AOSpine "Lecture-Based" Principles Course

Notes for Chairpersons and Faculty Regarding Structure and Content

AOSpine Principles Education Working Group (January 2014)

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Contents

Introduction

This document outlines a multipathology 2-day course with the goal of delivering a more standardized Principles event that delivers the required learning outcomes without being overly prescriptive and that accommodates some regional flexibility.

The accompanying Excel file provides a template for delivering the content described below with suggested timing. (PowerPoint files for lectures and cases will be provided at a later date).

General comments

In this program the aim is to cover all relevant material in a "lecture-based" format. Cases are integrated to introduce a topic, to provide clinical examples, and to outline treatment options.

Information regarding classification systems, bone metabolism, and biomechanics relevant to the topics covered should be distributed to participants prior to the course and considered as "assumed knowledge" at the commencement of the program. The focus can then be on the interpretation and application of the classification systems and other materials to clinical practice.

Welcome and introductory remarks

Welcome the participants, introduce the faculty, and provide all relevant logistical information appropriate to the course and venue.

Precourse assessment

Introduce the precourse assessment explaining that the purpose of the course is to help participants achieve their learning goals and for this reason it is important to identify their knowledge gaps.

The assessment questions will be used to focus discussion on the points most relevant to the participants' needs. Cases presented during the quiz will be revisited during or at the end of the course to provide answers and explain learning points.

The results of the assessment should be provided to faculty at the end of the first session of the program.

Note: Where possible, use cases from the questions in the discussion of the relevant topics in order to provide an explanation of the answer and to complete the learning loop.

Module 1: Cervical Trauma— upper cervical trauma

Case presentation: *Cervical trauma–C1*

Begin the first session of the course with a case presentation to demonstrate the relevance of the content to their daily activities of assessing patients with cervical trauma. The suggested case is a Jefferson C1 fracture with disruption of the transverse ligament.

Participants should discuss the clinical assessment of patients presenting with a cervical injury, the clinical and radiographic processes for a suspected cervical injury, and "clearing" the cervical spine. Also reinforce ATLS principles.

Discussion should lead into the lecture regarding the classification of upper cervical spinal trauma/injury.

Lecture: *Upper cervical injury classification systems*

The presentation should be an overview of the classification systems relevant to upper cervical injuries (C0–1, C1, and C2 injuries). There is no need to present excessive detail. The focus should be to identify factors that indicate the presence of significant instability or poor outcomes if neglected or treated inadequately. Include clinical examples of fracture patterns in the presentation to reinforce learning points.

The provision of handouts or access to online resources would enable participants to review and consolidate knowledge of the relevant classification systems on their own time.

This lecture and the relevant material may be provided to participants prior to the course and considered "assumed knowledge". In this situation focus on the application of the classification system rather than the details of the system itself. Additional time can then be allocated to the discussion of cases.

Learning outcomes

- Recognize an injury to the upper cervical spine
- Evaluate the stability of an upper cervical spinal injury
- Classify the injury according to an appropriate and recognized classification system
- Describe the nature of the injury to a colleague or supervisor
- Outline the surgical principles and procedures that may be used to stabilize an upper cervical spinal injury

Case presentation: *Cervical trauma–C2*

Use the case to review the process for clinical and radiographic assessment of patients with upper cervical spinal trauma. Discuss prognostic factors in relation to upper cervical injuries, particularly the incidence of nonunion with this sort of injury, age-related factors, and indications for surgical intervention. Also consider

comorbidities (such as osteoporosis, cardiac, and respiratory disease) and how the presence of these conditions influences management.

Conclude the discussion with a brief summary of the key points and take-home messages.

Discussion

Review relevant points and discuss topics identified during discussion that warrant further emphasis or clarification.

Lecture: *Spinal biomechanics*

The presentation should focus on assessment of injury mechanism and morphology and clinical and radiographic features indicating the presence of instability. Identify differences between the upper and lower cervical regions and the ligamentous and bony structures that contribute to the stability of both regions.

Discuss nonoperative methods used to stabilize the spine for transportation or during clinical and radiographic evaluation. Discuss the features of various types of braces and their application and the general principles in relation to the indications for surgical stabilization.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Define the mechanism and morphology of a spinal injury
- Recognize the presence of instability
- Describe the principles of spinal biomechanics

Lecture: *Imaging in spinal trauma–tips and special features*

Discuss the application and interpretation of screening radiographic imaging (plain x-rays and CT) and the indications for and interpretation of more advanced forms of imaging such as MRI, dynamic films, angiography etc.

The focus should be on the practical "day-to-day" process of assessing a patient following spinal trauma and the use and interpretation of imaging to "clear" the spine and to define the morphology of the injury, canal compromise, and injury to the spinal cord. Correlation with clinical features should be made where possible.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Describe the imaging modalities that are indicated for the assessment of spinal trauma

- Interpret abnormalities evident on x-rays, dynamic films, CT, MRI, etc used to assess spinal trauma
- Identify radiographic features of instability and spinal cord injury

Module 1: Cervical Trauma– subaxial cervical trauma

Case presentation: *Cervical trauma–cervical burst fracture*

Participants should discuss the clinical assessment of patients presenting with a cervical injury, particularly in relation to the assessment of neurological loss. Review the ASIA scoring system and the relevance of neurological compromise in relation to the indications for and timing of treatment. Also discuss the need to achieve stability of the spinal column and decompression of the neural elements, the role of bracing, and the application of traction. Also reinforce ATLS principles and the management of patients with spinal cord injury in relation to associated injuries to the axial skeleton.

Discussion should lead into the lecture regarding the classification of subaxial cervical spinal trauma.

Lecture: *Subaxial cervical injury classification systems*

The presentation should summarize relevant points only (there is no need to go over all historical classification systems unless relevant to the learning outcomes). Focus on what residents can use in their day-to-day practice that will assist them when they communicate with attending surgeons and colleagues. There is no need to present excessive detail. The focus should be to identify factors that indicate the presence of significant instability or poor outcomes if neglected or treated inadequately. Include clinical examples of fracture patterns in the presentation to reinforce learning points and indicate the need for surgical intervention.

The provision of handouts or access to online resources would enable participants to review and consolidate knowledge of the relevant classification systems on their own time.

This lecture and the relevant material may be provided to participants prior to the course and considered “assumed knowledge”. In this situation focus on the application of the classification system rather than the details of the system itself. Additional time can then be allocated to the discussion of cases.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Recognize an injury to the subaxial cervical spine
- Evaluate the stability of a subaxial cervical spinal injury
- Classify the injury according to an appropriate and recognized injury classification system

- Describe clearly the nature of the injury to a colleague or supervisor
- Describe the surgical principles and procedures that may be used to stabilize an upper cervical spinal injury

Case presentation: *Cervical trauma–cervical dislocation*

Use the case to review the process for clinical and radiographic assessment of patients with subaxial cervical spinal trauma. As bilateral facet dislocation is usually associated with neurological compromise, discuss the need for a multidisciplinary approach to the management of acute spinal cord injury (ASCI).

The application of traction, the use of traction to achieve reduction, and the role of closed reduction and the associated risks should be discussed.

Also discuss the mechanism of injury and the importance of considering this in determining the structures that have been disrupted and the most appropriate surgical approach when surgery is indicated.

Lecture: *Spinal cord injury assessment*

Discuss the ASIA scoring system and common spinal cord injury patterns, the assessment of spinal shock, and strategies that can be used to minimize secondary spinal cord damage due to compression, edema, and instability.

Discuss the implications of cord injury in relation to the indications for treatment and the timing of this, and the current evidence regarding medical strategies to minimize cord injury (drugs, hypothermia, etc) and experimental treatments such as stem cells.

Cover the principles and techniques for the application of cervical traction and reduction of a dislocation, fracture dislocation, or subluxation.

Common complications associated with the management of spinal cord injured patients (pressure sores, DVT, contractures, psychological distress, autonomic dysreflexia, etc) and strategies to avoid or manage these issues should also be addressed.

Reinforce the need for collaboration with a multidisciplinary rehabilitation team early in the management of spinal cord injured patients.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Assess neurological status of spinal injured patients using the ASIA scale
- Describe the prognostic factors associated with spinal cord injury

- Recognize complications associated with the presence of a significant spinal cord injury and outline the principles of their management
- Apply and manage cervical traction

Case presentation: *Cervical trauma–cervical dislocation*

Use the case to discuss the natural history of central cord syndrome in this group of patients, and the association with preexisting cervical canal stenosis, degenerative disease, and associated comorbidities.

Discuss clinical assessment, features of cord injury syndromes, and indications for surgical intervention.

Lecture: *Cervical trauma–special considerations*

Cover injuries where the identification of the injury may be masked or not readily apparent and where the nature of the injury requires special attention and/or management, or where there is an increased incidence of complications.

Address the management strategies that can be used to identify, avoid, or overcome these factors. Discuss these strategies using case examples.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcome

- Recognize features in patients with spinal column or spinal cord injuries that require special consideration and treatment.

Discussion

Review relevant points and discuss topics identified during discussion that warrant further emphasis or clarification. It is also possible to discuss other cases such as a Hangman's fracture or an odontoid fracture in the elderly if relevant to the needs of the participants and if there is time available. These types of cases could also be covered at the end of the day in the hour allocated for discussion.

Module 2: Cervical Degeneration

Case presentation: *Cervical degeneration–assessment*

Participants should discuss the clinical assessment and natural history of patients presenting with cervical degeneration.

Lecture: *Cervical degeneration–assessment*

The natural history, symptoms, and examination findings associated with this process should be discussed.

The differential diagnosis of shoulder pathology, fibromyalgia, MS, etc, should also be addressed.

Nonoperative treatments, physical therapy, etc, and the evidence-based indications for surgical intervention and the influence of psychological issues and compensation should be discussed.

Discuss the social, emotional, and psychological factors that influence the presentation and course of symptomatic cervical degeneration.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Describe the natural history of cervical degenerative disease
- Obtain a relevant history and perform a screening clinical examination for cervical degenerative disease
- Exclude or differentiate symptoms related to cervical degeneration from other non-spinal pathology

Lecture: *Radiological evaluation of cervical pathology*

Indications for and the interpretation of radiographic investigations should be discussed. Assessment of canal capacity, radiographic features of myelopathy, and instability should also be covered.

The place for and interpretation of EMG studies should be covered along with the use of injection procedures, such as epidural or facet injections, to diagnose and treat cervical pathology.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Use and interpret appropriate diagnostic tools to assess cervical degenerative disease

- Outline the role and indications for the use of other diagnostic tools such as EMG and injections
- Correlate investigation findings with clinical features

Case presentation: *Cervical radiculopathy*

Participants should discuss the clinical presentation, symptoms, and examination of findings and assessment of patients presenting with cervical nerve root compression.

Lecture: *Cervical radiculopathy*

The lecture should cover the presenting features and natural history of this condition and the initial nonoperative treatments that can be used to control or manage symptoms.

The indications for and the interpretation of radiographic investigations (EMG, etc) should be discussed. Assessment of canal capacity, radiographic features of myelopathy and instability, and their influence on decision making regarding operative treatment should also be covered.

Conclude discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Identify patients with cervical nerve root or spinal cord compression due to localized cervical spine pathology—disc protrusions predominantly, but also spondylosis leading to foraminal stenosis
- Correlate diagnostic tests with clinical features
- Implement appropriate nonoperative treatments in the management of cervical nerve root compression
- Describe the natural history and indications for surgical intervention
- Outline the appropriate surgical procedures to manage this condition

Case presentation: *Cervical myelopathy*

Participants should discuss the clinical assessment of patients presenting with cervical myelopathy. The natural history, symptoms, and examination findings associated with this process should be discussed with an emphasis on identifying factors indicating a poor clinical outcome with ongoing nonoperative treatment.

Indications for and interpretation of radiographic investigations should be discussed. The identification of red flags, tumors, and instability should be covered along with the differential diagnosis of shoulder pathology, fibromyalgia, MS, etc. Influence of comorbidities (such as rheumatoid disease, diabetes, osteoporosis, and respiratory and cardiac disease) on the management of this condition should also be discussed.

Lecture: *Cervical myelopathy*

The evidence-based indications for surgical intervention should be discussed along with surgical options and provide guidelines for anterior vs posterior surgery without being prescriptive.

Discuss possible complications of treatment, such as C5 nerve root palsy with laminoplasty, nonunion, and implant failure.

The introduction of different scenarios, eg, gradual onset of myelopathy with stenosis and signal change on MRI and a case of myelopathy in a patient with rheumatoid arthritis and osteoporosis and/or OPLL, could be undertaken during the case discussion at the end of the day.

Conclude the discussion with a brief summary of the key points and take-home messages.

Learning outcomes

- Describe the natural history of cervical myelopathy and the indications for surgical intervention
- Outline the principles for surgical intervention, surgical options, and possible complications

Discussion

Review relevant points and discuss topics identified during discussion that warrant further emphasis or clarification.

Module 3: Practical Exercise

Cervical—*Laminoplasty and lateral mass screws*

Ensure activities undertaken during the practical exercise are relevant to the needs of the participants.

This practical should go over the aims of cervical decompression and stabilization and the anatomical landmarks for lateral mass fixation.

While laminoplasty is not an established practical activity it is a technique that can be well demonstrated using sawbones and is relevant to the learning needs of residents and junior fellows. Some additional resources may be needed for this activity (eg, drill or burr and a spacer) to hold the lamina open once the laminoplasty has been performed.

Learning outcomes

- Identify the anatomical landmarks to perform a laminoplasty and the insertion of lateral mass screws in the cervical spine
- Place C1 lateral mass, C2 pedicle, C2 lamina and C1–2 transarticular screws
- Place lateral mass screws in the cervical spine

Lumbar/thoracic—*Pedicle screw insertion in the thoracic and lumbar spine*

Go over the landmarks for pedicle screw insertion and the creation of a simple construct for the treatment of degenerative conditions in the lumbar spine, thoracolumbar trauma, and deformity.

Learning outcomes

- Identify the anatomical landmarks related to the placement of thoracic and lumbar pedicle screws
- Place pedicle screws in the thoracic and lumbar spine

Dural repair (This practical activity is currently under development)

It is hoped a simple model will be available in 2014 for demonstration, allowing participants to practice techniques of dural repair.

Learning outcomes

- Outline the principles for the management of a dural tear
- Perform a “water tight” closure of a simulated dural tear

Module 4: Thoracolumbar Trauma

Case presentation: *Thoracolumbar fracture–A type*

Participants should discuss the clinical assessment of patients presenting with thoracolumbar trauma. Reinforce ATLS principles and review clinical findings and relevant radiographic investigations and interpretation.

Lecture: *Classification and management of thoracolumbar fractures*

The presentation should summarize relevant points only. There is no need to go over all historical classification systems unless relevant to the learning outcomes. Focus on what residents can use in their day-to-day practice and what will assist them when they communicate with attending surgeons and colleagues. There is no need to present excessive detail. The focus should be to identify factors that indicate the presence of significant instability or poor outcomes if neglected or treated inadequately. Include clinical examples of fracture patterns in the presentation that reinforce learning points and indicate the need for surgical intervention.

Biomechanical assessment and principles should be covered and linked to the application of the classification system for thoracolumbar trauma.

The provision of handouts or access to online resources would enable participants to review and consolidate knowledge of the relevant classification systems on their own time.

This lecture and the relevant material may be provided to participants prior to the course and considered "assumed knowledge". In this situation focus on the application of the classification system rather than the details of the system itself. Additional time can then be allocated to the discussion of cases.

Learning outcomes

- Describe and apply an appropriate anatomical classification of thoracolumbar fractures to facilitate communication with colleagues and senior surgeons
- Identify the morphology and mechanism of a thoracolumbar injury

Case presentation: *Thoracolumbar fracture–B type*

Focus on assessment of the posterior column and significance in relation to the stability of the segment. Reinforce points from the earlier discussion of classification systems.

Neurological assessment and the differentiation of a cord vs conus vs cauda equina compromise should be covered and the ASIA classification system, discussed in cervical trauma module, reinforced.

Conclude the discussion with a brief summary of the key points and take-home messages.

Lecture: *Clinical and radiographic assessment of stability*

Discuss the process undertaken to evaluate and "clear" the thoracic and lumbar spine in the presence of spinal trauma.

Review and reinforce items discussed in the cervical trauma section relating to the need to follow ATLS principles and the assessment of spinal cord or neurological injury.

Review the use of plain x-rays, CT, and MRI in the assessment of the morphology of thoracolumbar trauma and the assessment of stability. Link these features to the evaluation of the need for surgical intervention and the classification of these injuries.

Learning outcomes

- Perform a screening clinical examination to assess the presence and extent of a spinal injury
- Assess and identify the presence of a spinal cord or neurological injury
- Order and interpret appropriate radiographic investigations
- Recognize radiographic features of instability

Lecture: *Indications for surgical intervention: aims and approach*

Discuss evidence-based treatment options, the indications for surgical intervention, the approach and timing, especially in relation to the presence of a neurological deficit.

Also cover associated injuries and how these may influence decision making regarding indications for surgery.

Learning outcomes

- Identify features indicating either instability or poor outcomes with nonoperative management of thoracolumbar fractures
- Identify those patients who will benefit from operative intervention
- Describe the indications for surgery and options in relation to surgical approach
- Appreciate the importance of a multidisciplinary approach in the management of spinal cord and neurological injuries

Case presentation: *Thoracolumbar fracture–C type*

Focus on identifying features of the history, examination, and radiographic investigations that indicate shear or translational injuries associated with significant instability.

These translational injuries are often associated with neurological compromise, so use the discussion to reinforce points discussed in the cervical trauma module and in the discussion of "B type" injuries. Reinforce the importance of a multidisciplinary approach to spinal cord injury management.

Discuss the evidence-based treatment options, the indications for operative intervention, and the approach and timing of surgery.

Also cover associated injuries and how these may influence decision making regarding indications for surgery.

Conclude the discussion with a brief summary of the key points and take-home messages.

Lecture: *Thoracolumbar fractures–special situations*

Cover how the presence of confounding factors may influence the decision-making process when considering the need for surgical intervention, the risk of complications with surgery and nonoperative treatment, and how to overcome these issues. Use case examples to illustrate these points.

Learning outcome

- Be aware of conditions such as ankylosing spondylitis and osteoporosis and how they may alter the management of a thoracolumbar injury

Case discussion: End of day 1

The day should end with case discussion to reinforce points brought out during the program. Consider discussion of a trauma patient with ankylosing spondylitis in order to discuss the risks related to this particular patient group.

Suggested cases:

- A patient with rheumatoid arthritis or OPLL and cervical myelopathy (if not covered earlier in the program)
- A patient with a postoperative infection following stabilization of an unstable spinal injury (an example of how to manage the infection while preserving spinal stability)
- An elderly patient with an odontoid fracture (an example of the issues regarding the risk benefit analysis of surgical treatment)

Module 5: Lumbar Degeneration

Case presentation: *Lumbar degeneration assessment*

Participants should discuss the clinical assessment of patients presenting with back pain with or without features of neurological compromise, the indications for imaging and other investigations and the natural history of acute and chronic degenerate back pain in the absence of neurological compromise or demonstrable instability.

Lecture: *Clinical and x-ray assessment of degenerative back pain*

Cover the clinical and radiographic assessment of patients presenting with degenerative conditions of the lumbar spine.

Also cover the clinical features of instability or neural compromise and the identification of "red flags", the influence of confounding factors such as compensation, depression, and other comorbidities such as diabetes and obesity. Consider the use of injections and other investigations, such as EMG, to confirm the origin and nature of symptoms.

Discuss the use of nonoperative interventions, physical therapy and core stabilization, and the identification of features indicating more significant pathology, especially instability and neural compromise.

Learning outcomes

- Obtain a relevant history and perform a screening clinical examination for lumbar degenerative disease
- Outline the role and interpretation of investigations used to assess degenerative conditions of the lumbar spine
- Exclude or differentiate symptoms related to lumbar degeneration from other nonspinal pathology (hip, SI joint, knee, etc)
- Initiate appropriate nonoperative interventions in the management of symptoms related to lumbar degeneration

Lecture: *Natural history of lumbar degenerative disease—indications for surgery and outcomes*

Address the incidence, economic impact and the natural history of acute and chronic back pain in the absence of neurological compromise or instability.

Discuss the evidence regarding the indications for and outcomes of surgical treatment of degenerative disease of the lumbar spine in the absence of instability or neural compromise.

Review relevant literature regarding the outcome of motion preserving and lumbar fusion surgery in the treatment of this condition. This should include the evidence regarding the use of interspinous spacers, "dynamic" stabilization, disc replacement, and fusion, both anterior and posterior.

Also discuss the role of investigations such as discography and facet injections in the assessment of these patients, features of psychological disturbance, and principles of management of chronic pain.

Learning outcomes

- Describe the natural history of lumbar degenerative disease
- Identify indicators for consideration of surgical intervention
- Outline the evidence regarding the surgical treatment of degenerative disease of the lumbar spine in the absence of instability or neural compromise
- Identify patients with significant psychological issues
- Recognize the importance of a multidisciplinary approach to the management of chronic pain

Case presentation: *Lumbar radiculopathy*

Participants should discuss the clinical assessment of patients presenting with sciatica due to focal nerve root compression. They should discuss the natural history, nonoperative treatments and injections, and appropriate investigations.

Lecture: *Natural history, nonoperative, and operative treatment of lumbar radiculopathy*

Outline the natural history of patients presenting with sciatica, the appropriate timing and nature of radiographic investigation, medical management, and the use of injections such as epidural steroid injections.

Also cover "red flags" such as evidence of cauda equina compromise or neural compression due to malignant disease and then the evidence-based indications for surgical intervention. Also address etiology related to foraminal compromise but the focus of this presentation should be in relation to the management of acute disc herniation.

Participants should also have an understanding of the surgical treatment of this condition, the surgical approach, outcomes, and common complications.

Learning outcomes

- Describe the natural history of sciatica due to disc herniation
- Request and interpret appropriate radiographic investigations
- Outline the evidence regarding the surgical treatment of disc herniation and relevant complications (recurrence, back pain, discitis)
- Outline the appropriate surgical management of these patients, including timing and type of surgery

Case presentation: *Lumbar spinal canal stenosis*

Participants should discuss the clinical assessment of patients presenting with symptoms of canal stenosis. Cover the differentiation of spinal stenosis and vascular claudication, facet arthritis and degeneration, diabetes, and SI joint, hip, and knee pain.

Lecture: *Clinical and radiographic assessment of lumbar spinal canal stenosis*

Outline the typical history of patients presenting with spinal claudication or radicular symptoms due to spinal canal stenosis.

Outline the key differentiating clinical features of canal stenosis compared with degenerative back pain, vascular claudication, and hip and knee arthritis.

Discuss the type and timing of appropriate investigations and diagnostic tests and treatments, such as epidural injections. Discuss the indications and techniques used to decompress the canal surgically. Focus discussion on decompression (laminectomy) alone as the issue regarding the indications will be covered in the lecture “Indications for fusion in patients undergoing surgical treatment for lumbar canal stenosis".

Learning outcomes

- Describe the natural history of lumbar spinal canal stenosis
- Request and interpret appropriate radiographic investigations
- Discuss the evidence regarding the surgical treatment of lumbar canal stenosis in the absence of instability by decompression alone
- Outline the appropriate surgical management of these patients, including timing and type of surgery
- Identify and manage common complications such as dural tear, epidural hematoma, iatrogenic instability, and aggravation of degenerative back pain

Case presentation: *Lumbar degenerative spondylolisthesis*

Participants should discuss the clinical assessment of patients presenting with symptoms of canal stenosis in association with mechanical instability.

Here the focus should be on being able to identify factors indicating clinical and radiographic features of instability of the spine and the need for fusion/stabilization in association with decompression.

Lecture: *Lumbar degenerative spondylolisthesis indications for fusion*

The focus of this lecture should be the identification of features of instability or other pathology that indicates the need for stabilization/fusion in association with decompression in patients presenting with lumbar canal stenosis.

Features such as gas or fluid in the facet joints, the orientation of the facet joints, the presence of a degenerative spondylolisthesis with evidence of instability or a significant risk of this developing postoperatively should be covered.

The evidence regarding the indications for fusion in these patients must be addressed.

The use of interspinous spacers and the evidence regarding their use in these patients should also be covered.

Also consider indications for DVT prophylaxis in patients undergoing spinal surgery.

Learning outcomes

- Identify the clinical and radiographic features of instability in patients presenting with lumbar spinal canal stenosis
- Discuss the evidence in relation to this treatment
- Outline the surgical techniques appropriate to manage this condition
- Identify and manage common complications relating to the management of this condition

Case presentation: *Lumbar spondylolisthesis*

Participants should discuss the clinical assessment of patients presenting with symptoms of spondylolisthesis. They should discuss the incidence, natural history, nonoperative treatments and injections, appropriate investigations, and the evidence-based indications for surgical intervention.

Lecture: *Natural history and indications for surgery–lytic spondylolisthesis*

Discuss the classification of spondylolisthesis, the incidence and natural history of lytic spondylolisthesis, and the indications for surgical intervention.

Outline the indications for surgical intervention and the objectives of treatment, decompression of neural elements, stabilization of the spine and the achievement of a solid fusion, and the maintenance or restoration of normal sagittal balance.

The focus of the discussion should be related to low-grade (Grade I and II) spondylolisthesis, but should also present treatment options for high-grade slips and the principles of treatment.

Learning outcomes

- Identify the clinical and radiographic features of a lytic spondylolisthesis
- Discuss the evidence in relation to the surgical treatment of this condition
- Describe the surgical techniques appropriate to manage low-grade spondylolisthesis
- Outline the treatment options for high-grade spondylolisthesis

- Identify and manage common complications relating to the management of this condition

Module 6: Deformity

Case presentation: *Adolescent idiopathic scoliosis*

Participants should discuss the incidence, family history, clinical assessment, and treatment principles regarding the management of AIS. They need to be able to identify features indicative of progression and describe the indications for surgical intervention

Lecture: *Adolescent idiopathic scoliosis–assessment, classification, and indications for surgery*

Provide an overview of the incidence, assessment, and management of AIS. Discuss family history and the identification of red flags related to age of onset, rate of progression, neurological features, and congenital anomalies.

Participants must also understand the need for a detailed clinical and neurological evaluation in order to identify red flags (such as tumors, neural tube abnormalities, and connective tissue and muscular disease) and their association with spinal deformity.

Review radiographic assessment and the interpretation of plain x-rays, bending and traction films, and the place for and interpretation of MRI, CT, myelography, etc.

Outline the commonly used classification systems and key features regarding the likelihood of progression, the role of and indications for brace treatment, and the indications for and timing of surgical intervention.

Outline the surgical principles of correction, achieving or maintaining balance, and minimizing the number of levels to be fused. Common complications and their management should also be covered.

Learning outcomes

- Perform a screening clinical examination in patients with AIS
- Request and interpret appropriate radiographic investigations
- Describe the main classification system (Lenke) for AIS
- Outline the treatment principles in the management of AIS
- Identify significant associated pathology

Case presentation: *Adolescent idiopathic scoliosis*

Present details of treatment strategy and outcome.

Case presentation: *Congenital scoliosis*

Participants should discuss the etiology, incidence, classification, and association with other congenital anomalies. The clinical assessment and treatment principles regarding the management of congenital scoliosis should be addressed, but the focus should be on identifying factors indicating progression or a risk to neurological structures.

Lecture: *Congenital scoliosis*

Go over the embryology of spinal development and the development of congenital defects of the spine due to failure of formation, failure of segmentation, or a combination of these.

Review associated congenital anomalies and the assessment of growth potential, which is a major determinant in relation to the indications for surgical intervention. Discuss the principles of treatment, observation, bracing and surgery, and discuss factors that influence the timing of any surgical intervention.

Also review common complications of treatment and the fact that many patients with this congenital spinal deformity are diagnosed incidentally on a chest or abdominal film performed for other reasons or an intrauterine ultrasound. The need to educate parents and monitor progression through growth should be emphasized.

Learning outcomes

- Identify and classify congenital abnormalities of the spine
- Discuss the treatment principles and options
- Recognize associated anomalies and common complications of treatment
- Describe the natural history to enable discussion with parents regarding natural history, need to monitor, and likelihood of surgery

Case presentation: *Degenerative scoliosis*

Participants should discuss the incidence, etiology (AIS or de novo due to degenerative disease), natural history, clinical and radiographic assessment, and treatment principles.

Lecture: *Degenerative scoliosis–considerations and indications for surgical treatment*

Discuss the natural history and common presenting features of adult or degenerative scoliosis and the fact that they will often present with a combination of symptoms related to imbalance, neural or canal compression, and degeneration.

As patients are often elderly the association with other comorbidities (such as diabetes, osteoporosis, cardiac and respiratory disease, as well as degeneration of the hips, knees shoulders and SI joints) that add to the risks of surgery need to be considered.

Definition of the goals of surgery, nonoperative treatment strategies, and evaluation of risks vs benefits should be emphasized.

The indications for surgery and the need to define the surgical goals (spinal balance, neural decompression, and the avoidance of complications such as junctional breakdown nonunion, and implant failure) should be reviewed. As participants are unlikely to be undertaking the assessment of these patients or planning treatment

independently, the focus should be on the principles of treatment and evidence-based indications for intervention.

Also make the participants aware of common complications and their management.

Learning outcomes

- Outline the treatment principles and options in relation to adult or degenerative spinal deformity
- Recognize associated comorbidities and their influence on the outcome of surgery
- Outline the principles in relation to restoration and maintenance of spinal balance
- Perform assessment in relation to restoration and maintenance of spinal balance

Module 7: Infection

Case presentation: *Pyogenic infection*

Participants should discuss the salient features of the clinical presentation and differential diagnosis of pyogenic infection of the spine.

Point out risk factors for this condition and discuss appropriate radiographic and laboratory investigations. Also consider the strategy for obtaining a tissue diagnosis and principles of management (both medical and surgical).

Lecture: *Assessment and management of pyogenic spinal infection*

Outline the common clinical presentation and history, the etiology and risk factors, and conditions associated with pyogenic infection of the spine, eg, diabetes, HIV, IV drug use, immunocompromise.

Review the appropriate radiographic and laboratory investigations, plain x-rays, MRI, CT, and bone scan and laboratory tests (such as WCC, ESR, CRP), and how they can be used to monitor the progress of treatment.

Also discuss the need to isolate the infective organism, the principles of biopsy, the common pathogens and the appropriate selection, timing, administration, and duration of antimicrobial therapy.

Emphasize the need to interact with infectious disease specialists in relation to the ongoing management of antimicrobial therapy.

Also discuss the indications for surgical intervention and the principles of treatment—neural decompression, debridement, achieving and maintaining stability, and management of potential complications.

Learning outcomes

- Identify the features in the history and on physical examination of pyogenic infection of the spine
- Recognize risk factors associated with the development of this condition
- Order and interpret appropriate radiographic and laboratory investigations
- Describe the principles of medical and operative treatment of this condition
- Initiate and supervise appropriate management of spinal infection

Case presentation: *Spinal tuberculosis infection*

Participants should discuss the history and presentation of this condition and the "at risk" populations.

They should be able to request and interpret appropriate radiographic and laboratory investigations, plain x-rays, MRI, CT, bone scans, and laboratory tests (such as WCC, ESR, and CRP).

Point out risk factors for this condition and discuss appropriate radiographic and laboratory investigations. Also consider the strategy for obtaining a tissue diagnosis and principles of management, both medical and surgical

Lecture: *Assessment and management of spinal tuberculosis infection*

Outline the common clinical presentation and history, etiology, risk factors, and conditions associated with TB infection of the spine.

Review the appropriate radiographic and laboratory investigations, plain x-rays, MRI, CT, and bone scan, and laboratory tests (such as WCC, ESR, and CRP), and how they can be used to monitor the progress of treatment.

Also discuss the need to isolate the infective organism, and the administration and supervision of appropriate antimicrobial therapy.

Indications for surgical intervention and the principles of treatment, neural decompression, debridement, achieving and maintaining stability, and the management of potential complications should also be discussed.

The need to interact with infectious disease specialists in relation to the ongoing management of antimicrobial therapy should again be emphasized.

Learning outcomes

- Identify the features on history and physical examination of TB infection of the spine
- Recognize risk factors associated with the development of this condition
- Request and interpret appropriate radiographic and laboratory investigations
- Describe the principles of medical and operative treatment of this condition
- Initiate and supervise appropriate management of TB infection of the spine

Case presentation: *Postoperative spinal infection*

Participants should discuss the history, presentation, and etiology of early and late postoperative infection. Also review factors indicating increased risk of postoperative infection such as diabetes, immunosuppression, steroid use, prolonged surgery, smoking, obesity, etc.

Also discuss the implications of spinal instability in relation to the management of this condition, as removal of instrumentation is not an option in this situation.

Lecture: *Assessment and management of postoperative spinal infection*

Review the incidence, risk factors, clinical presentation, and assessment of early and late postoperative infection, appropriate investigations, their interpretation and principles of management.

Participants should be able to differentiate findings due to infection from "normal" postoperative changes and laboratory tests such as the WCC, ESR, and CRP.
Also discuss the indications for and timing of surgical intervention, debridement and removal of instrumentation, and the clinical and radiographic assessment of stability in this context, eg, implant loosening, deformity, pain.

Focus on the need to maintain/restore stability while elimination or controlling the infection as well as principles in relation to determining the duration of antimicrobial treatment, both IV and oral. Also cover strategies to manage deep infection such as the use of negative-pressure wound therapy, etc.

Learning outcomes

- Identify patients with early and late postoperative infection
- Describe the treatment principles of the medical and surgical management of this complication
- Initiate and monitor the progress of treatment and response to therapy
- Explain the biomechanical principles and need to maintain stability.

Lecture: *Principles of performing percutaneous biopsy for infection and tumor*

Discuss the principles of performing a biopsy to diagnose spinal infection or tumor.

Review the principles regarding the timing of antimicrobial treatment and the fact that the differentiation of infection and tumor may be difficult if relying on imaging alone.

Learning outcomes

- Describe the principles of performing a spinal biopsy to obtain a tissue diagnosis of spinal infection or tumor
- Request and interpret the results of a spinal biopsy

Module 8: Tumor

Case presentation: *Spinal tumor*

Minor compression fracture and radiographic evidence of a missing pedicle suggestive of an infiltrative metastatic process affecting the thoracic or lumbar spine without a history of neoplastic disease

Participants should discuss the typical history and presenting features of metastatic disease as it affects the spine. They should be aware of the fact that a significant number of patients present with spinal pain without a known history of malignant disease.

Discuss the process of staging and assessing the prognosis of patients presenting with metastatic spinal disease and an unknown primary.

Discussion should also include the indications for nonoperative treatments such as radiotherapy and chemotherapy and the timing of these treatments as an adjuvant to surgical treatment when this is indicated.

Lecture: *Spinal metastatic disease–assessment, prognostic factors, and management*

Discuss the typical clinical features of patients presenting with metastatic disease of the spine (such as nocturnal pain and neurological dysfunction).

Outline the appropriate strategy for investigation, particularly in the context of the patient presenting without a prior diagnosis of malignancy or a confirmed primary site or known pathology. Also cover the indications for and the interpretation of various investigative studies, both radiographic and laboratory.

Discuss the differential diagnosis and the relative incidence of primary and secondary neoplastic disease of the spine.

Participants should have an understanding of the process of staging and assessing the prognosis of patients presenting with metastatic spinal disease and an unknown primary.

Participants should have an understanding of the relevant prognostic and staging tools available (Tokuhashi Score, SINS, etc) to assist in determining the indications and nature of any surgical intervention to be undertaken – palliative only to decompress neural elements and achieve stability, or curative or heroic where an attempt is made to resect the lesion where a reasonable duration of survival is expected.

Discuss the prognostic implications relating to the nature of the tumor, visceral involvement, number of metastatic sites, etc. Also the need for a multidisciplinary approach to the staging and work up of these patients with medical oncologists and radiotherapists to optimize patient outcomes should be emphasized.

Participants should also have an understanding of the principles of management, both medical and surgical, when neural decompression or stabilization is needed in the absence of a definite tissue diagnosis, the place of steroids, etc.

Learning outcomes

- Recognize the signs, symptoms, and "red flags" of metastatic disease of the spine
- Initiate and interpret appropriate radiographic and laboratory tests, biopsy, and input from professional colleagues to determine the patient's prognosis
- Determine the appropriate course of action based on presenting symptoms, radiographic features, pathology, and prognosis
- Recognize and manage common complications relating to metastatic disease of the spine

Lecture: *Primary spinal tumors–assessment, prognostic factors, and management*

Discuss the typical clinical features and history of patients presenting with primary neoplastic disease of the spine including age, location, and nature of the tumor.

Outline the appropriate strategy for investigation, particularly in the context of the patient presenting without a prior diagnosis of malignancy, to determine the presence of metastatic spread, pathology, and prognosis.

Discuss the principles of medical and operative management, relating to the common types of tumors and the indications for surgical intervention and the surgical objectives.

Also cover the indications for and the interpretation of various radiographic and laboratory investigative studies.

Learning outcomes

- Recognize the signs and symptoms of primary malignant disease of the spine
- Initiate and interpret appropriate radiographic and laboratory tests, biopsy, and input from professional colleagues to determine the patient's prognosis
- Determine the appropriate course of action based on presenting symptoms, radiographic features, pathology, and prognosis
- Recognize and manage common complications relating to primary malignant disease of the spine

Module 9: Neurosurgery

The level of detail required in relation to information covered in any individual course will be determined by the makeup of the participant group, with greater discussion of surgical principles and techniques appropriate for a neurosurgical audience. This section may also be expanded to include a discussion of craniocervical junction and intracranial pathology if appropriate for the region and the background of the expected participants in the course.

Case presentation: *Chiari malformation and syrinx in a patient with scoliosis*

Participants should be made aware of the possible association of intradural pathology to deformity and patients presenting with pain and neurological disturbance of the upper and lower limbs.

Lecture: *Chiari malformation and syrinx–clinical relevance and treatment principles*

Discuss the typical clinical features and history of patients presenting with a symptomatic Chiari malformation and outline the relevance in relation to spinal deformity, spine surgery, the development of a syrinx, and neurological dysfunction in the upper limbs.

Review the classification of these disorders and discuss typical imaging investigations and their interpretation.

Discuss differentiating clinical and radiographic features for intradural and extradural pathology as participants of a Principles course should be able to recognize common neurosurgical pathology – Chiari malformation, syrinx, intra and extradural neural tumors.

Also discuss, in general terms, the indications for, and the nature of surgical intervention that may be undertaken.

There is also an opportunity to discuss the place and principles of intraoperative neural monitoring in spinal surgery.

Learning outcomes

- Recognize features of intradural pathology and its relevance in relation to spinal deformity and neurological dysfunction of the upper and lower limbs
- Identify a Chiari malformation and other intradural abnormalities on standard investigations used to assess spinal pathology
- Outline the indications for and interpretation of intraoperative neural monitoring

Lecture: *Intradural pathology–assessment and management principles for AV malformations and tumors*

Review primarily the radiographic features on plain x-rays, CT, and MRI relating to intradural lesions such as AV malformations, congenital defects of the neural tube such as tethered cord, and intradural tumors.

Also review the salient clinical features of these lesions and outline the principles of management.

Participants should be introduced to the concepts in relation to the management of this type of lesion but in most cases referral will be made to neurosurgical colleagues to deal with this pathology.

Also discuss the management of postoperative dural leaks.

Learning outcomes

- Recognize features of intradural pathology and its relevance in relation to spinal deformity, pain, and neurological dysfunction of the upper and lower limbs
- Identify radiographic features of intradural pathology
- Outline the management principles for these conditions
- Recognize and manage common complications such as a postoperative dural leak

Postcourse assessment

Conclude the course with a set of questions that:

- Assess the retention and understanding of the course content
- Evaluate the achievement of the learning outcomes

A prize may be awarded to the individual with the greatest improvement from the precourse assessment or highest overall score.