

The Spine Fellowship is a combined Orthopaedic and Neurosurgical Adult and Pediatric Spine Program offering a comprehensive spectrum of spinal disorders with non-operative and operative interventions.

Goals:

1. Provide the Fellow with the most well-rounded and diverse exposure to spinal disorders. The fellow rotates through coordinated orthopaedic and neurosurgical spine services that focus on cervical, thoracic and lumbar pathology.
2. Expose the Fellow to the most up-to-date and modern diagnostic procedures for the evaluation of spinal disorders.
3. Teach the Fellow the entire range of operative treatment of spinal disorders - from occiput to ilium; from routine decompression and stabilization to complex deformities; (approached both anterior and posterior) - running the spectrum of pathology including pediatric and adult deformities, trauma, tumors, and Intradural anomalies.
4. Didactic weekly core curriculum lectures will be presented by fellow, faculty, guest faculty, and selected non-spine faculty.
5. Weekly didactic topics will be presented by the fellow to attending faculty for discussion.
6. The fellow will gain experience in critical and creative thinking, decision making, operative and non-operative management of patients with virtually all types of spinal disorders (deformity, degenerative, traumatic, pediatric and tumor).
7. The spine fellowship program provides comprehensive training in the surgical and nonsurgical management of adult spinal disorders, Open and minimally invasive techniques are utilized from anterior, posterior, and lateral approaches, for primary and revision surgeries, and for simple and complex spine reconstructions.
8. The fellows work closely with attendings to gain a comprehensive approach to spinal pathologies, develop an understanding of the natural history of spine conditions, and gain clinical and surgical autonomy, particularly during trauma cases.
9. Emphasis is on fellow education to optimize patient care, surgical and nonsurgical decision-making and technique, and research.

At the end of the fellowship, the trainee will be familiar with anterior/posterior and lateral approaches to all levels of the spinal column.

The fellow will have an excellent knowledge as well as technical expertise in the application of spinal instrumentation including anterior/posterior cervical plates and screws, transarticular screws, various techniques of occipital cervical fusion, anterior thoracolumbar plates, and thoracolumbar instrumentation including hooks and pedicle screws.

The fellow will develop the technical skills to manage a variety of tumors and trauma of the spine.

The fellow will be able to perform minimally invasive spine decompressive and fusion surgery.

## **SPINE FELLOWSHIP CURRICULUM:**

### **1- BASIC SCIENCE:**

This provides an in-depth overview of the basics of spinal disorders and constructs the base of knowledge for other modules. The summary of history of spinal disorders allows understanding of how developments occurred. The knowledge on Spinal Biomechanics and Cell Biology are important in understanding of diseases and treatment strategies in spine surgery. Pathways of Spinal Pain, genetics of spinal disorders and age-related changes are important in every aspect of understanding treatment strategies that are discussed in further modules in more detail. Principles of spinal balance and development of spinal dys-balance are reviewed and summarised. Basic technical concepts of biomechanics of spinal instrumentation, biologics in fusion, and also epidemiological concepts such as predictors of treatment outcome and spinal registries are provided. The pre-operative evaluation of the patient, including history and physical assessment, imaging studies and neurological investigations are summarised. Anaesthesiological aspects before, during and after a spine surgery are described in a very understandable and efficient way.

This Module provides the basic knowledge and concepts of spinal disorders and is the foundation for subsequent Modules.

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### **Learning Objectives**

1. Know the main steps in the history of spinal disorders
2. Understand principles of spinal biomechanics and biomechanics of spinal instrumentation
3. Know the concepts of cell biology in spine, and the biology of spinal fusion
4. Understand spinal balance and dys-balance
5. Have an overview about the epidemiology of spinal disorders, predictors of treatment outcomes and the function of spine registries
6. Know the principles of pre-operative assessment of a patient, including spinal imaging and neurological investigations

7. Understand the concepts of anaesthesiological management of a spine patient before, during and after surgery

## **2-DEGENERATIVE SPINE DISEASES: CERVICAL AND LUMBAR:**

Covers the degenerative disorders of the cervical spine. It is structured by reference to the anatomy, biomechanics and kinematics of the cervical spine. A section deals with the diagnostic evaluation and focuses on the specific imaging, neurophysiological assessment as well as diagnostic injection studies. The different pathologies like axial neck pain, cervical radiculopathy as well as cervical myelopathy are widely discussed in terms of clinical findings, pathophysiology and natural history, as well as the surgical and non-surgical treatment modalities.

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### **Learning Objectives**

1. To acquire the knowledge to assess, evaluate and make the diagnosis of degenerative cervical spine disorders
2. To learn the decision making for different treatment modalities
3. To know the evidence of the different treatment modalities
4. To become familiar with the surgical principles and indications in the treatment of cervical spine degenerative disorders.

It also covers the degenerative disorders of the thoraco-lumbar spine. It comprehensively addresses the main pathologies like disc herniation of the lumbar as well as the thoracic spine, spinal stenosis, spondylosis and degenerative spondylolisthesis in terms of epidemiology, pathogenesis, and clinical as well as imaging assessment, surgical and non-surgical treatment.

Non-specific low back pain is dealt with extensively. The continuum from degenerative conditions to new onset deformity is looked at specifically and its significance in the context of an ageing society is emphasized.

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### *Learning Objectives*

1. To acquire the knowledge to assess, evaluate and diagnose degenerative disorders of the thoracolumbar spine
2. To learn the decision making to select different treatment modalities
3. To know the evidence for the different treatment modalities
4. To understand the surgical principles of, and the indications for the treatment of degenerative disorders of the thoracolumbar spine

### **3-DEFORMITY (PEDIATRIC AND ADULT):**

Covers extensively the different aspects of deformities in spinal disorders. Introductory lectures concerning the epidemiology, natural history, classification as well as clinical and outcome assessment and radiology are preparing the field. Adult idiopathic scoliosis and degenerative scoliosis are addressed at length in terms of clinical presentation, diagnostic evaluation, surgical and non surgical treatment as well as expected outcomes.

Different surgical techniques like minimally invasive deformity surgery, the role of XLIF, ALIF, TLIF and OLIF techniques and the different types of spinal osteotomies with their specific indications are discussed in depth. Scheuermann disease and ankylosing spondylitis as a deformity equally are discussed in detail.

A whole section is dedicated to the epidemiology, etiology classification, imaging and treatment of non-degenerative spondylolysis and spondylolisthesis.

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#### **Learning Objectives**

1. Understand the ethiopathogenesis and natural history of adult spinal deformities of any origin
2. Be aware of and understand the different classification systems in adult deformities
3. Be updated on adult spinal deformity in terms of new understanding of the natural history and new treatment options
4. Become familiar with the different imaging modalities which are used to make treatment-oriented decisions
5. Understand in particular the biomechanics of the instrumented fixation of complex adult deformity correction and stabilisation
6. Recognise the paramount importance of balance in the adult spine and in particular, sagittal balance
7. Learn to define precisely, surgical indications based on objective evaluation and diagnostic algorithms
8. Recognise the limitations of conservative treatment modalities.

It also deals with the paediatric and adolescent deformities of the spine, their etiology, pathomorphology, imaging and clinical presentation, and classification. For better understanding, there is a focus on the growing spine at the beginning. Included is a presentation on spinal cord anomalies which play an important role in the context of congenital scoliosis.

Following on from the biomechanics of a deformed spine, there is a focus on treatment modalities, spanning cast treatment, brace treatment and the surgical treatment of the different pathologies. The different techniques and concepts of surgical treatment of paediatric and adolescent scoliosis, including modern

navigation technology, are all described and discussed in the context of their appropriate indications. The practical preoperative preparation of the patient in the operating room is appropriately considered.

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### *Learning Objectives*

1. Understand ethiopathogenesis and natural history of paediatric and adolescent deformities of any ethiology
2. Be updated on spinal cord anomalies and congenital deformities in paediatric patients.
3. Learn about specific imaging and biomechanics of spinal deformities.
4. Understand indications and principles of conservative treatment in paediatric spinal deformities.
5. Learn principles for surgical treatment and describe the different surgical approaches and strategy to correct paediatric deformities

## **4-TRAUMA:**

This is sub-divided into trauma of the upper, middle/lower cervical spine, the thoracolumbar spine and the sacrum. Classical spinal trauma is extensively dealt with in terms of injury mechanism, classification concepts, clinical presentation and applied imaging techniques. Indication criteria for non-surgical and surgical treatment modalities are discussed widely together with the expected outcome.

There is a specific section dealing with fragility fractures in the elderly (osteoporosis), their identification, diagnostic work up, risk factors and the augmentation procedures available in the case of persistent pain, progressive deformity or instability.

At the other end of the age curve, the Module does also focus on the specificity of paediatric and growing spine injuries, their diagnostic workup, their natural history and treatment options.

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### **Learning Objectives**

- Understand the epidemiology presentation and basic spine anatomy
- Request appropriate imaging investigation
- Correctly identify and classify the injury
- Suggest an appropriate management strategy

## **5-TUMORS:**

This treats most of the rarely seen primary tumours, malignant as well as benign tumours such as osteoid osteoma, eosinophilic granuloma, giant cell tumors,

aneurysmal bone cyst, Ewing Sarcoma, chondrosarcoma of the spine, as well as ependymoma and chordoma at the craniocervical junction and in the sacrum.

Different surgical technique issues are looked at for the different locations and neoplastic disease like multiple myeloma are equally presented, as are intradural extramedullary spinal tumours.

A whole section is dedicated to the diagnosis, staging and surgical treatment of metastatic spine disease and its results.

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### **Learning Objectives**

1. Understand biology and pathophysiology of neoplastic conditions affecting the spinal column and associated neural structures.
2. Enable case based selection of appropriate imaging and laboratory diagnostic work up for patients presenting with primary and secondary neoplastic conditions of the spinal column and associated neural structures
3. Formulate evidence based treatment strategies for primary and secondary neoplastic conditions of the spine in accordance with principles of stability, curative or palliative intent and neoplastic aggression.

### **6-INFECTIONS AND INFLAMMATIONS:**

This addresses the different pathologies which can be encountered. Infections are categorised by the differentiating criteria of specific (tuberculosis) and non-specific infections. Indications for the different treatment modalities are discussed and the interdisciplinary character of this pathology is emphasised. A clear differentiation is made between the treatment of osteomyelitis of the spine and the epidural abscess.

Inflammatory disorders, specifically rheumatoid arthritis and ankylosing spondylitis, are presented with a focus of early rheumatological diagnosis and pharmacological treatment. The fully fledged deformity in late stage ankylosing spondylitis is alluded to but is dealt with more comprehensively in Module 4, Adult Deformity.

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### **Learning Objectives**

1. Understand biology and pathophysiology of inflammatory and infectious conditions of the spinal column.
2. Enable appropriate ethology based imagining and laboratory work- up to establish case based differential diagnosis.

Formulate appropriate evidence based medical and surgical management strategies for inflammatory and infectious disorders of the spinal column, including indication and techniques for urgent surgical intervention

## 7-COMPLICATIONS:

This is a unique teaching tool of 23 lectures. It unifies complications from approaches to the spine on the one hand, and from the different pathologies on the other – disc herniation, decompression surgery, deformity surgery, trauma surgery and surgery in osteoporosis.

Furthermore, typical complications like dural leak, pseudarthrosis, wound infections, implant complications, as well as neurological deficit, spinal cord damage, and complications arising from positioning the patient are dealt with in depth.

Finally, there is a pair of lectures suggesting the algorithm of imaging in spinal complications.

### Learning Objectives

1. Know the main complications related to different anatomical segments, from cervical spine to sacrum
2. Be aware of the most frequent complications specific for different approaches, from anterior to lateral and posterior, classic open or minimally invasive
3. Recognize situations of increased risk, for osteoporotic patients, neuromuscular patients, multi-operated patients
4. Correctly use imaging and diagnostic tests to identify and manage postoperative complications
5. Build a solid, thorough knowledge in order to minimize postoperative complications in daily surgical practice