JESS fixator, Ilizarov fixator application.

REGULATIONS

Scheme of the Course

A summary of five years course in MS Orthopaedics is presented as under:

Course Structure	Components	Examination
At the End of 2nd year MS Orthopaedics Programme	<ul style="list-style-type: none"> Principles of General Surgery Relevant Basic Science (Anatomy, Physiology, Pharmacology & Pathology) 	<p><u>Intermediate Examination</u> at the end of 2nd Year of M.S. Orthopaedics Programme</p> <p>Written MCQs = 300 Marks Clinical, TOACS/OSCE & ORAL = 200 Marks</p> <p style="text-align: right;">Total = 500 Marks</p>
At the end of 5th year MS Orthopaedics Programme	<p style="text-align: center;"><u>Clinical component</u></p> <p>Training in Orthopaedics with rotations in the relevant fields.</p> <p style="text-align: center;"><u>Research component</u></p> <p>Research work / Thesis writing must be completed and thesis be submitted atleast 6 months before the end of final year of the programme.</p>	<p><u>Final Examination</u> at the end of 5th year of M.S. Orthopaedics Programme.</p> <p>Written = 500 Marks Clinical, TOACS/OSCE & ORAL = 500 Marks Contribution of CIS = 100 Marks Thesis Evaluation = 400 Marks</p> <p style="text-align: right;">Total = 1500 Marks</p> <p>Thesis evaluation and defense at the end of 5th year of the programme.</p>

Intermediate Examinations M. S. Orthopaedics

All candidates admitted in M.S. Orthopaedics courses shall appear in Intermediate examination at the end of second calendar year.

Eligibility Criteria:

The candidates appearing in Intermediate Examination of the M.S. Orthopaedics Programme are required:

- a) To have submitted certificate of completion of mandatory workshops.
- b) To have submitted certificate of completion of first two years of training from the supervisor.
- c) To have submitted CIS assessment proforma from his/her own supervisor on 03 monthly basis and also from his/her supervisors during rotation, achieving a cumulative score of 75%.
- d) To have submitted certificate of approval of synopsis or undertaking / affidavit that if synopsis not approved with 30 days of submission of application for the Intermediate Examination, the candidate will not be allowed to take the examinations and shall be removed from the training programme.
- e) To have submitted evidence of payment of examination fee.

Intermediate Examination Schedule and Fee

- a) Intermediate Examination at completion of two years training, will be held twice a year.
- b) There will be a minimum period of 30 days between submission of application for the examination and the conduction of examination.
- c) Examination fee will be determined periodically by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue Roll Number Slips on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee.

All candidates admitted in MS Orthopaedics courses shall appear in Intermediate examination at the end of second calendar year.

Written Examination	= 300 Marks
Clinical, TOACS/OSCE & ORAL	= 200 Marks
Total	= 500 Marks

Written:

MCQs 100 (2 marks each MCQ)

SEQs 10 (10 Marks each SEQ)

Total = **300 Marks**

Components of Theory Paper

Principles of General Surgery	= 70 MCQs	7 SEQs
Specialty specific	= 10 MCQs	1 SEQs
Basic Sciences	= 20 MCQs	2 SEQs
• Anatomy	= 6 MCQs	1 SEQs
• Pharmacology	= 2 MCQs	-----
• Pathology	= 6 MCQs	1 SEQ
• Physiology	= 6 MCQs	-----

Clinical, TOACS/OSCE & ORAL

Four Short Cases	= 100 Marks
One Long Case	= 50 Marks
TOACS/OSCE & ORAL	= 50 Marks

Total = 200 Marks

Declaration of Results

The Candidate will have to score 50% marks in written and oral, practical/ clinical component and a cumulative score of 60% to be declared successful in the Intermediate Examination.

A maximum total of four consecutive attempts (availed or unavailed) will be allowed in the Intermediate Examination during which the candidate will be allowed to continue his training program. If the candidate fails to pass his Intermediate Examination within the above mentioned limit of four attempts, the candidate shall be removed from the training program, and the seat would fall vacant, stipend/ scholarship if any would be stopped.

Final Examination M.S. Orthopaedics

At the end of 5th Calendar year of the Programme

Eligibility Criteria:

To appear in the Final Examination the candidate shall be required:

- i) To have submitted the result of passing Intermediate Examination.
- ii) To have submitted the certificate of completion of training, issued by the Supervisor will be mandatory.
- iii) To have achieved a cumulative score of 75% in Continuous Internal assessments of all training years.
- iv) To have got the thesis accepted and will then be eligible to appear in Final Examination.
- v) To have submitted no dues certificate from all relevant departments including library, hostel, cashier etc.
- vi) To have submitted evidence of submission of examination fee.

Final Examination Schedule and Fee

- a) Final examination will be held twice a year.
- b) The candidates have to satisfy eligibility criteria before permission is granted to take the examination.
- c) Examination fee will be determined and varied at periodic intervals by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue an Admittance Card with a photograph of the candidate on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee. This card will also show the Roll Number, date / time and venue of examination.

Written Part	= 500 Marks
Clinical, TOACS/OSCE & ORAL	= 500 Marks
Contribution Internal Assessment	= 100 Marks
Thesis Examination	= 400 Marks

Total = 1500 Marks

Written Papers:

Paper 1	= 100 MCQs	5 SEQs
Paper 2	= 100 MCQs	5 SEQs

Clinical, TOACS/OSCE & ORAL

Short Cases	= 200 Marks
Long Case	= 100 Marks
Toacs/OSCE & Oral	= 200Marks
Total	= 500 Marks

Declaration of Result

For the declaration of result

- I. The candidate must get his/her Thesis accepted.
- II. The candidate must have passed the final written examination with 50 % marks and the clinical & oral examination securing 50% marks. The cumulative passing score from the written and clinical / oral examination shall be 60%.
- III. The MS degree shall be awarded after acceptance of thesis and success in the final examination.
- IV. On completion of stipulated training period, irrespective of the result (pass or fail) the training slot of the candidate shall be declared vacant.

Submission / Evaluation of Synopsis

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on university website.
2. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.
3. Synopsis of research project shall be submitted by the end of the 2nd year of MS program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for consideration by the Advanced Studies & Research Board, through the Principal / Dean /Head of the institution.

Submission of Thesis

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor.
2. The minimum duration between approval of synopsis and submission of thesis shall be one year.
3. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.

4. The research thesis will be submitted along with the fee prescribed by the University.

Thesis Examination

- a) The candidate will submit his/her thesis at least 06 months prior to completion of training.
- b) The Thesis along with a certificate of approval from the supervisory will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.
- c) The Controller of Examinations will submit a panel of eight examiners within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examinations would bring the case personally to the Vice Chancellor.
- d) The Supervisor shall not act as an examiner of the candidate and will not take part in evaluation of thesis.
- e) The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.
- f) The thesis will be evaluated by the examiners within a period of 06 weeks.
- g) In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.

- h) In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause University Regulations.
- i) There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.
- j) The total marks of thesis evaluation will be 400 and 60% marks will be required to pass the evaluation.
- k) The thesis will be considered / accepted, if the cumulative score of all the examiners is 60%.
- l) The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier, the slot will fall vacant after stipulated training period.

Award of MS Orthopaedics Degree

After successful completion of the structured courses of MS Orthopaedics and Qualifying Intermediate and Final Examinations (written, Clinical, TOACS/OSCE & ORAL and Thesis) the degree with title MS Orthopaedics shall be awarded.

CONTENT OUTLINE

MS Orthopaedics

Basic Sciences:

Student is expected to acquire comprehensive knowledge of Anatomy, Physiology, Pathology and Pharmacology relevant to surgical practice appropriate for Orthopaedics.

1. Anatomy

- *Clinical and functional anatomy with pathological and operative relevance*
- *Surgical approaches to the limbs and axial skeleton*
- *Histology and embryology of musculoskeletal system*

- Cell Biology: Cytoplasm – Cytoplasmic matrix, cell membrane, cell organelles, cytoskeleton, cell inclusions, cilia and flagella.
- Nucleus – nuclear envelope, nuclear matrix, DNA and other components of chromatin, protein synthesis, nucleolus, nuclear changes indicating cell death.
- Cell cycle, mitosis, meiosis, cell renewal.
- Cellular differentiation and proliferation.
- Tissues of Body: Light and electron microscopic details and structural basis of function, regeneration and degeneration. Confocal microscopy.
- The systems/organs of body – Cellular organization, light and electron microscopic features, structure function correlations, and cellular organization.

General Embryology:

General Features of Human Development

Features of mitotic and meiotic modes of cell division. Genetic consequences of meiotic division.

Abnormal mitotic and meiotic divisions of clinical importance.

Gametogenesis: origin of germ cells.

Oogenesis: prenatal and postnatal development of ova.

Spermatogenesis: proliferation and maturation of male germ cells. Abnormal gametes, their clinical significance.

Ovulation, fertilization and the consequences of fertilization.

Early Embryonic Development:

Cleavage, morula and blastocyst formation and implantation. Formation of the three primary germ layers.

List of the derivatives of the respective germ layers.

Period of the Growing Fetus:

Various stages and salient features of the fetus development

Extraembryonic Membranes:

Development, functions and anomalies of yolk sac, amnion, chorion, allantois, umbilical cord and placenta.

Development of the External Body Form:

Shaping of the head, neck, trunk and limbs. Common developmental anomalies associated with this.

The Branchial Apparatus:

Development and fate of the bronchial grooves, arches and pouches. Their derivatives and anomalies.

Teratogenesis:

Factors known to be involved in the development of congenital anomalies especially related to the musculoskeletal system.

Concept of critical periods.

General Histology:

Structural and Functional Organization of the Tissues of Body

Classification of tissues and identification of various tissues particularly those related to the musculoskeletal system, in routine histological preparations under the light microscope.

The Epithelial Tissue

General structure, functions and classification of epithelia
Their location in the body
General characters of serous and mucous membranes
General structural features of exocrine and endocrine glands

The Connective Tissue

Cartilage

Structure of bone marrow. Cell lines seen in haemopoiesis.

Factors required for bone growth.

The Muscular Tissue

Structural and functional differences between the smooth skeletal and cardiac types of muscle.

Fine structure of skeletal and cardiac muscle fibers, and its relationship to the mechanism of contraction.

Specialized conducting tissue of the heart.

The Neural Tissue

The neuron, morphology of the perikaryon and its processes.

Coverings of the axons in the peripheral nerves and the central nervous system.

Types of neuroglia and their functions.

Process of myelination in the peripheral nerves and the central nervous system.

Axon terminals and synapses. Nerve fiber degeneration and regeneration.

Gross Anatomy / Surface Anatomy

1. Musculoskeletal System

Back and Spinal Cord

- Muscles of the Back
- Vertebral Canal and Spinal Cord

Upper Limb

- Scapular Region
- Pectoral Region
- Axillary Region
- Arm

- Flexor Region of the Forearm
- Palm of the Hand
- Extensor Region of the Forearm and Dorsum of the Hand
- Joints of the Upper Extremity
- Origins and insertions of all muscles associated with the upper extremity.
- Basic functions of these muscles.
- Nerve and general arterial supplies of all muscles associated with the upper extremity.
- Structural entities of the upper extremity
- Structural relationship of a these structures to all neighboring structures.
- Effect of injury to specific peripheral nerves (i.e. Muscles affected, specific deformity encountered).
- Locations for palpation of the pulse in major arteries of the upper limb.
- Locations of major nerves of the upper limb
- dermatomes of the upper limb.
-

Lower Limb

- Superficial Anatomy of the Lower Extremity
- Anterior and Medial Thigh Region
- Gluteal Region
- Posterior Thigh and Popliteal Fossa
- Leg
- Foot
- Major Joints of the Lower Extremity
- Origins and insertions of all muscles associated with the lower extremity.
- Basic functions of these muscles.
- Nerve and general arterial supplies of all muscles associated with the lower extremity.
- Structural entities of the lower extremity and their structural relationship to all neighboring structures.
-
- Effect of injury to specific peripheral nerves (i.e. Muscles affected, specific deformity encountered).
- Locations for compression and palpation of the pulse in major arteries of the lower limb.
- Dermatomes of the lower limb.

Thorax

- Thoracic Wall

- Pleural Cavities and Lungs
- Heart
- Mediastinum
- Bony thorax and relation with the muscles of respiration.
- Major vessels and nerves of the thorax and the structures supplied by each.
- Organic structural entities of the thorax and the structural relationship of these to all neighboring structures.
- Surface projections of the thoracic viscera.

Head and Neck

- Osteology of the Skull
- Superficial Face
- Posterior Triangle of the Neck
- Anterior Triangle of the Neck
- Cervical Viscera
- Infratemporal Fossa
- Cranial Fossa
- Orbits and Eye
- Temporal Bone and Ear
- Pharynx
- Larynx
- Nasal Cavity
- Oral Cavity
- Origins and insertions of all muscles associated with the head and neck
- Basic functions of these muscles.
- Nerve supply of all the muscles.
- Structural entities of the head and neck and their structural relationship to all neighboring structures.
- Locations for palpation of the pulse in major arteries of the head and neck.
- Locations of major nerves of the head and neck, along with their cutaneous distributions.
- Sensory and/or motor functions, as they apply for the 12 pairs of cranial nerves (including pupillary light and accommodation reflexes, corneal reflex, and gag reflex).

Abdomen:

- Anterior Abdominal Wall
- Inguinal Region, Scrotum and Testes
- Abdominal Cavity

- Stomach, Spleen and Liver
- Intestines and Pancreas
- Posterior Abdominal Wall

- Composition of the abdominal wall and identify all structures
- Significance of the contents of the spermatic cord.
- Visceral and peritoneal structures of the abdomen and their structural relationship of a sample structure to all neighboring structures.
- Major vessels of the abdominal cavity.
- General terms the innervation of the GI tract.
- Surface projections of the abdominal viscera.

Pelvis and Perineum:

- Female Perineum
- Male Perineum and the Penis
- Female Pelvis
- Male Pelvis
- Male and female pelvic organs, and external structures.

Bones

- Developmental aspects of the skeleton
- Identification of bony outlines on plain x-ray.
- Classification of bones.
- Bone growth and ossification.
- Blood supply of all long and small bones of human body

Axial Skeleton:

Skull /

Cranial bones

Facial bones

Auditory ossicles

Splanchnocranial bones

Vertebral column

- Vertebrae
- Cervical
- Thoracic
- Lumbar

- Sacrum
- Coccyx

Curvatures of the spine

Primary

Secondary

Abnormal spine

- Kyphosis
- Lordosis
- Scoliosis

Thorax

- Sternum
- Manubrium
- Ribs
- Costal cartilages

Appendicular Skeleton

Upper Extremity

Pectoral girdle

Scapula

Clavicle

Shoulder joint

Brachium [arm]

Elbow joint

Antebrachium [forearm]

Wrist [carpus]

Carpal bones

Hand [manus]

Lower Extremity

Pelvic girdle

Hip joint

Thigh

Knee

Leg

Ankle [tarsus]

Tarsal bones
Foot

Joints

- Classification of joints
 - Fibrous Joints
 - Cartilaginous Joints
 - Synovial Joint
 - Plane Joint
 - Hinge Joint
 - Pivot Joint
 - Condylloid Joint
 - Saddle Joint
 - Ball-and-Socket Joint
- Inflammatory Disorders of Joints
- Factors contributing to the stability of joints.
- Movements of the joints of shoulder, elbow, hip, knee and ankle.
- Movements of the shoulder girdle as a whole, supination and pronation of forearm, inversion and aversion of foot and movements of fingers and thumb.
- Maintenance of normal posture

Muscles and Fasciae

- Muscles of the human body
- General disposition, nerve supply and effects of nerve lesions
- Muscle attachments, group actions and nerve supply.

Body Cavities:

- Abdominal, thoracic, cranial, pelvic cavity
- A general description of the boundaries, land marks and surface anatomy of the internal organs and dermatomes of the body cavities
- General disposition, morphology, relations, blood and nerve supply, lymph nodes and areas of drainage of the viscera contained in these cavities.
- Identification of bony outlines on plain X-ray.

Cross Sectional / Imaging Anatomy of the Musculoskeletal System:

Skull

- Anterior View
- Lateral View
- Posterior View
- Superior View
- Inferior View
- Internal View
- Mandible
- Fetal Skull

Vertebral Column

- Atlas (C1)
- Axis (C2)
- Cervical
- Thoracic
- Lumbar
- Sacrum

Thoracic Bones

- Rib & Vertebra Articulated
- Sternum

Upper Limb Bones

- Scapula (Posterior Aspect)
- Scapula (Lateral Aspect)
- Humerus (Proximal End)
- Humerus (Distal End)
- Ulna
- Radius
- Hand (Dorsal Surface)
- Hand (Palmar Surface)

Lower Limb Bones

- Os Coxa (Lateral Aspect)
- Os Coxa (Medial Aspect)
- Femur (Proximal End)
- Femur (Distal End)
- Tibia

- Fibula
- Foot (Superior Aspect)
- Foot (Lateral Aspect)
- Knee Joint

Anatomy of the Nervous System

Development of the nervous system and common developmental anomalies.

The Brain

Subdivisions of the brain.

External morphology of cerebellum, lobes, surface, sulci and gyri. External morphology of cerebellum and its subdivisions.

External morphology of midbrain, pons and medulla.

Different grey matter masses in the brain.

Ventricular system of the brain.

Circulation of cerebrospinal fluid and its composition.

Blood supply of the brain. Parts of the cranial dura, formation and drainage of dural sinuses.

Appearance of CT and MRI scans and identification of structures.

Cerebrum as seen in horizontal sections.

Cerebral Cortex

Gross and microscopic organization of the cortex, location of motor and sensory cortical areas.

Functions and blood supply of various regions. White matter of the cerebrum, definition of association, commissural and projection fibers and their role in cortical functioning. Internal capsule, location, fibre content and blood supply.

Limbic System

Core structures of the limbic system.

Other nuclei and pathways associated with the limbic system.

Functions of thalamus, hypothalamus and the limbic system.

Basal Ganglia

Subdivisions, connections, functions and effects of lesions.

Thalamus

Nuclear groups, afferent and efferent connections and their functional correlations.

Hypothalamus

The nuclei, afferent and efferent connections and their functional correlations.
Effects of lesions.

Internal Structure Of Cerebellum

Cerebellar cortex: organization and functions.

Cerebellar nuclei: main connections.

Cerebellar peduncles, cerebellar afferent and efferent connections, functional correlations.

Effects of lesions.

Spinal Cord

External morphology, meninges and blood supply of the spinal cord. Relationship of the "segments" to vertebrae at different ages.

Internal structure of the spinal cord, organization of the grey and white matter.

Variations in the structure of the grey matter at different levels and location of the important nuclei.

Location of ascending and descending tracts, and their functions.

Effects of injury or disease.

Peripheral Nervous System

Anatomy and functions of cranial nerves with their intracranial and extracranial course and distribution.

Location of various cranial nerve nuclei.

Anatomy and functions of spinal nerves.

Foundation, course and distribution of a typical nerve.

Effects of lesions.

Respiration:

- Pulmonary ventilation
- Mechanics of respiration, pulmonary volumes, capacities and pressures.
- Transport and exchange of oxygen and carbon dioxide.
- Regulation of respiration. (chemical and neural)
- Physiology of respiratory insufficiencies, hypoxia, dyspnoea, asphyxia and hypercapnia.

- Exercise hypoxia and cyanosis
- Physiological changes due to altitude and space travel
- Principles and methods of artificial respiration.
- Principles of pulmonary function tests.
- Interpretation of data of diagnostic tests.
- Cardiopulmonary resuscitation.
- Patho-physiology of respiratory failure.

Renal function:

- Renal circulation
- Glomerular filtration
- Tubular function
- Water excretion
- Acidification of urine
- Regulation of Na + and K + excretion
- Regulation of extracellular fluid composition and volume
- Homeostatic mechanisms to maintain
 - Tonicity
 - Volume
 - H⁺ concentration of ECF.

Central Nervous System

- Motor cortex corticospinal and corticobulbar system.
- Basal ganglia
- Cerebellum

Autonomic Nervous System

- Overall functions of sympathetic and parasympathetic nervous systems.
Autonomic reflex activity.

Functional Aspects of the Nervous System

- Sensory activity: Peripheral sensory receptors, sensory pathways, physiology of pain and disorders of sensations.
- Motor activity: corticospinal and extracorticospinal pathways, cerebellum and Vestibular system.
- Motor neurons, motor units and neuromuscular junction.
- Disorders of motor activity.

Muscle and nerve physiology.

- Reflex activity: Monosynaptic stretch reflexes, polysynaptic withdrawal reflexes, general characters of reflexes.

- Electroencephalogram and its uses.
- Sleep, types, physiological changes during sleep.
- Speech mechanism and its disorders.
- Cerebrospinal fluid, cerebral circulation, metabolism and functions.
- Blood brain and blood CSF barriers.

2. Physiology

Cellular organization, structure function correlations and physiological alterations in the organ systems of body with particular emphasis on the musculoskeletal system

Structural and Functional Organization of the Cells of the Body

- Concept of cells as the structural, functional and genetic units of the body.
- Composition of protoplasm, division into cytoplasm and nucleus.
- Role of macromolecules in the structural organization of the cell.
- Cell components with their role in cell function.
- Diversity of cell morphology as related to the varied functional demands. Physical activities of the living cells, intracellular movements, cellular locomotion, endocytosis and exocytosis.
- Basic concepts of the principles of transport through cell membrane, membrane potential and action potential.
- The cell cycle and cell division.
- Energy balance, metabolism & nutrition
- Uses of cell and tissue cultures.
- DNA and RNA structure and protein synthesis.

Musculoskeletal Physiology

- Introduction
- Muscle types—skeletal, smooth and cardiac
- Shared characteristics
- Skeletal muscle filaments and associated proteins
- Thick filament—myosin
- Thin filament—actin and tropomyosin/troponin complex
- Skeletal muscle fibre types:
 - Type I

- Type IIa
- Type IIX
- Contraction cycle
- Sliding filament hypothesis
- Ratchet theory of muscle contraction
- Biochemical events that occur during a contraction cycle
- Mechanical properties of skeletal muscle
- Length-tension relationship
- Force-velocity relationship
- Motor units
- The functional unit of a muscle
- Motor unit recruitment
- Muscle contraction, all or non law
- Definition, methods of obtaining muscle relaxation
- Summation and tetanus
- Cumulative effect of repeated stimulation of a muscle
- Group action of muscles
- Control of coordination
- Voluntary movement
- Pattern of movement
- Muscle training and fatigue
- Tetanus—electrophysiological explanation
- Treppe or the staircase effect during repetitive stimulation of muscle contraction
- Energy sources for skeletal muscle contraction
 - Short-term regeneration of ATP
 - Anaerobic—glycolysis
 - Aerobic—Kreb’s Cycle/Oxidative Phosphorylation
 - Fast twitch—Glycolytic (White)
- Specialized cellular and subcellular structures
- Trophic factors that influence neuromuscular junction development
- Biosynthesis and metabolism of the neurotransmitter acetylcholine
- Synthesis—the key metabolic enzyme is choline-O-acetyltransferase

- Degradation—acetylcholine esterase terminates the action of released acetylcholine
- Neuromuscular transmission
- Ionic basis of the resting membrane or end-plate potential

- Nicotinic acetylcholine receptors
- Signal initiated by acetylcholine
- Excitation-contraction coupling
- Latent period
- Subcellular structures that carry the action potential to sarcoplasmic reticulum
- Calcium recycling
- Miniature end plate potentials
- Electrophysiological properties
- Skin and muscle sensibility
- Spinal reflexes
- Conditioned reflexes
- Definition, anatomical presentation of correct posture
- Reflex regulation of movement and posture
- Difference between correct and incorrect posture
- Strength, power, flexibility and endurance of muscles
- Changes in neuromuscular transmission following motor nerve section
- The reaction of degeneration.
- Toxins and other pharmacological agents that act on the neuromuscular junction
- Myasthenia gravis
- General adaptations of muscle to increased and decreased activity.
- The muscle hypertrophy and atrophy
- Prevention of muscle atrophy
- Skeletal muscle responses to activity
 - Aerobic training
 - Strength training
 - Disuse or immobilization
- Fuel stores in the body
 - Carbohydrate
 - Fat
 - Protein
- Fuel use during exercise
 - Effects of feeding during exercise
 - Effects of feeding before and after exercise
- Recording of muscular contraction
- EMG

Blood:

- General properties and composition.
- Structure, production, functions and fate of red blood cells, white blood cells and platelets.
- Structure, formation, functions, and fate of haemoglobin.
- Blood volume and principles of its measurement.
- Disorders of blood.

- Blood groups (ABO, Rh and other systems), blood transfusion and exchange transfusion.
- Precautions and hazards of blood transfusion.
- Plasma proteins, their production and functions.
- Diagnosis of various types of anaemias and leukaemias.
- Values of various components of blood in different age groups e.g. haemoglobin, WBCs, hormones etc.
- Interpretation of complete blood picture, haematological changes in infectious and non infectious diseases

Cardiovascular System:

- Cardiac muscle: electrical and mechanical properties.
- Metabolism
- Origin of the heart beat, the electrical activity of the heart (normal and findings in cardiac and systemic diseases)
- Mechanism of production of heart sounds, their location, characters and relationship with the cardiac cycle.
- The normal electrocardiogram and characters of its various components. Significance of its parts, voltage and calibration, principles and methods of recording, electrocardiographic leads and general information obtained from ECG.
- Physiology and abnormalities of apex beat.
- Cardiac output, amount, distribution, measurement, control, cardiac index and cardiac reserve.
- Echocardiography, exercise tolerance test and the basis of ETT.
- Patho-physiology of cardiac failure, valvular heart disease and hypertension. Interpretation of data of diagnostic tests.
- Dynamics of blood and lymph flow: biophysics
- Arterial and arteriolar circulation capillary circulation, lymphatic circulation and venous circulation

- Laws of haemodynamics governing flow, pressure and resistance in blood vessels.
- Arterial blood pressure, measurement and regulation.
- Vasomotor system and control of blood vessels.
- Characters of arterial pulse and venous pulse.
- Significance of central venous pressure.
- Mechanism of haemorrhage and shock.
- Coronary, cutaneous, splanchnic and peripheral circulation.
- Its measurement, control and special features, circulatory changes during muscular exercise
- Cardiovascular regulatory mechanisms local regulation
- Endothelium; systemic regulation by hormones and systemic regulation by nervous system.
- Circulation through special organs: organs: coronary circulation, cerebral circulation and pulmonary circulation.
- Cardiovascular homeostasis in health and diseases: exercise, gravity, shock, hypertension and heart failure.

Respiration:

- Pulmonary ventilation
- Mechanics of respiration, pulmonary volumes, capacities and pressures.
- Transport and exchange of oxygen and carbon dioxide.
- Regulation of respiration. (chemical and neural)
- Physiology of respiratory insufficiencies, hypoxia, dyspnoea, asphyxia and hypercapnia.
- Exercise hypoxia and cyanosis
- Physiological changes due to altitude and space travel
- Principles and methods of artificial respiration.
- Principles of pulmonary function tests.
- Interpretation of data of diagnostic tests.
- Cardiopulmonary resuscitation.
- Patho-physiology of respiratory failure.

Renal function:

- Renal circulation
- Glomerular filtration
- Tubular function

- Water excretion
- Acidification of urine
- Regulation of Na⁺ and K⁺ excretion
- Regulation of extracellular fluid composition and volume
- Homeostatic mechanisms to maintain
 - Tonicity
 - Volume
 - H⁺ concentration of ECF.

Endocrinology:

- General concepts of chemical nature, mechanism, site of action and functions of hormones of the hypothalamus, pituitary, thyroid, adrenal, parathyroid, pancreas, and pineal glands, ovaries and testis.
- Comprehensive knowledge of all hormones including their chemistry, biosynthesis, storage, release, transport, mechanism of inactivation mode and site of action, distribution, physiological and pathological activities and assessment of functions.
- Calcium homeostasis
- Effects of hypo- and hyperactivity of the endocrine glands.
- Production and functions of hormones related to the sex characters in the male and female.
- Endocrinology of the menstrual cycle.
- Role of hormones in pregnancy, parturition and lactation.
- Functions of placenta. Libido, impotence and infertility.
- Endocrine function of the kidney, heart, lung and gastrointestinal tract

Gastrointestinal function:

- Digestion and absorption
- Regulation of gastrointestinal function
- Motility: mastication, swallowing, gastric motility, intestinal motility and gall bladder motility.
- Secretory activity: formation, composition, function and control of saliva, gastric, pancreatic, bile and intestinal secretions.
- GIT hormones controlling activities: Functions of the stomach, pancreas, gall bladder, liver and large intestine. Formation and composition of faeces, mechanism of defecation.
- Circulation of bile. Principles and assessment of liver function tests. Interpretation of data, diagnostic tests.

- Hyperbilirubinaemia and congenital hyperbilirubinaemias.
- Control of hunger, appetite and its disorders.

Central Nervous System

- Motor cortex corticospinal and corticobulbar system.
- Basal ganglia
- Cerebellum

Autonomic Nervous System

- Overall functions of sympathetic and parasympathetic nervous systems.
Autonomic reflex activity.

Functional Aspects of the Nervous System

- Sensory activity: Peripheral sensory receptors, sensory pathways, physiology of pain and disorders of sensations.
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- Motor neurons, motor units and neuromuscular junction.
- Disorders of motor activity.

Muscle and nerve physiology.

- Reflex activity: Monosynaptic stretch reflexes, polysynaptic withdrawal reflexes, general characters of reflexes.
- Electroencephalogram and its uses.
- Sleep, types, physiological changes during sleep.
- Speech mechanism and its disorders.
- Cerebrospinal fluid, cerebral circulation, metabolism and functions.
- Blood brain and blood CSF barriers.
 - membrane biochemistry and signal transduction
 - Gene expression and the synthesis of proteins
 - Bioenergetics; fuel oxidation and the generation of ATP
 - Enzymes and biologic catalysis
 - Tissue metabolism

Vitamins

- Classification, components, sources, absorption and functions (physiological and biochemical role).
- Daily requirements, effects of deficiency and hypervitaminosis.
- Salient morphologic features of diseases related to deficiency or excess of vitamins.

Minerals

- Sources of calcium, phosphorous, iron, iodine, fluorine, magnesium and manganese.
- Trace elements and their clinical importance.
- Absorption and factors required for it.
- Functions and fate.

Metabolism

- Metabolic rate and basal metabolic rate
- Factors influencing metabolic rate, principles of measurement.

Carbohydrates

- Classification and dietary sources.
- Digestion, absorption and utilization of dietary carbohydrates. Glucose tolerance test.
- Glycogenesis, glycolysis, gluconeogenesis, glycogenolysis, processes with the steps involved and effects of hormones.
- Citric acid cycle, steps involved, its significance and the common final metabolic pathway.
- Hexose monophosphate shunt: mechanism and significance.

Lipids

- Classification of simple, derived and compound lipids.
- Dietary sources.
- Digestion, absorption, utilization and control.
- Fatty acid oxidation with steps involved.
- Ketogenesis and its significance.
- Lipotropic factors and their actions. Lipoproteins, types and importance.

Proteins and Amino Acids

- Classification and dietary sources of proteins.
- Digestion, absorption, utilization and control.
- Fate of amino acids.
- Urea formation with steps involved.
- Functions and effects of deficiency.

Nucleoproteins:

Structure and metabolism.

Pigment Metabolism

- Basic concept of endogenous and exogenous pigments.
- Causes of pigmentation and depigmentation.
- Disorders of pigment metabolism, inherited disorders, acquired disorders from deficiency or excess of vitamins, minerals, fats, carbohydrates, proteins etc.

Balanced Diet

- Requisites of an adequate diet.
- Role of carbohydrates, fats, proteins, minerals, vitamins and water in diet.
- Principles of nutrition as applied to medical problems
- Biotechnology and concepts of molecular biology with special emphasis on use of recombinant DNA techniques in medicine and the molecular biology of cancer

3. Pharmacology

- The Evolution of Medical Drugs
- British Pharmacopia
- Introduction to Pharmacology
- Receptors
- Mechanisms of Drug Action
- Pharmacokinetics
- Pharmacokinetic Process
 - Absorption
 - Distribution
 - Metabolism
 - Desired Plasma Concentration
 - Volume of Distribution
 - Elimination
 - Elimination rate constant and half life
 - Creatinine Clearance
- Drug Effect
 - Beneficial Responses
 - Harmful Responses
 - Allergic Responses
- Drug Dependence, Addiction, Abuse and Tolerance
- Drug Interactions
- Drug use in pregnancy and in children
- Autonomic Pharmacology

4. Pathology

Pathological alterations at cellular and structural level along with brief introduction of Basic Microbiology and Haematology

Cell Injury and adaptation

- Reversible and Irreversible Injury
- Fatty change, Pathologic calcification
- Necrosis and Gangrene

Cellular adaptation

- Atrophy, Hypertrophy,
- Hyperplasia, Metaplasia, Aplasia

Inflammation

- **Acute inflammation**
- Cellular components and chemical mediators of acute inflammation
- Exudates and transudate
- Sequelae of acute inflammation
- **Chronic inflammation**
- Etiological factors and pathogenesis
- Distinction between acute and chronic (duration) inflammation
- Histologic hallmarks
- Types of chronic inflammation, non-granulomatous and granulomatous, and their causes

Haemodynamic disorders

- Etiology, pathogenesis, classification and morphological and clinical manifestations of Edema, Haemorrhage, Thrombosis, Embolism, Infarction & Hyperaemia
- Shock; classification etiology, and pathogenesis, manifestations.
- Describe the compensatory mechanisms involved in shock
- Describe the pathogenesis and possible consequences of thrombosis
- Describe the difference between arterial and venous emboli

Neoplasia

- Dysplasia and Neoplasia
- Benign and malignant neoplasms
- Etiological factors for neoplasia
- Different modes of metastasis
- Tumor staging system and tumor grade

Immunity and Hypersensitivity

- Immunity
- Immune response
- Diagnostic procedures in a clinical microbiology laboratory
- Protective immunity to microbial diseases
- Tumour immunology
- Immunological tolerance, autoimmunity and autoimmune diseases.
- Transplantation immunology
- Hypersensitivity
- Immunodeficiency disorders
- Immunoprophylaxis & Immunotherapy

Haematopathology

- Normal blood picture & variation in disease

Related Microbiology

- Role of microbes in various central and peripheral nervous system diseases
- Infection source
- Nosocomial infections
- Bacterial growth and death
- Pathogenic bacteria
- Vegetative organisms
- Spores
- Important viruses
- Important parasites
- Surgically important microorganisms
- Sources of infection
- Asepsis and antisepsis
- Sterilization and disinfection
- Infection prevention
- Immunization
- Personnel protection from communicable diseases
- Use of investigation and procedures in laboratory
- Use Of Investigation And Procedures In Laboratory
- Sputum, Urine, Stool, Cerebrospinal Fluid(CSF), Pus, Aspirates

Special Musculoskeletal Pathology:

Bones:

- Atrophic and hypertrophic conditions of bones
- Congenital, developmental and hereditary abnormalities of bone and cartilage. Traumatic bony lesions leading to osteoporosis, fractures
- Healing of fracture
- Non-union & malunited fracture
- Pseudoarthrosis
- Bone graft
- Inflammatory and non-inflammatory lesions of bones.

Metabolic Diseases of Bone:

- Scurvy
- Rickets
- Osteomalacia
- Renal dwarfism
- Skeletal changes due to endocrine dysfunction
- Miscellaneous groups of osteopathies
- Secondary pulmonary hypertrophic osteoarthropathy
- Bone cyst
- Polystatic fibrous dysplasias of bone
- Paget's disease of bone
- Simple and malignant tumors of bone and cartilage.

Joints:

- Disease of joints
- Infective arthritis; gonococcal, pyogenic, tuberculosis, syphilitic, mycotic etc. Rheumatic arthritis
- Degenerative joint disease (osteoarthritis).
- Sero-negative and positive polyarthritis
- Lyme disease (Lyme arthritis)
- Bursitis
- Metabolic arthritis: (a) Due to systemic disorders (b) Due to local disorders.

Muscles

- Non-inflammatory myopathies
- Inflammatory myopathies
- Metabolic diseases

- Denervation, muscular atrophy
- Muscular dystrophy
- Myositis
- Myasthenia gravis
- Torticollis
- Dupuytren's contracture
- Tendonitis
- Tumors.

MS Orthopaedics

Basic Principles of Surgery for Intermediate Examination

- History of surgery
- Preparing a patient for surgery
- Principles of operative surgery: asepsis, sterilization and antiseptics
- Surgical infections and antibiotics
- Basic principles of anaesthesia and pain management
- Acute life support and critical care:
 - Pathophysiology and management of shock
 - Fluids and electrolyte balance/ acid base metabolism
 - Haemostasis, blood transfusion
- Trauma: assessment of polytrauma, triage, basic and advanced trauma
- Accident and emergency surgery
- Wound healing and wound management
- Nutrition and metabolism
- Principles of burn management
- Principles of surgical oncology
- Principles of laparoscopy and endoscopy
- Organ transplantation
- Informed consent and medicolegal issues
- Molecular biology and genetics

- Operative procedures for common surgical manifestations e.g cysts, sinuses, fistula, abscess, nodules, basic plastic and reconstructive surgery
- Principles of basic diagnostic and interventional radiography
- Interpretation of conventional and advanced imaging procedures including Ultrasonography, MRI, CT scan; plain or with contrast, and their correlation with disease

Common Surgical Skills

Incision of skin and subcutaneous tissue:

- Langer's lines
- Healing mechanism
- Choice of instrument
- Safe practice

Closure of skin and subcutaneous tissue:

- Options for closure
- Suture and needle choice
- Safe practice

Knot tying:

- Choice of material
- Single handed
- Double handed
- Superficial
- Deep

Tissue retraction:

- Choice of instruments
- Placement of wound retractors
- Tissue forceps

Use of drains:

- Indications
- Types
- Insertion
- Fixation
- Management/removal

Incision of skin and subcutaneous tissue:

- Ability to use scalpel, diathermy and scissors

Closure of skin and subcutaneous tissue:

- Accurate and tension free apposition of wound edges

Haemostasis:

- Control of bleeding vessel (superficial)
- Diathermy
- Suture ligation
- Tie ligation
- Clip application
- Plan investigations
- Clinical decision making
- Case work up and evaluation; risk management

Pre-operative assessment and management:

- Orthopaedic respiratory physiology
- Diabetes mellitus
- Renal failure
- Pathophysiology of blood loss
- Pathophysiology of sepsis
- Risk factors for surgery

- Principles of day surgery
- Management of comorbidity

Intraoperative care:

- Safety in theatre
- Sharps safety
- Diathermy, laser use
- Infection risks
- Radiation use and risks
- Tourniquets
- Principles of local, regional and general anaesthesia

Post-operative care:

- Monitoring of postoperative patient
- Postoperative analgesia
- Fluid and electrolyte management
- Detection of impending organ failure
- Initial management of organ failure
- Complications specific to particular operation
- Critical care

Blood products:

- Components of blood
- Alternatives to use of blood products
- Management of the complications of blood product transfusion including children

Antibiotics:

- Common pathogens in surgical patients
- Antibiotic sensitivities
- Antibiotic side-effects
- Principles of prophylaxis and treatment

Safely assess the multiply injured patient:

- History and examination
- Investigation
- Resuscitation and early management
- Referral to appropriate surgical subspecialties

Technical Skills

- Central venous line insertion
- Chest drain insertion
- Diagnostic peritoneal lavage
- Bleeding diathesis & corrective measures, e.g. warming, packing

- Clotting mechanism; Effect of surgery and trauma on coagulation
- Tests for thrombophilia and other disorders of coagulation
- Methods of investigation for suspected thromboembolic disease
- Anticoagulation, heparin and warfarin
- Role of V/Q scanning, CT angiography and thrombolysis
- Place of pulmonary embolectomy
- Awareness of symptoms and signs associated with pulmonary embolism and DVT
- Role of duplex scanning, venography and d-dimer measurement
- Initiate and monitor treatment

Diagnosis and Management of Common Surgical Conditions:

- Child with abdominal pain
- Vomiting child
- Trauma
- Groin conditions
 - Hernia
 - Hydrocoele
 - Penile inflammatory conditions
 - Undescended testis
 - Acute scrotum
- Abdominal wall pathologies
- Urological conditions
- Constipation
- Head / neck swellings
- Intussusception
- Abscess
- In growing toenail

In terms of general experience it is expected that trainees would have gained exposure to the following procedures and to be able to perform those marked (*) under direct supervision.

- Elective Procedures
 - Inguinal hernia
- (not neo-natal)
 - Orchidopexy
 - Circumcision*
 - Lymph node biopsy*
 - Abdominal wall herniae

- Insertion of CV lines
- Management of in growing toenails*
- EUA rectum*
- Manual evacuation*
- Open rectal biopsy
- Excision of skin lesions*
- Emergency Procedures
 - Appendicectomy
 - Incision and drainage of abscess*
 - Pyloromyotomy
 - Operation for testicular torsion*
 - Insertion of pleural drain*
 - Insertion of suprapubic catheter*
 - Reduction of intussusception

MS Orthopaedics
Specialty Clinical Component for Final Examination

I. Adult Orthopaedics

- Trauma
- Hand
- Neuromuscular
- Joints
- Tumour
- Infection
- Spine
- Foot and Ankle
- Amputation, Prosthetics and Orthotics
- Sports Medicine
- Pain

II. Paediatric Orthopaedics

- Criteria for Acceptable Performance
- General Affections of Bones
- Infections of Bones and Joints
- Affections of Joints
- Affections of Nervous System
- Affections of Muscle

- The Spine
- Congenital Disorders of the Upper Limb
- The Lower Limb
- Traumatic Disorders
- Miscellaneous Congenital Disorders

I. Adult Orthopaedics

1. TRAUMA

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the Supervisor or designate. This will be done by direct questioning or observation of clinical practice in the following areas:

GENERAL

- Initial management of major multiple system trauma
- Establishment of treatment priorities
- Systemic effects of trauma
- Patterns of injury
- Major bleeding
- Assessment and management of major multiple extremity injuries

FRACTURES

- Definition, classification
- Biomechanics and mechanism of production
- Principles of management, reduction, maintenance and mobilization, methods, of achieving these principles by closed means and indication for surgical management.
- Application of principles of surgical management of simple fractures
- Surgical management of moderately complex fractures
- Applications of external fixation

- Surgical management of complex fractures

Healing

- Histochemical, physical and radiological events
- Factors affecting fracture healing
- Clinical and radiological assessment of union, delayed union and non-union

Complications

Skin

- Classification of open fracture
- Assessment and management of Types 1 and 2 open fractures
- Assessment and investigation of infection
- Indication for amputation.
- Surgical management of Type III injuries.

Vascular

- Awareness, assessment and investigative techniques of the ischaemic limb
- Impending compartment syndrome, pathophysiology, assessment, initial management, indications for surgery
- Fasciotomy

Nerve Injury

- Awareness, assessment and investigative techniques

Muscle/Tendon Injury

- Awareness /assessment

Associated Injuries

- Awareness of common associated injuries and patterns

Early Fat Embolism Syndrome

- Clinical and radiological assessment
- Differential diagnoses, management including respiratory support
- Recognition, assessment, investigation and management of traumatically induced coagulopathies

Deep Venous Thrombosis/

- Pulmonary Embolism

Late Delayed Union & Non-Union

- Definition, clinical and radiological assessment, classification and non-operative management
- Indications for surgery
- Principles for use of internal fixation
- Types and techniques of bone grafting
- Surgical management using internal fixation, bone grafts
- Use of electrical stimulation both internal and external

Malunion

- Definition, criteria of a acceptable position
- Factors influencing remodeling and predictability
- Biomechanical and pathological effects of malposition
- Surgical revision of single plane malunion
- Surgical revision of complex fractures, malunions and osteotomies
- Others (eg Joint Stiffness, Muscle/Tendon, Tissue, Osteoporosis, Algodystrophy)
- Definition clinical assessment non-operative management
- Surgical soft tissue releases

Pathologic Fractures

- Definition, etiology, natural history
- Assessment clinically and radiologically, non-operative management
- Indications for surgery
- Adjunctive methods of management of open reduction, internal fixation
- Management of complex fractures by internal fixation, amputation, excision and prosthetic replacement.

Soft Tissue Injuries

- Histological and histochemical events in normal and abnormal healing
 - Assessment of mild, moderately severe and major injuries
 - Indications for surgery, timing of surgery
 - Selection of incisions, handling of tissues
 - Indications and methods of wound closure, simple, local flaps and Z-plasties
-
- Principles of methods of closure of soft tissue defects, use of local flaps and free flaps

- Assessment of infected and ischaemic wounds
- Recognition and assessment of myositis ossificans
- Management of wound healing by secondary intention
- Surgical excision

Joint Injuries

Closed

- Classification of ligament injuries, clinical and radiological assessment, non-operative management, indications for surgery
- Principles of operative management.
- Surgical repair of simple (single) injuries.
- Surgical management of complex acute injuries and late reconstruction.

Open

- Assessment and management of simple lacerations into joints, use of suction irrigation techniques
- Major surgical joint debridement

Articular Cartilage

- Classification, assessment, natural history
- Use of continuous passive movement devices
- Arthrotomy for excision of loose bodies or replacement
- Internal fixation
- Surgical management of complex injuries

Upper Limb

- Shoulder (Including Scapula, Sternoclavicular Joint, Clavicle and Acromioclavicular Joint)
- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Principles of operative management and indications for surgery
- Operative management including techniques of open reduction
- Non-operative management of fractures of the scapula – body, acromion, coracoid, glenoid.

Glenohumeral Joint

- Clinical and radiological assessment

- Classification
- Complications and associated injuries
- Prognostic factors
- Indications for surgery
- Ability to choose appropriately between the various forms of operative management
- Indications and contraindications
- Operative management of traumatic instability
- Operative management of complex, multi-axial instability
- Non-operative management – closed reduction

Proximal Humerus

- Clinical and radiological assessment
- Classification (Neer28)
- Complications and associated injuries
- Indications for surgery
- Indications for prosthetic replacement
- Open reduction/internal fixation
- Prosthetic replacement
- Non-operative management

Humeral Shaft

- Clinical and radiological assessment
- Classification
- Complications and associated injuries

- Indications for surgery
- Reduction, internal fixation
- Non-operative management

Distal Humerus

- Clinical and radiological assessment
- Classification and mechanisms
- Types of complications and their management
- Indications for open reduction
- Techniques of open reduction/internal fixation of simple fractures (unicondylar)
- Open reduction/internal fixation of complex supracondylar and T-fractures
- Closed treatment

Elbow Dislocation

- Clinical and radiological assessment
- Classification
- Complications and their management
- Indications for surgery
- Open reduction
- Closed reduction

Olecranon

- Clinical and radiological assessment
- Classification
- Indications for surgery
- Open reduction/internal fixation
- Non-operative management

Radial Head and Neck

- Clinical and radiological assessment
- Classification
- Complications and management of non-operative treatment
- Indications for surgery
- Open reduction/internal fixation
- Radial head excision

Combined Forearm and Elbow

- Clinical and radiological assessment
- Classification – (Monteggia25)
- Surgical management.

Radius and Ulna-Shaft

- Clinical and radiological assessment
- Classification
- Complications and management
- Indication and techniques of non-operative treatment
- Open reduction/internal fixation
- Operative management of complex cases
- Complications of non-union, malunion, synostosis

Distal Radius and Ulna

- Clinical and radiological assessment
- Classification (Colles'9, Smith's37, Barton's4)
- Complications
- Indications for surgery
- Operative management
- Surgical management malunion
- Non-operative management

Distant Radioulnar Joint

Isolated

- Clinical and radiological assessment
- Complications
- Indications for surgery
- Operative treatment
- Surgical management of late instability
- Non-operative management

Combined

- Clinical and radiological assessment
- Classification (Galeazzi15)
- Complications
- Indications for surgery
- Operative management of simple injuries
- Operative management of complex injuries and late instability
- Non-operative management

Carpal

- Clinical and radiological assessment
 - Classification and patterns of injury and late instability
 - Complications and their management
 - Indications for surgery
-
- Clinical assessment, methods of investigation, non-operative and operative management of late carpal instability
 - Operative management of simple injuries
 - Operative management of complex injuries
 - Closed treatment

Hand Trauma

Spine And Pelvis

- Knowledge of spinal anatomy, including blood supply to the spinal cord
- Pathology of spinal injury
- Complete neurological examination and its interpretation
- Patterns of neurological deficit
- Complications and associated injuries
- Radiological evaluation including myelography, CT scanning
- Functional assessment following spinal injury
- Anticipated functional capacity
- Bracing
- Team approach to spinal injuries

Cervical Spine

- Clinical and radiological assessment
- Classification
- Neurological evaluation
- Patterns of neurological injury
- Methods of investigation
- Non-operative management – orthotics
- Indications for surgery
- Knowledge of anterior approaches & instrumentation (not to include technical ability)
- Closed reduction of fractures and fracture dislocations
- Operative management of acute fractures and fracture dislocation to include decompression (posterior)
- Applications of halo and halo traction vest
- Stabilization of late instability

Thoracic and Lumber

- Clinical and radiological assessment
- Classification and 2 and 3 column concepts and relationship to treatment and prognosis
- Neurological evaluation
- Patterns and neurological injury
- Indications for non-operative management, both skeletal and neurological
- Knowledge of types of surgical approaches and their indications

- Knowledge of types of instrumentation and fusion
- Post-operative care. Rehabilitation
- Functional assessment
- Knowledge of complex anterior approaches and instrumentation not to include technical ability
- Non-operative management

- Operative treatment to include laminectomy posterior fusion, posterior instrumentation

Pelvis (General)

- Complete knowledge of pelvic anatomy – skeletal, vascular, visceral and neurological
- Classification and its relationship to stability, treatment and prognosis
- Clinical assessment including associated injuries
- Complications
- Radiological assessment, plane films, special views, special techniques (urological and vascular)
- Indications for surgery
- Non-operative management (general, pelvic and complications)
- Surgical management of simple fractures.
- Operative management of moderately complex fractures including internal and external fixation.
- Management of complications

Acetabulum

- Clinical and radiological assessment
- Classification (Judet-Letournel²¹)
- Complications and associated injuries
- Indications for surgery
- Open reduction – simple dislocations for failed closed reduction
- Arthrotomy for osteochondral loose fragments
- Open reduction for complex dislocation
- Late reconstruction
- Non-operative management (including traction)

Hip Dislocation

- Clinical and radiological assessment

- Classification
- Complications and associated injuries
- Indications for operative management
- Open reduction of simple dislocations for failed closed reduction
- Arthrotomy for osteochondral loose fragments
- Open reduction of complex dislocations
- Late reconstruction
- Non-operative management including closed reduction

Femur Intracapsular

- Clinical and radiological assessment
- Classification (Pauwels30, Garden16)
- Complications and associated injuries
- Indications and principles for surgical treatment
- Endoprosthesis replacement
- Late reconstruction
- Non-operative treatment

Extracapsular

- Clinical and radiological assessment
- Classification (Evans12, Boyd & Griffin6, Tronzo43)
- Complications and associated injuries
- Indications for surgical management.
- Open reduction/internal fixation of four-part fractures
- Surgical management of non-union
- Late reconstruction and osteotomy
- Non-Operative management
- Open reduction/internal fixation of two-part and three-part fractures.

Subtrochanteric

- Clinical and radiological assessment
- Classification (e.g. Fielding13)
- Complications and associated injuries
- Indications for surgery
- Open reduction/internal fixation of non-fixation of non-comminuted fractures.
- Surgical management of complex fractures

- Indications for grafting, special devices
- Non-Operative management

Femur Shaft

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Indications for grafting
- Post-operative management
- Operative management (types of internal fixation)
- Operative management of complications, delayed union, malunion, non-union (osteotomy, bone grafting)
- Non-Operative management (traction, spica, cast, cast bracing)

Distal Femur

- Clinical and radiological assessment
- Classification (supracondylar, T-condylar and bi-condylar)
- Complications and associated injuries
- Indications for surgery
- Operative management of simple fractures
- Operative management of complex fracture, complications, delayed union, non-union, malunion
- Non-Operative management

Knee Ligaments & Dislocations

- Clinical and radiological assessment
- Classification
- Associated injuries and complications
- Indications for surgery
- Recognition and classification of late instability
- Operative management of acute injuries
- Non-Operative management (therapy and bracing)
- Early and late ligament reconstruction
- Non-Operative management (cast, cast bracing, function bracing)

Patella Fractures & Dislocations

- Clinical and radiological assessment
- Operative management of acute injuries (ORIF, patellectomy retinacular repair)
- Patella stabilization
- Non-operative management
- Menisci
- Clinical and radiological assessment
- Associated injuries and complications
- Indications for surgery
- Operative management (including operative arthroscopy)
- Non-Operative management
- Diagnostic arthroscopy

Tibia Plateau

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management of simple injuries (ORIF, bone grafting)
- Complex injuries, late reconstruction and reconstruction for complications
- Non-Operative management

Tibial Shaft

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management acute injuries (ORIF)
- Operative management for complications (delayed union, non-union, malunion, single plane)
- Surgical reconstruction complex osteotomies
- Non-Operative management

Distal Tibia

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management of acute injuries (simple)

- Operative management of acute simple and complex injuries (ORIF)
- Late reconstruction for complications.
- Non-Operative management

Ankle Fractures

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management of complex including trimalleolar
- Operative management of late reconstruction for delayed union, non-union, malunion
- Non-Operative management
- Operative management of simple fractures

Ligament Injuries & Dislocations

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management of acute injuries
- Reconstruction for late ligament instability
- Non-Operative management

Foot – Tarsals (Fractures & Dislocations)

- Clinical and radiological assessment
- Classification (e.g. Talus-Hawkins¹⁸)
- Complications and associated injuries
- Indications for surgery
- Operative management of acute injuries
- Operative management of acute complex injuries
- Late reconstruction for complications (non-union, malunion, delayed union and avascular necrosis)
- Non-Operative management

Sub-Talar Dislocation

- Clinical and radiological assessment

- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management of acute dislocations and chronic instability
- Operative management of late complications (including triple arthrodesis)
- Closed treatment

Calcaneus Fractures

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management by manipulation
- Operative management by open reduction and internal fixation
- Non-Operative management not requiring manipulation

Tarsal Fractures

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Operative management
- Non-Operative management

Tarsal Metatarsal Dislocation

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management
- Non-Operative management

Metatarsal & Phalangeal Fracture

- Clinical and radiological assessment
- Classification
- Complications and associated injuries
- Indications for surgery
- Operative management

- Non-Operative management

2. HAND

The objectives of hand surgery training in a general orthopaedic training programmed are two fold:

- The preparation of candidates for specialized training in hand surgery.
 - Clinical competence in common “minor” hand surgery procedures, traumatic and reconstructive.
-
- Detailed knowledge of anatomy and functional anatomy of hand and wrist
 - Technique of physical examination of the hand to include detailed neurological examination, long tendon function, deformities and contractures, assessment of functional disability
 - Knowledge and clinical assessment of the hand and hand function in specific conditions (cerebral palsy, stroke, rheumatoid arthritis, congenital anomalies, Dupuytren’s contracture)

Trauma

- Clinical and radiological assessment
 - Classification
 - Complications and associated injuries
 - Indications for surgery
 - Detailed knowledge of post-operative care and rehabilitation
 - Knowledge of, but not technical competence for complications, delayed union, non-union, malunion.
 - Operative management of common, “minor hand injuries, simple fractures
-
- Non-operative management (including the causes of deformity and methods of splintage)
 - Technical competence in closed reduction and the use of percutaneous fixation pins

Dislocations & Ligament Injuries

- Clinical and radiological assessment
- Classification

- Complications and associated injuries
- Knowledge of the causes or irreducibility
- Indications for surgery
- Methods of splintage
- Rehabilitation and post-operative care
- Knowledge of but not technical competence, operative management of late deformity and instability.
- Operative management of acute injuries
- Non-operative management

Open Injuries

- Clinical and radiological assessment
- Assessment of tissue viability
- Principles of methods of closure
- Rehabilitation
- Operative management of appropriate soft tissue injuries
- Amputation levels and technique
- Technical competence in simple closure, delayed closure, local flaps, Z-plasties
- Assessment of priorities for repair of associated injuries (nerve, vascular, tendon, bone)

Tendon

- Clinical and radiological assessment of tendon injury
- Function
- Deformity
- Knowledge of late reconstruction
- Indications for operative management of acute injuries
- Methods of arthrodesis
- Repairs of extensor tendons and flexor tendons in zones 4,5

Massive Combined Injuries

- Clinical and radiological assessment
- Indications for surgery
- Assessment of tissue viability and function
- Establishment of treatment priorities
- Knowledge of principles of advanced reconstruction and rehabilitation
- Debridement and amputation levels
- Initial wound management

Rheumatoid Arthritis & Osteoarthritis

- Clinical and radiological assessment in mechanisms and pathogenesis of hand deformities
- Indications for surgery
- Assessment of function and disability
- Principles of hand rehabilitation
- Operative management of common soft tissue and bony procedures for the arthritic patient (e.g. synovectomy, wrist fusion, etc)
- Non-operative management (including splintage)

Congenital Anomalies

- Clinical and radiological assessment
- Classification
- Indications for surgery
- See also Paediatric Section
- Operative management of minor anomalies

Paralytic

- Clinical and functional assessment
- Principles and techniques of splintage
- Principles of tendon transfer
- Indications for surgery
- Surgical reconstruction of selected common problems (e.g., radial nerve palsy)

Infections

- Clinical and radiological assessment
- Non-operative management
- Technical competence in the management of paronychia, pulp space infection, septic tenosynovitis
- Operative management of infection of fascial spaces (mid-palmar, thenar, hypothenar, subaponeurotic)
- Indications and techniques of amputation

Tumours

- Clinical and radiological assessment
- Methods of investigation

- The assessment and staging of neoplasms
- Functional assessment
- Technique of open biopsy
- Levels and technique of amputation

3. NEUROMUSCULAR

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the Chief of Service, Programme Director or designate. This will be

done by direct questioning, or observation of clinical practice in the following areas:

Brain

- Knowledge of the anatomy, physiology and pathology of those traumatic, vascular and degenerative conditions causing, presenting as, or altering musculoskeletal function including control of sensory motor function (head injuries, cerebral palsy, stroke, co-ordination (Fiedreich's ataxia²²) psychomotor disturbances and psychic regional pain
- Detailed neurological examination of higher centers as they pertain to musculoskeletal function
- Non-operative management of deformity, spasticity by or injection techniques
- Principles of surgical management (tendon transfer, osteotomy, arthrodesis)
- Surgical management of deformity, spasticity by tendon transfer, osteotomy, arthrodesis, neurectomy)

Spinal Cord

- Congenital, traumatic, vascular, neoplastic and degenerative conditions including natural history
- Methods of presentation, clinical findings, methods of investigation – radiological (myelographic, tomographic, computerized tomography, magnetic resonance imaging) and electrophysiological (evoked potentials)
- Detailed clinical assessment and investigative techniques
- Principles of surgical management
- Non-operative management of weakness, deformity or spasticity by orthotics or injection techniques

- Surgical management of tendon transfer, arthrodesis

Peripheral Nervous System

- Degenerative disorders, neoplasms
- Methods of presentation, physical findings
- Performance of detailed neurological examination on a segmental or peripheral nerve basis
- Clinical classification of nerve injuries (according to Seddon³⁴ and Sunderland³⁸)
- The use and interpretation of electrophysiological testing
- Establishment of treatment plan
- Indications for surgery
- Knowledge of peripheral nerve repair (using magnification techniques (loupes, operating microscope)
- Operative management neurolysis, epineurolysis, nerve transfer
- Non-operative management (orthotics, therapy)
- Release of simple entrapment syndromes (carpal tunnel)
- Phasic activity and synergism, prime movers
- Retraining and rehabilitation

Muscle

- Inflammatory dystrophic, degenerative, neoplastic conditions
- Methods of presentation and physical findings, strength grading
- Clinical assessment, strength grading, long tendon imbalance, secondary deformities, tenodesis and contractures
- Principles of surgical management – pre-requisites for successful tendon transfer
- Operative management of simple tendon transfer
- Operative management of complex neuromuscular disorders

4. JOINTS

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the Chief of Service, Programme Director or designate. This will be done by direct questioning, or observation of the clinical practice in the following areas:

- Response of synovium to injury, effect of joint effusions on cartilage metabolism, supporting capsule and ligaments (joint stability), long tendon function and balance, (biomechanics of production of deformity)
- Synovial fluid analysis.
- Pathophysiology of synovial changes and articular cartilage damage inflammatory, degenerative, metaplastic, bleeding disorders and villonodular synovitis
- History, applied general physical examination, detailed examination of all joints including functional disability rating
- Formation of a differential diagnosis of swollen painful joint
- Principles for non-surgical management.

Investigative Techniques

- Arthrography, joint aspiration, arthroscopy, radionuclide scans
- Synovial fluid analysis

Pharmacology

- Non-steroidal anti-inflammatory medications, steroids, anti-metabolites, radioisotopes
- Including mechanisms of action, indications, complications, side effects, metabolism and dosage

Orthotic Principles

- Principles of construction and use of resting and dynamic splints

Role of Surgery

- Principles of synovectomy, joint realignment, stabilization, balance of long tendon function, osteotomy, arthrodesis, arthroplasty

Infection

- Differential diagnosis (including most likely infective organism), methods of staining and culture
- Antibiotic management (both initial blind and specific)
- Indications for surgery
- Investigation, diagnosis and surgery
- Principles of arthrodesis
- Investigation, differential diagnosis and indications for infected arthroplasty or revision surgery for arthroplasty following sepsis
- Major joint debridements
- Arthrodesis of major joints
- Arthrotomy, arthrocentesis, arthroscopic lavage, establishment of suction irrigation

Inflammation (Rheumatoid and Sero-negative)

- Pathology of inflammatory joint disease
- Radiological classification of inflammatory joint disease
- Principles of non-surgical and surgical treatment

Upper Extremities

Hand & Wrist

- Pathomechanics of joint deformity
- Non-operative management (Orthotics, therapy)
- Indications for surgery
- Detailed radiological evaluation (including carpal indices)
- Arthrodesis
- Implant arthroplasty
- Excision of distal ulna

Elbow

- Pathomechanics, clinical and radiological evaluation of deformity
- Indications for surgery (including debridement, synovectomy, and arthroplasty)
- Surgical management including joint debridement, synovectomy, radial head excision
- Surgical management of joint arthroplasty
- Non-operative management
- Excision rheumatoid nodules

- Ulnar nerve transposition

Shoulder

- Indications for surgery
- Indications for arthrodesis and arthroplasty
- Synovectomy and stabilization
- Arthroplasty, non-constrained both hemiarthroplasty and total replacement
- Arthrodesis
- Diagnostic arthroscopy
- Non-operative management Excision distal clavicle

Spine

- Awareness of cervical instability, classification
- Indications for surgery
- Knowledge of but not technical competence in surgical stabilization, including adjunctive methods, methyl methacrylate, internal fixation devices
- Halo application and management of halo-vest
- Non-operative management (types of cervical orthoses and their efficiency, including halo)

Lower Limb

Foot / Ankle

- Indications for surgery – debridement, synovectomy, arthrodesis
- Indications for total ankle arthroplasty
- Diagnostic arthroscopy
- Synovectomy and arthrodesis
- Non-operative management (orthotics)

Knee

- Indication of surgery
- Indications for total joint replacement and arthrodesis
- Synovectomy
- Total joint replacement
- Non-operative treatment (Radio-isotopic synovectomy)

Hip

- Indications for surgery (including cemented vs non-cemented arthroplasty)
- Total hip arthroplasty
- Indications for revision surgery for total joint replacement

- Technique of revision THR without severe bone loss
- Non-operative management.

Degenerative (Osteoarthritis)

Upper Limb

Hand / Wrist

- Classification of carpal instabilities
- Indications for surgery – including arthroscopy
- Indications for arthroplasty (excisional, interpositional)
- Detailed clinical and radiological assessment of wrist mechanics
- Arthrodesis (intercarpal and radiocarpal)

Elbow

- Indications for surgery – including arthroscopy, excision of loose bodies, release of contractures
- Indications for elbow arthroplasty
- Indications for release of contractures
- Joint debridement, excision loose body
- Arthrodesis
- Technique of arthroscopy
- Non-operative management
- Excision of radial head

Shoulder

- Indications for surgery
- Rotator cuff decompression (acromioplasty), repair
- Unipolar arthroplasty (Neer27)
- Arthrodesis
- Bipolar arthroplasty, non-constrained
- Excision distal clavicle
- Non-operative management (therapy-injection)

Spine (*see spine*)

Lower Limb

Foot & Ankle (*see relevant section*)

Knee

- Assessment of ligamentous instability
- Indications for surgery
- Assessment of biomechanical predisposing factors (clinical, arthroscopic, radiological)
- Indications of principles of distal femoral osteotomy
- Diagnostic arthroscopy
- Arthroscopic excision of loose bodies, debridement
- High tibial osteotomy
- Arthrodesis
- Total joint arthroplasty
- Non-operative management
- Patellectomy

Hip

- Indications for surgery
- Knowledge of biomechanics of proximal femoral and pelvic osteotomy
- Knowledge and assessment of the painful implant and indications for surgery
- Total hip arthroplasty – cemented and non-cemented
- Revision arthroplasty in the absence of severe bone loss
- Non-operative management.

Reactive and Metaplastic Disorders:

- (Villonodular Synovitis) (Synovial Chondromatosis)
- Investigative techniques (arthrography, diagnostic arthroscopy, synovial biopsy)
- Excision of pedunculated lesions
- Joint debridement, synovectomy, removal of loose bodies

Tumours

- (Syovioma and Synovial Sarcoma)

Trauma (*see relevant section*)

5. ONCOLOGY

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the supervisor / co-supervisor. This will be done by direct questioning, or observation of the clinical practice in the following areas:

Tumours and Reactive Lesions

Primary

- Definitions and terms (neoplasia, carcinoma, sarcoma, cyst, reactive lesion, hyperplasia, dysplasia)
- Theories of aetiology, pathogenesis, control of growth, methods of spread of neoplasms in general (local-systemic-privilege of joint) and of sarcomas in particular
- Clinical presentation of bone pain, systemic manifestations, limb locations, spine locations
- Epidemiology (geographical, social, risk factors)
- Methods of investigation (lab-discriminating tests)
- Radiological, scan, ultrasound, CT, MRI, skeletal survey, xerogram, tomograms, arteriograms
- Classification by cell or origin of primary tumours and reactive lesions of bone and primary soft tissue tumours
- Principles of technique of biopsy
- Principles of action of adjunctive methods of treatment

Local

- - Cryotherapy
- - Caustic agents
- - Radiotherapy

Systemic

- - Chemotherapy
- - Immunotherapy

Regional Techniques

- and their indications, timing and complications
- Clinical pathological and radiological picture of tumours and reactive lesions of bone and soft tissue tumours including incidence, epidemiology natural history and prognosis
- Technique of closed and open biopsy (including needle, trephine biopsy, i.e. spine)

- Knowledge of the techniques and significance of staging (Knneking11)
- Methods of investigation – indications of each study, what each shows and usefulness
- Principles of surgical management (margins, types of resection and compartments in different anatomical locations)
- Knowledge but not technical competence in the surgical management of major surgical ablative therapy and reconstruction.
- Limb sparing surgery, allograft considerations, implant considerations, regional adjuvant techniques
- Knowledge of the methods of reconstruction – allograft, autograft, custom prostheses, rotation plasty, amputations, arthrodesis
- Surgical management of intracompartmental soft tissue tumours
- Surgical management of bone tumours in the distal extremities

Metastatic Tumours to Bone

- Knowledge of the most common primary tumours metastasizing to bone
- Work-up for a tumour of unknown origin
- Radiological picture of metastatic bone disease and its differential diagnosis
- The investigation of a lytic lesion in bone
- Management of complications of metastatic bone disease (hypercalcaemia)
- Knowledge of methods of spine decompression and stabilization
- Open reduction /internal fixation of pathological fractures
- Non-operative management of pathological fracture

6. INFECTIOUS DISORDERS

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the supervisor or designate. This will be done by direct questioning, or observation of the clinical practice in the following areas:

Definitions and Terms

- Pus
- Sequestrum
- Involucrum

Aetiology and Classification

- Bacterial (acute, chronic), Tuberculosis

- Pathogenesis
- Hematogenous, inoculation (compound wound), direct spread, septic arthritis, osteomyelitis (vertebral, girdle and extremities) and periprosthetic (acute and chronic)
- Clinical Picture
- Acute – subacute – chronic
- Differential diagnosis
- Discriminate between bone and joint clinical signs

Investigations

Laboratory and Bacteriology

- Haematology (CBC, ESR)
- Bacteriology, technique of staining and staining characteristics
- Methods of culture, pathology, gross and microscopic treatment of specimens
- Detailed knowledge of the organisms found to produce musculoskeletal infections, their incidence, frequency, methods of spread, methods of culture microscopic characteristics, predilection for specific sites, tissue and conditions, pathogenesis of infection, mechanisms of spread

Imaging

- Radiology – early and late changes
- Radioisotope – Tc/gallium/indium
- CT and MRI

Biopsy

- Principles of biopsy (fine needle, core needle, arthrocentesis, arthroscopy, open biopsy)
- Treatment

General Principles

- Antibiotic selection
- Mechanism of action
- Pharmacology (including complications)
- Indications for surgery

Pharmacology of Antimicrobial Agents

- Mechanisms of action, spectrum, dose and administration, metabolism, specific variations and their use to specific conditions (renal failure), complications
- Prognosis and Complications
- Nosocomial infections

- Hospital bacteriological environment
- Altered host resistance
- Development of organism resistance, precautions

Osteomyelitis

- Cognitive
- Clinical and radiological assessment
- Classification
- Methods of clinical and radiological investigation
- Complications
- Non-operative management
- Simple surgical drainage
- Complex surgical drainage, debridement
- Adjunctive methods – management – (Intracavitary antibiotics)
- Major bone resections and reconstruction

Septic Arthritis

- Clinical and radiological assessment
- Classification
- Methods of clinical and radiological investigation
- Complications
- Non-operative management
- Indications for surgery
- Complex surgical drainage
- Late reconstruction for complications, instability – major joint destruction
- Simple surgical drainage
- Arthrocentesis, arthroscopy

Specific

- Compound Fractures
- Clinical and radiological assessment
- Assessment and classification of soft tissue wound, associated injuries, bony injuries
- Initial non-operative management (culture, wound care, tetanus prophylaxis, antibiotics)
- Operative management – Type I and II
- Operative management of Type III (soft tissue wound, neurovascular injury, fracture)

- Methods of fixation (including internal, external, external fixators)
- Technique of open cancellous grafting (Papineau29)
- Surgical management of established infections and other complications (delay union, non-union)
- Soft tissue coverage, local flaps & myocutaneous resection and reconstruction
- Amputation

Total Joint Replacement

- Clinical and radiological evaluation (including radioisotope scans)
- Differential diagnosis
- Methods of culture
- Antibiotic therapy (including antibiotic cement)
- Indications for surgery
- Operative management (debridement, suction, irrigation)
- Operative management (implant removal, direct exchange of wound care, late reconstruction)
- Aspiration techniques

Trophic Ulcerations (Neurovascular)

- Prevention (of diabetic foot)
- Clinical and radiological assessment
- Differential diagnosis
- Methods of investigation (bone, scan, gallium scan tomography, wound culture, sinogram)
- Causative agent
- Antibiotic management
- Operative management – debridement
- Amputation

Immune Compromised Conditions

- Clinical and radiological assessment
- Differential diagnosis – likely causative organisms
- Investigative techniques
- Methods of wound culture
- Antibiotic therapy
- Indications for surgery
- Operative management

Tuberculosis

- Clinical and radiological assessment
- Differential diagnosis
- Methods of culture
- Technique of aspiration biopsy of peripheral lesions
- Antibiotic therapy
- Atypical infections
- Aspiration spinal biopsy, open biopsy and debridement
- Resection
- Amputation
- Arthrodesis

REGIONAL DISORDERS

Spine

- Radiological assessment
- Differential diagnosis
- Methods of spread
- Pathogenesis
- Antibiotic therapy
- Indications for surgery
- Principles of operative management, anterior and anterolateral, decompression, debridement and fusion.
- Aspiration biopsy
- Methods of bracing

Prevention

Patient

- Immune compromise (disease or drugs)

Hospital

- Ward environment
- O.R. environment
- Skin preparation
- Draping technique

Surgeon

- Communicable disease
- Gown and glove technique
- Tissue management

- Wound care

7. SPINE

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the supervisor or designate. This will be done by direct questioning, or observation of the clinical practice in the following areas:

Spinal Disorders:

- Detailed knowledge of the embryology of the spine especially as it pertains to pathological processes (deformities, infections, tumours)
- Gross anatomy of the spinal column, spinal cord, their blood supply, both extrinsic and extrinsic
- Functional and microscopic anatomy of the spinal cord
- Detailed knowledge of the biomechanics of the spine and its abnormalities
- Non-operative management, various types of braces and their efficacy
- Role of physiotherapy

Fractures

- See Adult Trauma - Spine

Cervical Spine

- Detailed knowledge of the biomechanics of the motion segment (normal and pathological)
- Clinical and radiological assessment
- Classification
- Detailed neurological examination
- Non-operative management (medication, cervical orthoses, physiotherapy, functional assessment)
- Indications of surgery
- Detailed knowledge of pathogenesis, results, complications of management
- Methods of investigation
- Indications for surgery
- Laminotomy and disc excision
- Anterior approaches cervical discectomy and fusion (not necessarily in antero-lateral approaches – or odontoid)

Degeneration and Instability of the Cervical Spine

- Clinical and radiological assessment
- Classification (cervical segmental instability, cervical myelopathy, radiculopathy, vertebral foraminitis)
- Complications
- Non-operative management
- Detailed knowledge of pathogenesis and limitations of methods of investigation
- Indications for surgery
- Posterior and anterior fusion techniques (not in Laminectomy, Laminoplasty or Extensive anterior decompression)
- Results and complications

Thoracic Discs

- Clinical and radiological assessment
- Differential diagnosis
- Classification
- Neurological examination
- Non-operative management (medication, bracing, physiotherapy, other adjunctive pain treatments)
- Indications for surgery
- Investigation methods (myelography, electrophysiology, tomography and discography)
- Knowledge but not technical competence of more complex problems
- Results and complications
- Management of complications
- Chymopapain
- Minimally invasive techniques
- Foraminotomy
- Laminectomy
- Disc excision

Mechanical Instability (Spondylolytic or Degenerative)

- Clinical and radiological assessment
- Classification
- Complications and associated conditions
- Pathophysiology
- Non-operative management (spinal orthoses, physiotherapy)

- Indications for surgery
- Methods of investigation
- Advanced non-operative management
- Knowledge of more complex approaches including anterior (but not technical competence)
- Results and complications
- Basic techniques

Degeneration etc. (Spinal Stenosis, Central and Lateral)

- Clinical and radiological assessment
- Classification
- Associated conditions
- Non-operative management
- Indications for surgery
- Detailed knowledge of the pathogenesis
- Methods of investigation (myelography, electrophysiology, discography)
- Indications for surgery
- Results and complications)
- Operative management (foraminotomy, laminectomy, lateral recess release, fusion)

Infection

- Diagnosis
- Classification
- Investigation
- Basic treatment
- Knowledge of operative approaches (but not technical competence in surgical treatment)

Biopsy

- Awareness
- Competence in closed biopsy techniques

Tumours

- X-ray assessment of disease states
- Knowledge of operative approaches
- Knowledge of methods of surgical treatment (but not technical competence of surgical treatment)

Deformity

- Clinical and radiological assessment
- Pathogenesis
- Natural history
- Neurological examination
- Non-operative management
- Indications for surgery
- Exposure to technique (but not necessarily technical competence of surgical treatment)

8. FOOT AND ANKLE

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the supervisor or designate. This will be done by direct questioning, or observation of the clinical practice in the following areas:

- Detailed knowledge of the anatomy of the normal foot (including embryology and radiological anatomy)
- Recognition of common foot patterns and their predisposition to symptoms (variations of normal anatomy)

Biomechanics

- Detailed knowledge of the biomechanical analysis of the normal foot and its function.
- Predisposing biomechanical factors to symptomatology

Clinical Evaluation

- The ability to conduct a thorough clinical evaluation (including biomechanical evaluation, stress mats, neurovascular examination)

Investigative Technique

- Detailed knowledge of the normal and radiological appearance, electrophysiological investigation and ankle arthroscopy

Ankle

Trauma

See Trauma – Fractures and Dislocations

Osteochondritis Dissecans

- Clinical and radiological assessment
- Differential diagnosis
- Classification
- Aetiology
- Non-operative management
- Indications for surgery
- Arthroscopy
- Operative management (including the indications for arthroplasty, arthrodesis)

Rheumatoid Arthritis

See Rheumatoid Factors

Subtalar Complex

- Detailed knowledge of the anatomy (including talocalcaneal navicular joint, both gross and radiological)
- Biomechanical (long muscle control, function, predisposition to pathological states)
- Orthotics – detailed knowledge of the orthotic management of subtalar conditions.

Hypermobile Pes Planus

- Clinical and radiological assessment
- Non-operative treatment
- Indications for surgery
- Operative management (stabilization, osteotomy, arthrodesis)

Spastic Flat Foot

- Clinical and radiological assessment
- Classification
- Non-operative management
- Indications for surgery
- Operative management

Trauma

See also Trauma

Lateral Process Fracture

- Clinical and radiological assessment
- Non-operative management
- Indications for surgery
- Operative management

Tarsal and Tarsometatarsal

Pes Cavus

- Clinical and radiological assessment
- Aetiology
- Associated conditions
- Non-operative management
- Indications for surgery
- Operative management

Degenerative

- Clinical and radiological assessment
- Non-operative management
- Indications for surgery
- Operative management

Metatarsophalangeal

- Clinical and radiological assessment
- Classification
- Biomechanical causes
- Non-operative management
- Indications for surgery
- Technical competence in realignment procedure, exostectomy and pseudarthrosis (excision arthroplasty)
- Osteotomy and implant arthroplasty

Sesamoids

- Clinical and radiological assessment

- Non-operative management (orthotics)
- Indications for surgery
- Realignment procedures and excision

Neuroma

- Assessment and Non-operative management
- Indications for surgery
- Competence in decompression and neurectomy

Toes

- Clinical and radiological assessment
- Biomechanical forces contributing to deformity
- Non-operative treatment
- Competence in interphalangeal fusion
- Tendon transfers
- Tenotomy

Specific Conditions

Neuropathic (Diabetic Charcot)

- Clinical and radiological assessment
- Neurological and vascular evaluation
- General methods of foot care and precautions
- Causes of ulceration and deformity
- Non-operative management (healing cast technique, orthotics, General foot care of skin lesions)
- Indications for antibiotics
- Special investigative methods (bone scan, tomography)
- Competence in debridement of calluses and minor ulcerations
- Debridement and amputations
- Arthrodesis
- Exostectomies
- Management of complex combined neuropathic changes

Ankle

- Clinical and radiological assessment
- Biomechanical analysis of the causes of deformity
- Specific orthotic management

- Competence in the operative management

Rheumatoid

- Clinical and radiological assessment
- Differential diagnosis
- Pathogenesis of deformity
- Complications
- Non-operative management (orthotics, therapy)
- Competence in management of minor deformities, nodules
- Operative management (arthrodesis, arthroplasty – excisional and interpositional) osteotomies and realignment procedures

9. AMPUTATIONS, PROSTHETICS AND ORTHOTICS

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence as determined by the supervisor or designate. This will be done by direct questioning, or observation of the clinical practice in the following areas:

Amputations

Conditions

- Detailed knowledge of the congenital conditions requiring amputation are, ischaemia, due to disease and vascular injuries, tumour, infection, trauma and the specific indications required for each.

Limb Assessment

- Knowledge and clinical competence in the assessment of the limb with reference to viability of the stump and successful eradication of disease.

Patient Assessment (Psychological Status) – Social, Psychological and Economics Impact

- Ability to co-operate with occupational therapist, physiotherapist and rehabilitation team. Ability to use a prosthetic appliance functionally (intelligence, cardiopulmonary status, motivation).

Team Approach – Contributions and Roles played by the Prosthetist, Physiotherapist, Occupational Therapist, Psychologist and Social Worker.

Surgical Principles

- Levels of amputation, optimal stump length, technical considerations for standard amputations, recognition and management of complications, post-operative care (types of dressings, i.e. immediate vs early fitting), management of stump oedema, haematoma, infection, necrosis, contractures, neuromas and phantom pain.

Prosthetics

Material

- Knowledge of the materials used in the formation of the various components of the prosthesis, their benefits, shortcomings and alternative materials available.

Functional Assessment

- Knowledge and functional assessment of the demands placed on the prosthesis related to patient age, size, sex, vocation and the ability to alter various prosthetic components for best function.

Socket

- Knowledge of the methods of socket fitting, difficulties with variation in stump size and length, special conditions and the assessment of stump symptoms with their reference to socket fitting.

Suspension

- Knowledge of the standard methods of prosthetic suspension, various alternatives available and the ability to choose from these for the most functional prosthetic fitting.

Joint

- Knowledge of the standard types of joints used in prosthetic fittings, their benefits, shortcomings, alternative joints available and the ability to choose from these alternatives.

Cosmetics

- Knowledge of the methods of cosmetic covering of prostheses.

Fitting

- Knowledge of the methods of prosthetic fitting, balancing, alignment and ability to relieve stump socket symptoms due to these causes.

- Knowledge of the above general components to allow correct prosthetic prescription for each of the standard lower extremity amputation levels.
- Knowledge of the major contact and pressure areas in the lower extremity stump for each phase of gait.

Upper Extremity

- Knowledge of the above general components to allow correct prosthetic prescription for best function prosthesis.
- Knowledge and clinical ability to assess the causes of limited function relative to prosthetic fitting or components.

Orthotics

Orthotic Principles

- Knowledge of the aims of orthotic fitting – stability, control of motion, prevention of deformity, maintenance of alignment and the basic methods by which these are achieved.

Materials

- Knowledge of the materials commonly used in orthoses, their benefits, drawbacks and alternative materials available.

Assessment

- Knowledge and clinical ability to assess the biomechanical problem at hand, the function deficiency and apply basic orthotic principles for their correction.

Fitting

- Knowledge of the techniques of orthotic fitting.

Prescription

- Knowledge of the above general components to allow correct orthotic fitting and the assessment of function of the orthoses.

Regional

Lower Extremity

- Post-operative management including immediate prosthetic fitting
- Detailed knowledge of prosthetic prescribing and supervision of rehabilitation
- Assessment of complications of amputation surgery for toes, transmetatarsal, below knee, above knee amputations, (chronic stump pain, stump ulceration,

neuroma, stump overgrowth, hypertrophic new bone, ankle disarticulation (Syme40 & Boyd5), knee disarticulation and hip disarticulation)

- Management of complications
- Hip disarticulation
- Hemipelvectomy
- Amputations of toes, transmetatarsal, below knee, above knee (including assessment of neurovascular status, potential viability of the stump, selection of types, location of flaps)
- Musculotendinous reinsertion, (“myoplasty, myodesis”)

Upper Extremity

- Occupational and physiotherapy
- {Prescription of prosthetic appliances
- Post-operative management of the stump
- Prescription fitting
- Shoulder disarticulation and fore-quarter amputation
- Amputations of the finger or ray amputation
- Amputations through the wrist, forearm, elbow disarticulation, upper arm (including care of the stump)

10. SPORTS MEDICINE

The trainee, upon completion of the rotation indicated, will demonstrate a satisfactory level of knowledge, clinical competence and technical competence

as determined by the supervisor or designate. This will be done by direct questioning, or observation of the clinical practice in the following areas:

- Detailed knowledge of applied functional anatomy to athletic performance.
- Detailed knowledge of the concept of fitness, especially with reference to cardiopulmonary conditioning and exercise physiology. Muscle metabolism, function (slow twitch, fast twitch, neuromuscular conduction, glycogen metabolism) and training (aerobic and anaerobic).

Osteopenia (secondary to amenorrhoea).

Pathophysiology

- Inflammatory process (with special reference to repetitive injuries and stresses).

Biomechanics

- Involving specified function, i.e. walking, running, throwing, swimming. Development and use of protective equipment and safe surroundings.

Pharmacotherapeutics

- Use and abuse of drugs in relation to sports (injury management, performance enhancing).

Team Approach

- Awareness that the contemporary setting involves a sophisticated team of experts including physicians, physical educationalists, physiotherapists, nutritionists, physiologists, engineers, nutritionists.

Upper Limb

Shoulder – Impingement Syndromes (Rotator Cuff)

- Clinical and radiological assessment
- Classification
- Complications and associated conditions

- Non-operative management (physiotherapy, injection techniques)
- Indications for surgery
- Investigative techniques (injection, arthrography, arthroscopy)
- Surgical decompression of impingement
- Operative repair of tears, acute and chronic

Biceps Tendon

- Clinical and radiological examination
- Non-operative management (injection techniques, physiotherapy)
- Indications for surgery
- Surgical management of instability, chronic inflammation and rupture

Instability (Glenohumeral)

See Adult Trauma

Elbow – Epicondylitis

- Clinical and radiological assessment
- Non-operative management (physiotherapy, medication, injection therapy)
- Indications for surgery
- Differential diagnosis
- Investigative techniques (arthrography, electrophysiology)
- Surgical management (muscle slide, tendon lengthening and repair)

Instability Medial (Throwing)

- Clinical and radiological assessment
- Differential diagnosis
- Non-operative management
- Indications for surgery
- Biomechanical analysis
- Investigative techniques
- Operative management

Lower Limb

Foot

- Clinical and radiological assessment of foot pain (including stress fractures, tendinitis, tibialis posterior)
- Differential diagnosis
- Primary non-operative treatment
- Detailed knowledge of the biomechanics of running, normal and pathological (planovalgus, pes cavus concerning pre-disposition)
- Non-operative management (footwear, special orthotics, training schedules)
- Operative management
- See also Foot and Ankle Objectives

Ankle

See Adult Trauma

Achilles Tendon

- Assessment (Thompson test⁴¹)
- Differential diagnosis (“plantaris pop”)
- Non-operative management (rest, medication, therapy)
- Indications for surgery

- Surgical repair of acute ruptures
- Surgical reconstruction for late rupture

Lower Leg

- Clinical and radiological assessment
- Differential diagnosis – “shin splints” (compartment syndrome, vascular insufficiency, stress fracture, tendinitis, periostitis)
- Techniques of investigation (compartment pressure studies, bone scan, vascular assessment)
- Non-operative management
- Indications for surgery
- Operative management

Knee

- Meniscus and Ligament
- See Joint and Trauma Objectives

Patella

- Clinical and radiological assessment (mal-alignment, instability, abnormal tracking)
- Non-operative management (activity schedules, bracing, physiotherapy, medication)
- Indications for surgery
- Others overuse syndrome (patellar tendinitis, iliotibial band friction syndrome)
- Biomechanical principles, predisposition
- Methods of management (including training techniques)
- Methods of investigation (including diagnostic arthroscopy)
- Operative management (arthroscopic shaving, realignment, stabilization, Maquet procedure²³, Elmslie-Trillat¹⁰, patellectomy)

Hip

- Stress Fractures
- Clinical and radiological assessment
- Differential diagnosis of groin pain (with special reference to overuse syndromes)
- Associated conditions
- Investigative techniques (bone scan, arthrography, arthroscopy)
- Non-operative management (medication, physiotherapy, orthotics)
- Indications for surgery
- Diagnostic Surgery

Muscle Tendon (adductor Tendinitis, Pubic Symphysitis, Hip Pointer)

- Clinical and radiological assessment
- Differential diagnosis
- Associated conditions
- Non-operative management

- Spine (See under Spine)
- Detailed knowledge of biomechanics of the spine and brachial plexus (with special reference to sports injuries)
- Predisposing condition (congenital anomalies)
- Special precautions
- Non-operative management (training techniques, orthotics, physiotherapy)
- Advice re: risk of injury, participation

11. PAIN

- Definition of chronic pain syndromes.
- Theories of the mechanisms – central (Melzack44) – peripheral.
- Role of endogenous opiates (endorphins).
- Psychological factors.
- Clinical picture
- Investigation
- Principles of management.

II. PAEDIATRIC ORTHOPAEDICS

1. GENERAL AFFECTIONS OF BONE

Development Disorders

After studying specified material, the trainee, without aid of references, will be able to:

Define

- Dysplasia
- Dystrophy

- Dysostosis
- Classify the epiphyseal, physeal, metaphyseal, and diaphyseal dysplasias,
- The trainee should have an understanding of the interpretation of radiographs and knowledge of the reference source to assist in the classification of the diagnosis.
- Identify each of the following conditions, pointing out the distinguishing clinical, radiological and laboratory features giving the prognosis.
 - Acrocephalosyndactyly
 - Multiple epiphyseal dysplasia
 - Achondroplasia
 - Melorheostosis
 - Metaphyseal dysostosis
 - Metaphyseal dysplasia
 - Osteopetrosis
 - Osteogenesis imperfecta
 - Englemann's disease
 - Osteopoikilosis
 - Diastrophic dwarfism
 - The mucopolysaccharidoses
 - Spondyloepiphyseal dysplasia
 - Enchondromatosis
 - Hypophosphatasia
 - Dysplasia eiphysealis hemimelica

Metabolic and Endocrine Disorders

- Slipped Capital Femoral Epiphysis

After studying specified material, the trainee, without aid of references will be able to:

- List of predilected age group, sex, body types, and the incidence of bilaterality in slipped capital femoral epiphysis.
- Describe the theories of aetiology.
- List the expected clinical and roentgenographical features encountered with the following types of slipped epiphysis:
 - Pre-slip
 - Acute slip of 25%
 - Acute slip of 50%

 - Acute slip of 75%

- Chronic slip of 50%
- Describe the optimal operative treatment for each of the above slipped capital femoral epiphyses.
- Discuss the complications of slipped capital femoral epiphysis and its treatment.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopedic surgeon, his ability to:
 - Plan a corrective osteotomy of the proximal femur.
 - Demonstrate the ability to manage an acute slipped capital femoral epiphysis by traction and pinning in situ.

Rickets

After studying specified material, the trainee, without aid of references, will be able to

- List the types of rickets and the specific aetiology of each.
- Describe the characteristic clinical, radiological, laboratory, and pathological findings in each type of rickets.
- Discuss the management of a given patient with rickets.

Renal Osteodystrophy

- After studying specified material, the trainee, without aid of references, will be able to:
 - Describe the initial pathologic lesion in renal osteodystrophy.
 - List the characteristic clinical, radiological and laboratory features of renal osteodystrophy.
 - Discuss the management of a given patient with renal osteodystrophy.

Hypophosphatasia

- After studying specified material, the trainee, without aid of references will be able to:
 - Discuss the metabolic defect, genetics, clinical, radiological and laboratory characteristics of hypophosphatasia.

Hypoparathyroidism

- After studying specified material, the trainee, without aid of references, will be able to:
 - Describe the clinical and laboratory findings in idiopathic hypoparathyroidism.

- Give the primary feature that distinguishes hypoparathyroidism.

Hypothyroidism

- After studying specified material, the trainee, without aid of references, will be able to:
- Discuss the aetiology and the clinical, radiological and laboratory findings in Cretinism
- Discuss the management and prognosis of a given patient with Cretinism.

Circulatory Disorders

Osteonecrosis

After studying specified material, the trainee, without aid of references, will be able to:

- Define osteonecrosis as to pathogenesis.
- Given a specific history, physical examination, and x-rays, identify, outline a rational plan of management, and give the prognosis for:
 - Osgood-Schlatter's Disease
 - Köhler's Disease
 - Sever's Disease
 - Freiberg's Infraction
 - Scheuermann's Disease
 - Calve's disease (not an osteonecrosis)
 - Panner's Disease
 - Blount's Disease
 - Legg-Calve-Perthes Disease
 - Osteochondritis dissecans
- List the causes of aseptic necrosis of the capital femoral epiphysis in children.
- Describe the types of Legg-Calve Perthes disease according to Catterall 7 and Herring 19 including at least two characteristics of each type of their prognostic significance.
- Describe the pathological stages of coxa plana and correlate each stage with its radiological appearance.
- Discuss the operative and non-operative management of Legg-Calve Perthes
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated to the satisfaction of an attending orthopaedic surgeon, his ability to:

- Describe the various orthoses available and prescribe and check out an orthoses for use in the ambulatory treatment of unilateral coxa plana.
- Perform an arthroscopy or arthrotomy of the knee and remove a loose body.

Sickle Cell Disease

After studying specified material, the trainee, without aid of references will be able to:

- Classify a given primary tumour (benign or malignant) according to the AFIP Fascicle in the following series:
 - Osteogenic
 - Chondrogenic
 - Collagenic
 - Myelogenic
 - Recognize a given bone or soft somatic tissue tumour by clinical, radiological, and pathological examination.
 - Stage a tumour.
 - Outline the management and prognosis of the above tumour, and give the rationale for the plan chosen including indications for limb salvage or amputation.
-
- Demonstrate knowledge of principles of radiotherapy and chemotherapy for malignant tumours.
 - Describe the clinical, radiological and pathological features, prognosis and management of :
 - Eosinophilic granuloma
 - Hand-Schuller-Christian disease
 - Letterer-Siwe disease
 - Gaucher's disease
 - Chondroblastoma
 - Fibrous dysplasia
 - Unicameral bone cyst
 - Aneurysmal bone cyst
 - Fibrous cortical defect
 - Non-ossifying fibroma
 - Chondromyxoid fibroma
 - Enchondroma
 - Discuss the biopsy techniques and pre-requisites for a satisfactory biopsy.

- Discuss the common metastatic bone tumours in children.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of his supervisor, his ability to:
- Excise a benign tumour
- Inject a bone cyst

2. INFECTIONS OF BONES AND JOINTS

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the pathogenesis of haematogenous osteomyelitis.
- List the characteristic clinical, radiological, radio-isotopic, laboratory and pathological features in acute, subacute, chronic and residual osteomyelitis.
- Prescribe an appropriate course of antibiotic therapy for a given patient with acute osteomyelitis.
- List the indications for operative treatment of acute and chronic osteomyelitis.
- Discuss the management of a given patient with one of the following complications of osteomyelitis:
 - fracture
 - pyarthrosis
 - growth disturbance
- Upon completion of core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to :
- Treat a case of acute osteomyelitis.
- Understand the principles and techniques of treatment of chronic osteomyelitis including the Papineau technique.

3. AFFECTIONS OF JOINTS

Arthritis

Pyogenic

- After studying specified material, the trainee, without aid of references will be able to:
- Describe the pathogenesis and pathological changes occurring in the joints of infants and children with acute pyogenic arthritis

- Describe the bacteriological, clinical, laboratory, and radiological characteristics of acute septic arthritis.
- Describe the management and list possible complications of acute pyogenic arthritis
- List factors that may affect the prognosis of acute septic arthritis in children.
- List the conditions to be considered in the differential diagnosis of a child with an acutely painful joint and the plan by which you would reach a specific diagnosis.
- Discuss the clinical, radiological, laboratory, and bacteriological characteristics of inflammatory conditions of the intervertebral disc.
- Discuss the management and prognosis of a given paediatric patient with an inflammatory condition of the intervertebral disc.
- Discuss foreign bodies and nail puncture wounds in the aetiology of septic arthritis.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Aspirate the hip joint.
 - Incise and drain the affected hip joint of a patient with pyogenic arthritis.

Rheumatoid

After studying specified material, the trainee, without aid of references will be able to:

- List the clinical, laboratory, radiological and prognostic differences between rheumatoid arthritis in adults and children.
- Outline an approach to the management of a given child with monoarticular rheumatoid arthritis, including the indications for:
 - specific drug therapy
 - Splints, casts, and traction
 - Physical therapy
 - Surgery
 - Ophthalmology consultation
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Make and apply appropriate splints to immobilize specified joints in a patient with arthritis.
 - Aspirate any joint illustrating anatomical landmarks.

Haemophilia

After studying specified material, the trainee, without aid of references will be able to:

- List the congenital disorders of coagulation that may be associated with recurrent haemarthrosis and indicate the distinguishing genetic, laboratory and clinical characteristics of each.
- Discuss the management of a given child with an acute hemophilic haemarthrosis, including:
 - type, amount and duration of replacement therapy
 - use of traction, splints and casts
 - indications for aspiration
- Discuss the management of a given child with chronic hemophilic arthropathy, including the indications for:
 - home maintenance therapy
 - use of traction, splints, and casts
 - operative treatment
- Discuss the specific indications and contraindications for, expected results from, and coagulation management of:
 - synovectomy of the knee joint
 - replacement of the knee joint
 - excision of pseudotumour
- Discuss the previous high incidence of H.I.V. infection in hemophilic patients and the precautions to be taken during invasive procedures.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to :
 - Demonstrate various traction and casting techniques to correct a knee flexion contracture in a patient with haemophilia.
 - Knowledge of orthotics and techniques to arrest a flexion contracture of the knee or elbow.
 - Set up continuous passive motion equipment for post-haemarthrosis of knee.

Tuberculosis

After studying specified material, the trainee, without aid of references will be able to:

- List the distinctive clinical, laboratory (including bacteriology and analysis of the synovial fluid), radiological, and pathological features of tuberculous arthritis in peripheral joints.
- Discuss the pathogenesis, clinical, radiological, and pathological findings in spinal tuberculosis (Pott's disease) with and without Pott's paraplegia.
- Describe the management of a child with tuberculous arthritis of the hip or spine, including:
 - Type and duration of drug therapy
 - Indications for casting
 - Types of operative treatment, with indications for each
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to :
 - Perform a needle biopsy of a vertebral lesion.

Discoid Meniscus

- After studying specified material, the trainee, without aid of references will be able to:
 - Discuss the embryology of the knee joint.
 - Describe the altered anatomy in the knee and mechanism by which it produces a "discoid" lateral meniscus according to Kaplan²⁰.
 - List the clinical and pathological findings encountered in a "discoid" lateral meniscus.
 - Discuss the operative treatment of a "discoid" lateral meniscus with emphasis on technical differences between excision of a "non-discoid" and "discoid" menisci, including arthroscopic differences.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Perform a diagnostic arthroscopy of the knee in a teenage patient.

Popliteal Cyst

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the aetiology and natural history of popliteal cysts in children (as opposed to adults).
- Describe the possible anatomical relationships between popliteal cysts and the adjacent bursae, muscles and joint.

- Discuss the indications for non-operative and operative treatment of a popliteal cyst.
- Give a differential diagnosis of swelling behind the knee and how to differentiate.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to :
 - Aspirate and inject a popliteal cyst.

Transient Synovitis of the Hip

After studying specified material, the trainee, without aid of references will be able to:

- Discuss possible aetiologies of transient synovitis of the hip.
- Describe the clinical, laboratory and radiological findings and differential diagnosis of transient synovitis of the hip.
- Discuss the treatment of transient synovitis of the hip.

4. AFFECTIONS OF THE NERVOUS SYSTEM

Cerebral Palsy

After studying specified material, the trainee, without aid of references will be able to:

- Classify cerebral palsy according to the aetiology and site of neuropathological changes and discuss the clinical findings in each.
- Given a patient with cerebral palsy, discuss the principles upon which the total care of the patient will be based.
- Discuss appropriate non-operative and/or operative management of a given patient with cerebral palsy.

- List the indications, advantages, disadvantages, post-operative management, and unique complications of each of the following types of surgery in cerebral palsy:
 - Neurectomy
 - Tendon or muscle lengthening
 - Tendon transfer
 - Arthrodesis
- List the commonly encountered hand, wrist, elbow, spine, hip, knee, ankle and foot deformities in cerebral palsy and discuss the management of each – alone or in combination.
- Discuss the pathogenesis and management of the subluxed hip in the cerebral palsy child.
- Understand the progression and management principles of scoliosis in the cerebral palsy patient.
- Discuss the principles of seating the non-ambulatory cerebral palsy child.
- Discuss the pathogenesis and treatment of pelvic obliquity.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to :
 - Perform a tendon transfer or lengthening for correction of a spastic deformity.
 - Perform a subtalar arthrodesis.
 - Perform a femoral osteotomy.

Spinal Dysraphism

After studying specified material, the trainee, without aid of references will be able to:

- Describe the incidence and natural history of myelomeningocele, according to Sharrard 15 and to Smith.
- Describe the genetics and list theories of aetiology of spinal dysraphism indicating the strengths and weaknesses of each.
- Describe the pathological features of spinal dysraphism.
- Describe the most likely deformity of the hip, knee, ankle, foot and toes resulting from neurosegmental lesions at levels L1, L2, L3, L4, L5, S1, S2, S3 and indicate the reasons for each deformity.
- List the spinal levels of involvements by myelomeningocele in order of frequency according to Sharrard.

- Describe, for each of the following deformities, the pathogenesis, segmental level, indications, and contraindications to non-operative and operative management and methods to retain management gains:
 - Equinovarus foot
 - Equinovalgus foot
 - Planovalgus foot
 - Hyperextension deformity of the knee
 - Paralytic dislocation of the hip
 - Knee flexion deformity
 - Pelvic obliquity
 - Lumbar lordosis
 - Paralytic scoliosis
 - Calcaneus foot
- Discuss the incidence, prevention and treatment of each of the following complications of myelomeningocele:
 - Trophic ulceration
 - Neuropathological arthropathy
 - Non-union of attempted arthrodesis
 - Fractures and epiphyseal separations
 - Pelvic obliquity
- Understand the ambulatory and mobility devices available for the myelomeningocele child.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to :
 - Apply a cast to the limb of a given patient with sensory deprivation of the limb.
 - Prescribe and check an orthoses for deformity in the paraparetic child

Diastematomyelia

After studying specified material, the trainee, without aid of references will be able to:

- List the pathological, clinical and radiological findings in diastematomyelia.
- Discuss the management of a given patient with a slowly progressive neurological deficit in one lower limb caused by diastematomyelia.
- Discuss tight filum terminale with regards to investigation, differential diagnosis and management.

Friedreich's Ataxia

After studying specified material, the trainee, without aid of references will be able to:

- Give the pathogenesis and mode of inheritance and describe the pathological changes in the spinal cord and cerebellum in Friedreich's ataxia²²,
- Describe the clinical findings in classical Friedreich's ataxia.
- Discuss the management of the orthopaedic problem in a given patient with Friedreich's ataxia.

Peripheral Nerve Disorders

After studying specified material, the trainee, without aid of references will be able to:

- List the types of inheritance of Charcot-Marie-Tooth disease.
- Discuss the clinical, electromyographic, and pathological findings in Charcot-Marie-Tooth disease.
- Discuss the prognosis and management of a given patient with Charcot-Marie-Tooth disease.

Poliomyelitis

After studying specified material, the trainee, without aid of references will be able to:

- List the clinical and laboratory features of poliomyelitis that are important in its differential diagnosis.
- Describe the clinical stages of poliomyelitis.
- Describe the pathological findings in poliomyelitis.
- Discuss the non-operative management of a given patient with:
 - Acute, and
 - Convalescent
- Poliomyelitis, including indications for the use of bed rest, splints, braces, muscle strengthening exercises, and timing of ambulation.
- List the indications for operative treatment in a patient with residual poliomyelitis.
- Describe a rational plan of reconstructive surgery in a given patient with residual poliomyelitis affecting either the limbs or the spine or both.

Neurofibromatosis

After studying specified material, the trainee, without aid of references will be able to:

- Describe the clinical manifestations and pathological findings encountered in neurofibromatosis involving the following tissues:
 - Cutaneous
 - Subcutaneous
 - Nervous
 - Skeletal
 - Vascular
 - Lymphatic
- Discuss the possible relationships with neurofibromatosis in patients who have as the primary manifestation:
 - Hypertrophy of an upper limb
 - Leg length inequality
 - Scoliosis
 - Congenital pseudarthrosis of the tibia

Spinal Atrophy

After studying specified material, the trainee, without aid of references will be able to:

- Describe the pathological, clinical and laboratory findings encountered in spinal atrophy.
- Discuss the management of a given patient with spinal atrophy.
- Discuss the management of spinal curvature in the child with spinal muscular atrophy.

5. AFFECTIONS OF MUSCLE

Muscular Dystrophy

- Pseudohypertrophic muscular dystrophy.
- Facioscapulohumeral (Landouzy-Dejerine) muscular dystrophy
- Scapulohumeral (Erb) muscular dystrophy
- Myotonic dystrophy
- Congenital myopathies
- Myotonia Congenita
- Myositis Ossificans Progressive
- Bacterial Myositis
- Progressive Systemic Sclerosis (scleroderma)

Dermatomyositis

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the mode of inheritance, clinical manifestations, laboratory and electromyographical findings, pathological changes and management of a given patient with one of the following conditions affecting skeletal muscle:
 - Pseudohypertrophic muscular dystrophy
 - Facioscapulohumeral (Landouzy-Dejerine) muscular dystrophy
 - Limb girdle muscular dystrophy
 - Myotonia congenita
 - Myositis ossificans progressiva
 - Bacterial myositis

6. THE SPINE

Scoliosis

After studying specified material, the trainee, without aid of references will be able to:

- Discuss three possible aetiological factors in "idiopathic" scoliosis.
- Classify, list the differences in curve pattern, sex distribution, incidence, management and prognosis in:
 - Idiopathic scoliosis
 - Congenital scoliosis
 - Paralytic scoliosis
- Demonstrate his ability to measure accurately scoliotic curves according to the methods of Cobb.
- List the factors of prognostic significance in "idiopathic" scoliosis.
- Discuss the cause(s), significance, and measurement of vertebral rotation in scoliosis.
- List the characteristics of a structural scoliotic curve.
- List the indications for spinal instrumentation in the treatment of scoliosis.
- List the indications for spinal fusion in the treatment of scoliosis.
- Given a pre-operative patient with scoliosis and appropriate x-rays, select the proper fusion area, give the optimal method of correction and outline the studies necessary for adequate evaluation of respiratory function.

- List the indications and contraindications for use of the Milwaukee Brace and the lower profile brace in the treatment of scoliosis.
- List the complications of the non-operative management of scoliosis, and means to avoid them.
- Discuss the pseudarthrosis following spinal fusion, including causes, recognition, and management.
- Discuss the natural history of the untreated spinal curvature.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Apply a body cast. Perform a subtalar arthrodesis.
 - Prescribe and check out an appropriate orthosis for use in the management of a given patient with scoliosis.

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the aetiological, clinical and radiological manifestations, and management of
 - Klippel-Feil syndrome
 - Kyphosis (congenital)
- Discuss the possible aetiologies, clinical and pathological findings, and management of muscular torticollis

Scheuermann's Disease

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the possible aetiological factors in Scheuermann's diseases.
- List the distinguishing clinical and radiological features encountered in Scheuermann's disease of:
 - Thoracic spine
 - Lumbar spine
- Discuss the management and prognosis of a given patient with Scheuermann's disease.

7. CONGENITAL DISORDERS

The Upper Limb

After studying specified material, the trainee, without aid of references will be able to:

- Classify congenital skeletal limb defects according to Frantz and O’Rahilly¹⁴ and according to the New International Classification (Swanson³⁹).
- Given one of the following disorders of the upper limb, the trainee will be able to identify and/or classify the defect, describe the clinical and pathological features, outline a rational plan for management, and write an appropriate prosthetic prescription (in indicated):
 - Sprengel’s deformity
 - Cleidocranial dysostosis
 - Pseudarthrosis of the clavicle
 - Ankylosis of the elbow
 - Radioulnar synostosis
 - Dislocation of the radial head
 - Madelung’s deformity
 - Polydactyly
 - Syndactyly
 - Camptodactyly
 - Clasped thumb
 - Macrodactyly
 - Clinodactyly
 - Brachydactyly
 - Symphalangism
 - Trigger finger or thumb
 - Poland’s syndrome
 - Reduction deformities (including club hand, phocomelia, amputations, etc)
 - Brachial plexus palsy
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Perform the necessary operative procedures for correction of a given patient with a simple accessory digit, trigger finger or thumb.

The Lower Limb

Foot Deformities

- Pes Planus

After studying specified material, the trainee, without aid of references will be able to:

- List the important clinical and radiological features in the differential diagnosis between a relaxed flexible flatfoot deformity secondary to ligamentous laxity and one associated with a short tendo Achilles.
- Describe the pathology in one type of flatfoot deformity caused by each of the following:
 - primary ligamentous laxity
 - primary osseous abnormality (tarsal coalition)
 - primary joint abnormality (e.g. rheumatoid arthritis)
 - primary muscle pathology (e.g. cerebral palsy)
- Describe the differential clinical and radiological features in each of the above types of flatfoot.
- Describe the management (non-operative, operative, or both) of a given patient with one of the above types of flatfoot deformity.

Pes Cavus

After studying specified material, the trainee, without aid of references will be able to:

- List the specific neuromuscular lesions that may lead to a cavus deformity of the foot and describe the operative approach to each.

Leg Deformities

▪ Torsional

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the normal torsional development of the femur and tibia from the pre-natal period until growth is complete.
- Describe the postural attitudes associated with the development of abnormal femoral and tibial torsion.
- Describe how hip rotation is altered by femoral anteversion and retroversion.
- Describe the clinical and radiological techniques for the measurement of femoral torsion.
- Describe the clinical techniques for measuring and recording abnormal tibial torsion.
- List the acquired conditions attributed to increased femoral anteversion.
- Discuss the indications for exercises, splinting and osteotomy in the treatment of abnormal femoral and tibial torsion.

Angular

After studying specified material, the trainee, without aid of references will be able to:

- Describe the normal variation in the femoral neck shaft angle between birth and old age.
- Classify congenital coxa vara according to Amstutz¹, describe the pathological, clinical and radiological features of each.
- Describe the management of a given child with congenital coxa vara.
- List the causes of acquired coxa vara in children.
- Describe the physiological angulation at the knee (genu varum, valgum) from birth through to adolescence.
- Describe the techniques for measurement and recording of angulation at the knee.
- Discuss the management of a given patient with genu varum or valgum.

Leg Length Inequality

After studying specified material, the trainee, without aid of references will be able to:

- Specify the growth contributions of proximal and distal femur and tibia.
- List factors to consider in the evaluation of leg length inequality, with the significance of each.
- Discuss the indications, results and complications of :
 - Epiphyseal plate stimulation
 - Surgical lengthening of a limb
 - Surgical shortening of a limb
 - Epiphyseal plate arrest
 - Epiphyseal plate stapling
 - Resection of a bony bridge across the epiphyseal plate

Given a patient with leg length inequality:

- Make a growth prediction, using the Green-Anderson² or Moseley²⁶ methods.
- Read scanograms and skeletal age films, using the Greulich-Pyle¹⁷ atlas.
- Outline a plan of management of the leg length discrepancy specifying the reasons for the plan chosen.
- Understand the principle of lengthening through the callus.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Perform an epiphyseodesis in the lower limb of a given patient.

- Appreciate the concept of limb lengthening using the Ilizarov or Orthofix techniques

Torsional

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the pathogenesis of talipes equinovarus.
- List the pathological findings in ligaments, muscles and bones in talipes equinovarus.
- Discuss the aetiology, management and prognosis of talipes calcaneovalgus.
- List the major elements of the foot deformity in talipes equinovarus.
- Describe in detail the management of talipes equinovarus in a neonate by each of the following techniques:
 - Strapping
 - Splinting
 - Casting
- List the characteristic radiological findings of an incompletely corrected talipes equinovarus in the older child.
- List the indications for and describe the techniques of operative treatment of talipes equinovarus in a given patient under the age of six months.
- Describe the operative approach to each of the following patients with talipes equinovarus:
 - Six year old with 150 fixed forefoot adduction
 - Seven year old with fixed heel varus of 100
 - Sixteen year old male with 100 fixed heel varus and 150 fixed equines
- List three permanent stigmata of congenital talipes equinovarus.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Correct the deformities in a given patient with talipes equinovarus by non-operative methods.
 - Prescribe appropriate orthoses to maintain correction in patients with talipes equinovarus

Metatarsus Varus

After studying specified material, the trainee, without aid of references will be able to:

- Describe the types of Metatarsus varus and discuss the management and prognosis of a given patient with either variety.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
- Correct a given metatarsus varus deformity by serial cast application.

Tarsal Coalition

After studying specified material, the trainee, without aid of references will be able to:

- List the most common tarsal coalitions in order of frequency.
- Describe the radiological techniques for demonstration of the above coalitions.
- Describe the usual clinical findings in patients with symptomatic tarsal coalitions.
- Discuss the management of a given child with a symptomatic tarsal coalition.

Developmental (Congenital) Dislocation of the Hip

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the genetic, hormonal, mechanical factors that have been incriminated in the aetiology of developmental (congenital) dislocation of the hip.
- Demonstrate the clinical findings in development (congenital) dislocation of the hip in the neonate and discuss the relative importance of each in the diagnosis.
- List the radiological findings (including arthrography) in development (congenital) dislocation of the hip in the neonate and in the older child.
- List the normal value for the acetabular index and C-E angle at a given age.
- Describe the expected gross pathological findings in development (congenital) displacement of the hip in a patient:
 - 18 months of age or under
 - over 18 months of age
- Discuss the management of unilateral developmental (congenital) displacement of the hip in a given child under the age of 18 months.
- Discuss the management of unilateral developmental (congenital) displacement of the hip in a given patient between 18 months and 6 years of age.

- List the complications of development (congenital) displacement of the hip and its treatment and discuss the management of a given patient who has developed one of the complications.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
- Obtain and maintain reduction of a given developmental (congenital) displacement of the hip by non-operative methods.

Congenital Dislocation of the Knee

After studying specified material, the trainee, without aid of references will be able to:

- List the possible aetiological factors in congenital dislocation of the knee including genu recurvatum.
- Describe the optimum management of a given patient with congenital dislocation of the knee.

Vertical Talus

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the pathogenesis of congenital vertical talus, and describe the gross pathological findings.
- List the clinical and radiological findings that distinguish congenital vertical talus from the other types of flatfoot.
- Describe the management of a given child with congenital vertical talus including:
 - Indications, techniques, and prognosis of non-operative treatment
 - Indications for operative treatment
 - Type of staging and procedures

Proximal Femoral Focal Deficiency

See Leg Deformities – Angular

Reduction Deformities

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the principles involved in the selection of the operative procedures for the reconstruction of a lower limb deformity caused by absence (partial or complete) of the femur, tibia or fibula.

Coxa Vara

See Leg Deformities – Angular

Pseudarthrosis of the Tibia

After studying specified material, the trainee, without aid of references will be able to:

- Describe the radiological and pathological findings in congenital pseudarthrosis of the tibia.
- Describe operative techniques that have been used successfully to obtain union in the treatment of congenital pseudarthrosis of the tibia with the efficacy of each.
- Understand the principles of the electrical stimulation of bone healing in pseudarthrosis of the tibia.
- Discuss microvascular bone transplants in the treatment of congenital pseudarthrosis of the tibia.
- Discuss the orthotic management of congenital pseudarthrosis of the tibia.

Miscellaneous Congenital Disorders

Constricting Bands

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the pathogenesis and gross pathological findings of congenital constricting bands.
- List the indications for surgical excision of congenital constricting bands.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
- Perform a Z-plasty to release a skin contracture.

Congenital Amputation

After studying specified material, the trainee, without aid of references will be able to:

- Discuss the aetiology of congenital amputations.
- Discuss the principles of prosthetic management of infant and child with upper extremity and lower extremity congenital amputations.

Arthrogryposis

After studying specified material, the trainee, without aid of references will be able to:

- Give the evidence supporting primary muscle and primary central nervous system aetiologies of arthrogryposis.
- List the clinical features of arthrogryposis.
- Discuss the optimal management of a given child with arthrogryposis.
 - Marfan's Syndrome
 - Ellis-van Creveld Syndrome
 - Nail-Patella Syndrome
 - Ehlers-Danlos Syndrome
 - Trisomy-21 (Down's Syndrome)
 - Turner's Syndrome
 - Klinefelter's Syndrome
 - Mucopolysaccharidoses
 - Achondroplasia
 - Larsen's Syndrome

Klippel Trenaunay Weber

After studying specified material, the trainee, without aid of references will be able to:

- Define; discuss the genetics, clinical and radiological features, laboratory abnormalities, management and prognosis in Marfan's Syndrome, Ellis-van Creveld Syndrome, Nail-Patella Syndrome, Ehlers-Danlos Syndrome, Trisomy-21 (Down's syndrome), and Turner's syndrome, Klinefelter's Syndrome, mucopolysaccharidoses and achondroplasia.

8. TRAUMATIC DISORDERS

Epiphyseal Plate Injury

The trainee will be expected to have a basic knowledge of the anatomy, histology and physiology of the growth plate and its reactions to injury and disease including the ability:

- Give a classification of the growth plate injuries and their treatment.
- Discuss the prognosis of growth plate injury and types of growth disturbance.
- Discuss the apophyseal injuries especially as related to sports injuries.
- Explain the development of epiphyseal bars and methods of treatment.
- Discuss the relative growth contributions of the major epiphyseal plates and their influence on fracture management.

Differences in Fractures between Children and Adults

- The trainee will be expected to be able to discuss in detail the anatomical and physiological differences in fractures and dislocations between children and adults with the implications on treatment including the ability to :
- Discuss the complications of fractures and dislocations in general as related to children.
- Discuss the effects of remodeling on fracture management.
- Discuss the effects of fractures on growth on long bones and appropriate treatment to ensure limb length equality.
- Discuss pathological fractures in children and how they differ from similar fractures in adults.

Birth Fractures

- The trainee will have a good understanding of birth presentation predisposed to the fractures of long bones as well as those disease entities with a high incidence of fractures at parturition including the ability to :
- Discuss the treatment and management of birth fractures.
- Classify birth fractures and discuss the incidence and management of specific fractures of clavicle, humerus and femur.
- Discuss associated soft tissue birth trauma, eg brachial plexus, spinal cord injury.

Fractures in Child Abuse

- The trainee will be expected to be familiar with the signs and symptoms of trauma secondary to child abuse.
- Discuss the management of the abuse child (including legal responsibility)

- Discuss the radiological features of the abused child.
- Discuss the epidemiology and prevalence of child abuse.

Fractures and Dislocations of Specific Bones and Joints in Children

- The trainee will be expected to have knowledge of the types and treatment of fractures and dislocations of each bone and joint with particular emphasis on complications and differences in management from the comparable adult injury.

Hand

- The trainee should be able to discuss fractures of the phalanges, metacarpals and carpal bones including the management of intra-articular and epiphyseal injuries including the ability to;
- Discuss the avulsion injuries of the paediatric hand and their treatment.
- Discuss dislocation of the finger joints in children and their management.

Wrist

The trainee will be expected to discuss the various types of epiphyseal injuries around the wrist including complications and management; and should be able to :

- Discuss the concept of the periosteal hinge in the treatment of fractures of children.
- Discuss of treatment of torus and greenstick fractures in children
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
- Reduction and plaster immobilization of a Type I or II epiphyseal injury distal radius.
- Reduction and plaster immobilization of displaced (bayonet apposition) distal radius and ulna metaphyseal fractures.

Forearm Fractures in Children

- The trainee should be expected to understand the biomechanics and treatment of fractures of the distal, middle and proximal third of the radius and ulna including the ability to :

- Discuss the cause and management of the Monteggia²⁵ fracture dislocation and its equivalents in children.
- Discuss proper casting techniques and limb positioning for optimum treatment of various forearm fractures.
- Discuss treatment of malunion of fractures of the forearm.
- Upon completion of his core curriculum in paediatric orthopedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Reduce greenstick fracture midshaft radius and ulna.
 - Reduce displaced fracture midshaft radius and ulna by closed or open means.

Fractures and Dislocations about the Elbow.

- The trainee will be expected to understand the anatomy and epiphyseal development in the region of the elbow as well as the ability to:
 - Discuss the complications of elbow trauma in children.
 - Discuss fractures of the distal humerus at various ages.
 - Comment upon the investigation of elbow injuries.
 - Discuss vascular complications following elbow trauma.
 - Comment upon the treatment of complications of the supracondylar fracture in children.
- Contrast clinically and radiologically between the various fractures encountered about the elbow.
- Upon completion of his core curriculum in paediatric orthopedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to perform:
 - Reduction and plaster immobilization of:
 - supracondylar fracture humerus (including percutaneous pinning)
 - dislocation of the elbow
 - insertion of traction pin in ulna for traction treatment of supracondylar fracture Monteggia fracture-dislocation.
 - Open reduction and fixation of medial and lateral epicondylar fractures.
 - The application of Dunlop's traction with and without skeletal traction.
 - Compartment pressure monitoring.

Fractures of Humeral Shaft and Shoulder.

- The trainee will be expected to understand the biomechanics and management of fractures of the shaft and proximal humerus in the child including the ability to:

- Discuss the epiphyseal plate injuries about the proximal humerus including methods of reduction.
- Discuss the relative growth contributions of the proximal humerus and its influence on treatment.
- Discuss fractures of the clavicle and acromioclavicular joint in children; aetiology and management.
- Upon completion of his core curriculum in paediatric orthopaedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to carry out:
 - Proper application of Figure of Eight bandage for fractured clavicle.
 - Application of Navy Sling or Velpeau bandage.
 - Reduction and plaster immobilization of displaced fracture of proximal humerus.

Spinal Injury in Children

- The trainee will be expected to be able to discuss the approach of spinal injury in children re: diagnosis and management, but in particular, the differences between adult and paediatric injury. The trainee will also be expected to:
 - Discuss cervical spine injury in children and its relation to congenital abnormalities.
 - Explain the differences in anatomy of the cervical spine between infants and adults and its influence on spinal injury.
 - Explain rotatory subluxation and facet dislocation and underlying mechanisms predisposing the child to these injuries.
 - Discuss pathological fractures of the spine in children.
 - Describe and discuss the features of spondylolysis in the child including treatment.

Pelvic Fractures in Children

- The trainee will be expected to have an understanding of the biomechanics and types of pelvic fractures characteristic in childhood including associated soft tissue trauma. The trainee will also be expected to be able to:
 - Discuss apophyseal avulsion injuries about the pelvis.
 - Explain methods of investigation and pelvic fractures and associated trauma.
 - Classify fractures of the pelvis in children
 - Discuss the investigation and diagnosis of associated adjacent soft tissue injury.

Fractures and Dislocations about the Hip in Children

- The trainee will be expected to know the anatomy and development of the hip with particular emphasis on the blood supply to the femoral head at various ages as well as be able to:
- Classify fractures of the head and neck of the femur in childhood including a discussion of management.
- Discuss acute dislocations of the hip in childhood.
- Discuss the management of complications of fracture dislocation of the hip with particular reference to coxa vara and avascular necrosis.
- Discuss the Type I fracture of the proximal femoral epiphysis with respect to aetiology, diagnosis, management and prognosis.

Fractures of the Femoral Shaft

- The trainee will be expected to understand the anatomy, vasculature and biomechanics of the femur that predispose it to injury in childhood and as well to be able to:
- Discuss the emergency management of fractured femurs in children.
- Discuss the traction treatment of femoral fractures in children of different ages and complications to be avoided.
- Explain the problems encountered in managing subtrochanteric fractures in children.
- Discuss the indications and complications of intramedullary rodding in children.
- Upon completion of his core curriculum in paediatric orthopedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
- Demonstrate proper application of :
 - Thomas splint
 - Skin traction techniques for management of fractured femur – distal and proximal insertion of traction pin to distal femur

Fractures about the Knee in Children

- The trainee will have good understanding of the anatomy of the knee area, predisposing the child to specific injury. In addition, the resident will be expected to:
- Discuss the types and management of epiphyseal injuries of the distal femur and proximal tibia in children and their prognosis.
- Explain the differences in cruciate injuries between children and adults.

- Discuss avulsion injuries about the knee.
- Discuss referred pain about the knee.
- Discuss osteochondral fractures of the knee.

Fractures and Dislocations of the Patella in Children

- The trainee will be expected to understand the influence of developmental anatomy on patella stability and be able to:
 - Discuss chondromalacia patellae.
 - Discuss operative and non-operative management of patella instability.
 - Discuss osteochondral fractures secondary to patella dislocations.

Fractures of the Tibia and Fibula

- The trainee is expected to know the influence of growth of one paired bone on the other as well as the types of fractures encountered in the tibia and fibula. The trainee will also be expected to:
 - Describe and discuss toddler's fractures.
 - Discuss fractures involving the epiphyseal plate in the distal fibula and tibia.
 - Discuss fractures of the tibia and fibula with regard to varus and valgus angulation.
 - Discuss stress fractures.
 - Discuss fractures of the distal tibia in children including the Triplane and Tillaux fracture.
 - Upon completion of his core curriculum in paediatric orthopedics, the trainee will have demonstrated, to the satisfaction of an attending orthopaedic surgeon, his ability to:
 - Demonstrate closed reduction and plaster fixation of :
 - fractured tibia and fibula
 - fractured proximal tibia
 - Type II growth plate injury of the distal tibia
 - Perform open reduction and internal fixation of growth plate injury where indicated.

Fracture and Dislocation of the Foot

- The trainee is expected to know the ossification pattern of the bone of the feet together with the types of fractures characteristic of each bone. As well, the trainee should be able to :
 - Discuss injuries of the talus in children together with the blood supply of the talus.

- Classify fractures of the calcaneus.
- Discuss avulsion fractures about the foot.
- Discuss osteochondral fractures of the talus.
- Discuss accessory bones of the foot.

Pathological Fractures

- The trainee understands the types of paediatric conditions predisposing to pathological fractures including:
 - Tumours and cysts
 - Myelomeningocele
 - Osteogenesis imperfecta
 - Stress fractures
 - Disease osteoporosis
 - Osteomyelitis
 - Fibrous dysplasia

Thesis Component (Fifth year of MS Orthopaedics Programme)

RESEARCH/ THESIS WRITING

Total of one year will be allocated for work on a research project with thesis writing. Project must be completed and thesis be submitted before the end of training. Research can be done as one block in 5th year of training or it can be stretched over five years of training in the form of regular periodic rotations during the course as long as total research time is equivalent to one calendar year.

Research Experience

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Recent productivity by the program faculty and by the residents will be required, including publications in peer-reviewed journals. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and interpretation of data. The program must provide instruction in the critical

assessment of new therapies and of the surgical literature. Residents should be advised and supervised by qualified staff members in the conduct of research.

Clinical Research

Each resident will participate in at least one clinical research study to become familiar with:

1. Research design
2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation
3. Data collection and data analysis
4. Research ethics and honesty
5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

Case Studies or Literature Reviews

Each resident will write, and submit for publication in a peer-reviewed journal, a case study or literature review on a topic of his/her choice.

Laboratory Research

Bench Research

Participation in laboratory research is at the option of the resident and may be arranged through any faculty member of the Division. When appropriate, the research may be done at other institutions.

Research involving animals

Each resident participating in research involving animals is required to:

1. Become familiar with the pertinent Rules and Regulations of the University of Health Sciences Lahore i.e. those relating to "Health and Medical Surveillance Program for Laboratory Animal Care Personnel" and "Care and Use of Vertebrate Animals as Subjects in Research and Teaching"
2. Read the "Guide for the Care and Use of Laboratory Animals"
3. View the videotape of the symposium on Humane Animal Care

Research involving Radioactivity

Each resident participating in research involving radioactive materials is required to

1. Attend a Radiation Review session

-
2. Work with an Authorized User and receive appropriate instruction from him/her.

METHODS OF INSTRUCTION/COURSE CONDUCTION

As a policy, active participation of students at all levels will be encouraged. Following teaching modalities will be employed:

1. Lectures
2. Seminar Presentation and Journal Club Presentations
3. Group Discussions
4. Grand Rounds
5. Clinico-pathological Conferences
6. SEQ as assignments on the content areas
7. Skill teaching in ICU, Operation theatres, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Self study, assignments and use of internet
10. Bedside teaching rounds in ward
11. OPD & Follow up clinics
12. Long and short case presentations

In addition to the conventional teaching methodologies interactive strategies like conferences will also be introduced to improve both communication and clinical skills in the upcoming consultants. Conferences must be conducted regularly as scheduled and attended by all available faculty and residents. Residents must actively request autopsies and participate in formal review of gross and microscopic pathological material from patients who have been under their care. It is essential that residents participate in planning and in conducting conferences.

1. Clinical Case Conference

Each resident will be responsible for at least one clinical case conference each month. The cases discussed may be those seen on either the consultation or clinic service or during rotations in specialty areas. The resident, with the advice of the Attending Surgeon on the Consultation Service, will prepare and present the case(s) and review the relevant literature.

2. Monthly Student Meetings

Each affiliated medical college approved to conduct training for MS Orthopaedics will provide a room for student meetings/discussions such as:

- a.** Journal Club Meeting
- b.** Core Curriculum Meetings
- c.** Skill Development

a. Journal Club Meeting

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application. Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be invited to present outlines or results of current research activities. The article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department.

b. Core Curriculum Meetings

All the core topics of Orthopaedics should be thoroughly discussed during these sessions. The duration of each session should be at least two hours once a month. It should be chaired by the chief resident (elected by the residents of the relevant discipline). Each resident should be given an opportunity to brainstorm all topics included in the course and to generate new ideas regarding the improvement of the course structure

c. Skill Development

Two hours twice a month should be assigned for learning and practicing clinical skills.

List of skills to be learnt during these sessions is as follows:

1. Residents must develop a comprehensive understanding of the indications, contraindications, limitations, complications, techniques, and interpretation of results of those technical procedures integral to the discipline
2. Residents must acquire knowledge of and skill in educating patients about the technique, rationale and ramifications of procedures and in obtaining procedure-specific informed consent. Faculty supervision of residents in their performance is required, and each resident's experience in such procedures must be documented by the program director.
3. Residents must have instruction in the evaluation of medical literature, clinical epidemiology, clinical study design, relative and absolute risks of disease, medical statistics and medical decision-making.
4. Training must include cultural, social, family, behavioral and economic issues, such as confidentiality of information, indications for life support systems, and allocation of limited resources.
5. Residents must be taught the social and economic impact of their decisions on patients, the primary care physician and society. This can be achieved by attending the bioethics lectures
6. Residents should have instruction and experience with patient counseling skills and community education.
7. This training should emphasize effective communication techniques for diverse populations, as well as organizational resources useful for patient and community education.
8. Residents should have experience in the performance of Orthopaedics related clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance and proficiency standards
9. Each resident will manage at least the following essential Orthopaedic surgical cases and observe and participate in each of the following

procedures, preferably done on patients under supervision initially and then independently

3. Annual Grand Meeting

Once a year all residents enrolled for MS Orthopaedics should be invited to the annual meeting at UHS Lahore.

One full day will be allocated to this event. All the chief residents from affiliated institutes will present their annual reports. Issues and concerns related to their relevant courses will be discussed. Feedback should be collected and suggestions should be sought in order to involve residents in decision making.

The research work done by residents and their literary work may be displayed.

In the evening an informal gathering and dinner can be arranged. This will help in creating a sense of belonging and ownership among students and the faculty.

LOG BOOK

The residents must maintain a log book and get it signed regularly by the supervisor. A complete and duly certified log book should be part of the requirement to sit for MS examination. Log book should include adequate number of diagnostic and therapeutic procedures observed and performed, the indications for the procedure, any complications and the interpretation of the results, routine and emergency management of patients, case presentations in CPCs, journal club meetings and literature review.

Proposed Format of Log Book is as follows:

Candidate's Name: _____

Roll No. _____

The above mentioned procedures shall be entered in the log book as per format:

Procedures Performed

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure Performed	Supervisor's Signature
1					
2					
3					
4					

Emergencies Handled

Sr. #	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure/Management	Supervisor's Signature
1					
2					
3					
4					

Case Presented

Sr. #	Date	Name of Patient, Age, Sex & Admission No.	Case Presented	Supervisor's Signature
1				
2				
3				
4				

Seminar/Journal Club Presentation

Sr. #	Date	Topic	Supervisor's signature
1			
2			
3			
4			

Evaluation Record

(Excellent, Good, Adequate, Inadequate, Poor)

At the end of the rotation, each faculty member will provide an evaluation of the clinical performance of the fellow.

Sr.#	Date	Method of Evaluation (Oral, Practical, Theory)	Rating	Supervisor's Signature
1				
2				
3				
4				

EVALUATION & ASSESSMENT STRATEGIES

Assessment

It will consist of action and professional growth oriented ***student-centered integrated assessment*** with an additional component of ***informal internal assessment, formative assessment*** and measurement-based ***summative assessment***.

Student-Centered Integrated Assessment

It views students as decision-makers in need of information about their own performance. Integrated Assessment is meant to give students responsibility for deciding what to evaluate, as well as how to evaluate it, encourages students to **'own'** the evaluation and to use it as a basis for self-improvement. Therefore, it tends to be growth-oriented, student-controlled, collaborative, dynamic, contextualized, informal, flexible and action-oriented.

In the proposed curriculum, it will be based on:

- Self Assessment by the student
- Peer Assessment
- Informal Internal Assessment by the Faculty

Self Assessment by the Student

Each student will be provided with a pre-designed self-assessment form to evaluate his/her level of comfort and competency in dealing with different relevant clinical situations. It will be the responsibility of the student to correctly identify his/her areas of weakness and to take appropriate measures to address those weaknesses.

Peer Assessment

The students will also be expected to evaluate their peers after the monthly small group meeting. These should be followed by a constructive feedback according to the prescribed guidelines and should be non-judgmental in nature. This will enable students to become good mentors in future.

Informal Internal Assessment by the Faculty

There will be no formal allocation of marks for the component of Internal Assessment so that students are willing to confront their weaknesses rather than hiding them from their instructors.

It will include:

- a. Punctuality
- b. Ward work
- c. Monthly assessment (written tests to indicate particular areas of weaknesses)
- d. Participation in interactive sessions

Formative Assessment

Will help to improve the existing instructional methods and the curriculum in use

Feedback to the faculty by the students:

After every three months students will be providing a written feedback regarding their course components and teaching methods. This will help to identify strengths and weaknesses of the relevant course, faculty members and to ascertain areas for further improvement.

Summative Assessment

It will be carried out at the end of the programme to empirically evaluate cognitive, psychomotor and affective domains in order to award diplomas for successful completion of courses.

Intermediate Examination MS Orthopaedics
Total Marks: 500

All candidates admitted in MS Orthopaedics course shall appear in Intermediate examination at the end of second calendar year.

Written Examination	= 300 Marks
Clinical, TOACS/OSCE & ORAL	= 200 Marks
Total	= 500 Marks

Written:

MCQs 100 (2 marks each MCQ)

SEQs 10 (10 Marks each SEQ)

Total	= 300 Marks
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Components of Theory Paper

Principles of General Surgery	= 70 MCQs	7 SEQs
Specialty specific	= 10 MCQs	1 SEQs
Basic Sciences	= 20 MCQs	2 SEQs
• Anatomy	= 6 MCQs	1 SEQs
• Pharmacology	= 2 MCQs	-----
• Pathology	= 6 MCQs	1 SEQ
• Physiology	= 6 MCQs	-----

Clinical, TOACS/OSCE & ORAL

Four Short Cases	= 100 Marks
One Long Case	= 50 Marks
Toacs/OSCE & Oral	= 50 Marks

Total = 200 Marks

Final Examination MS ORTHOPAEDICS
Total Marks: 1500

All candidates admitted in MS Orthopaedics course shall appear in Final examination at the end of structured training programme (end of 5th calendar year) and after clearing Intermediate examination.

There shall be two written papers of 250 marks each Clinical, TOACS/OSCE & ORAL of 500 marks, Internal assessment of 100 marks and thesis examination of 400 marks.

Topics included in paper 1

Adult Orthopaedics

- | | |
|--|-----------|
| 1. Trauma | (15 MCQs) |
| 2. Joints | (15 MCQs) |
| 3. Infections | (10 MCQs) |
| 4. Neuromuscular Disorders & Spine | (15 MCQs) |
| 5. Hand, Foot and Ankle | (15 MCQs) |
| 6. Amputation, Prosthetics and Orthotics | (15 MCQs) |
| 7. Tumours | (10 MCQs) |
| 8. Sports Medicine & Pain | (05 MCQs) |

Topics included in paper 2

Paediatric Orthopaedics

- | | |
|-----------------------------------|-----------|
| 1. Congenital Disorders | (15 MCQs) |
| 2. Trauma | (15 MCQs) |
| 3. General Affections of Bones | (15 MCQs) |
| 4. Infections of Bones and Joints | (15 MCQs) |
| 5. Affections of Joints & Muscles | (10 MCQs) |

6. Neuromuscular Disorders & Spine	(15 MCQs)
7. Affections of Nervous System	(05 MCQs)
8. Tumours	(10 MCQs)

Components of Final Clinical Examination

Theory

Paper I	<u>250 Marks</u>	3 Hours
5 SEQs	50 Marks	
100 MCQs	200 Marks	
Paper II	<u>250 Marks</u>	3 Hours
5 SEQs	50 Marks	
100 MCQs	200 Marks	

Only those candidates, who pass in theory papers, will be eligible to appear in the Clinical, TOACS/OSCE & ORAL.

<u>Clinical, TOACS/OSCE & ORAL</u>	<u>500 Marks</u>
Four short cases	200 Marks
One long case:	100 Marks
TOACS/OSCE & ORAL	200 Marks

APPENDIX "E"
(See Regulation 9-iii)

MANDATORY WORKSHOPS

1. Each candidate of MD/MS/MDS program would attend the 04 mandatory workshops and any other workshop as required by the university.
2. The four mandatory workshops will include the following

- a. **Research Methodology and Biostatistics**
 - b. **Synopsis Writing**
 - c. **Communication Skills**
 - d. **Introduction to Computer / Information Technology and Software programs**
- 3 months

1. The workshops will be held on 03 monthly basis.
4. An appropriate fee for each workshop will be charged.
5. Each workshop will be of 02 - 05 days duration.
6. Certificates of attendance will be issued upon satisfactory completion of workshops.

APPENDIX "F"
(See Regulation 9xxiii, 13, 14 & 16)

CONTINUOUS INTERNAL ASSESSMENTS

a) **Workplace Based Assessments**

Workplace based assessments will consist of Generic as well as Specialty Specific competency Assessments and Multisource Feedback Evaluation.

Generic Competency Training & Assessments

The Candidates of all MD / MS / MDS programs will be trained and assessed in the following five generic competencies.

i. **Patient Care.**

- a. Patient care competency will include skills of history taking, examination, diagnosis, plan of investigation, clinical judgment, plan of treatment, consent, counseling, plan of follow up, communication with patient / relatives and staff.
- b. The candidate shall learn patient care through ward teaching, departmental conferences, morbidity and mortality meetings, core curriculum lectures and training in procedures and operations.
- c. The candidate will be assessed by the supervisor during presentation of cases on clinical ward rounds, scenario based discussions on patient management, multisource feedback evaluation, Direct Observation of Procedures (DOPS) and operating room assessments.
- d. These methods of assessments will have equal weightage.

ii. **Medical Knowledge and Research**

- a. The candidate will learn basic factual knowledge of illnesses relevant to the specialty through lectures/discussions on topics selected from the syllabus, small group tutorials and bed side rounds.
- b. The medical knowledge/skill will be assessed by the teacher during case based discussions and presentations to the supervisor.
- c. The candidate will be trained in designing research project, data collection, data analysis and presentation of results by the supervisor.

- d. The acquisition of research skill will be assessed as per regulations governing thesis evaluation and its acceptance.

iii. **Practice and System Based Learning**

- a. This competency will be learnt from journal clubs, review of literature, policies and guidelines, audit projects, medical error investigation, root cause analysis and awareness of healthcare facilities.
- b. The assessment methods will include case studies, presentation in morbidity and mortality review meetings and presentation of audit projects if any.
- c. These methods of assessment shall have equal weight-age.

iv. **Communication Skills**

- a. These will be learnt from role models, supervisor and workshops.
- b. They will be assessed by direct observation of the candidate whilst interacting with the patients, relatives, colleagues and with multisource feedback evaluation.

v. **Professionalism as per Hippocratic Oath**

- a. This competency is learnt from supervisor acting as a role model, ethical case conferences and lectures on ethical issues such as confidentiality, informed consent, end of life decisions, conflict of interest, harassment and use of human subjects in research.
- b. The assessment of residents will be through multisource feedback evaluation according to proformas of evaluation and its' scoring method.

Specialty Specific Competencies

- i. The candidates will be trained in operative and procedural skills according to a quarterly based schedule.
- ii. The level of procedural competency will be according to a competency table to be developed by each specialty.

iii. The following key will be used for assessing operative and procedural competencies:

a. **Level 1 Observer status**

The candidate physically present and observing the supervisor and senior colleagues

b. **Level 2 Assistant status**

The candidate assisting procedures and operations

c. **Level 3 Performed under supervision**

The candidate operating or performing a procedure under direct supervision

d. **Level 4 Performed independently**

The candidate operating or performing a procedure without any supervision

iv. **Procedure Based Assessments (PBA)**

a. Procedural competency will assess the skill of consent taking, preoperative preparation and planning, intraoperative general and specific tasks and postoperative management

b. Procedure Based assessments will be carried out during teaching and training of each procedure.

c. The assessors may be supervisors, consultant colleagues and senior residents.

d. The standardized forms will be filled in by the assessor after direct observation.

e. The resident's evaluation will be graded as satisfactory, deficient requiring further training and not assessed at all.

f. Assessment report will be sub

g. A satisfactory score will be required to be eligible for taking final examination.

Multisource Feedback Evaluation

- i. The supervisor would ensure a multisource feedback to collect peer assessments in medical knowledge, clinical skills, communication skills, professionalism, integrity, and responsibility.
- ii. Satisfactory annual reports will be required to become eligible for the final examination

b) Completion Of Candidate's Training Portfolio

- i. The Candidate's Training Portfolio (CTP) will be published (or computer based portfolio downloadable) by the university.
- ii. The candidates would either purchase the CTP or download it from the KEMU web site.
- iii. The portfolio will consist of the following components
 - a) Enrollment details.
 - b) Candidate's credentials as submitted on the application for admission form.
 - c) Timeline of scheduled activities e.g dates of commencement and completion of training, submission of synopsis and thesis, assessments and examination dates etc (**Appendix H**)
 - d) Log Book of case presentations, operations and procedures recorded in an appropriate format and validated by the supervisor.
 - e) Record of participation and presentations in academic activities e.g lectures, workshops, journal clubs, clinical audit projects, morbidity & mortality review meetings, presentation in house as well as national and international meetings.
 - f) Record of Publications if any.
 - g) Record of results of assessments and examinations if any
 - h) Synopsis submission proforma and IRB proforma and AS&RB approval Letter
 - i) Copy of Synopsis as approved by AS&RB
- iv. Candidates Training Portfolio shall be assessed as per proforma given in "**Appendix-G**".

Supervisor's Annual Review Report.

This report will consist of the following components:-

- i. Verification and validation of Log Book of operations & procedures according to the expected number of operations and procedures performed (as per levels of competence) determined by relevant board of studies.
- ii. A 90 % attendance in academic activities is expected. The academic activities will include: Lectures, Workshops other than mandatory workshops, Journal Clubs, Morbidity & Mortality Review Meetings and Other presentations.
- iii. Assessment report of presentations and lectures
- iv. Compliance Report to meet timeline for completion of research project.
- v. Compliance Report on Personal Development Plan.
- vi. Multisource Feedback Report, on relationship with colleagues, patients.
- vii. Supervisor will produce an annual report based on assessments as per proforma in appendix-G and submit it to the Examination Department.
- viii. 75 % score will be required to pass the Continuous Internal Assessment on annual review.

APPENDIX " G "

(See Regulation 9ix, 9xxiii-d, 10, 11, 14 & 16)

Supervisor's Evaluation

PROFORMA FOR CONTINUOUS INTERNAL ASSESSMENTS

1. Generic Competencies			
(Please score from 1 – 100. 75% shall be the pass marks)		Component Score	Score achieved
i.	Patient Care	20	
ii.	Medical Knowledge and Research	20	
iii.	Practice and System Based Learning		
	• Journal Clubs	04	
	• Audit Projects	04	
	• Medical Error Investigation and Root Cause Analysis	04	
	• Morbidity / Mortality / Review meetings	04	
iv.	Communication Skills		
	• Informed Consent	10	
	• End of life decisions	10	
v.	Professionalism		
	• Punctuality and time keeping	04	
	• Patient doctor relationship	04	
	• Relationship with colleagues	04	
	• Awareness of ethical issues	04	
	• Honesty and integrity	04	
2. Specialty specific competencies			
Please score from 1 – 100. 75% shall be the pass marks			Score achieved
Operative Skills / Procedural Skills			
3. Multisource Feedback Evaluation (Please score from 1 – 100. 75% shall be the pass marks)			
4. Candidates Training Portfolio (Please score from 1 – 100.75% shall be the pass marks)			
(Please score from 1 – 100. 75% shall be the pass marks)		Component Score	Score achieved
i.	Log book of operations and procedures	25	
ii.	Record of participation and presentation in academic activities	25	
iii.	Record of publications	25	
iv.	Record of results of assessments and examinations	25	