

Spine

I. Anatomy and basic science

A. Anatomy

1. Ascending spinal tracts: spinothalamic, dorsal column, spinocerebellar, spinoreticular, spinotectal
2. Descending spinal tracts: corticospinal, reticulospinal, rubrospinal, vestibulospinal, tectospinal
3. Spinal roots: myotomes and dermatomes
4. Spinal vasculature: vertebral artery, anterior spinal artery, thyrocervical trunk, artery of Adamkiewicz

B. Biomaterials

1. Titanium, cobalt chrome, stainless steel, PEEK, ultra-high molecular weight polyethylene, surface coating
2. Bone morphogenetic proteins, hydroxyapatite, tricalcium phosphate

C. Biomechanics

1. Kinematics
2. Alignment: sagittal, coronal, axial; segmental, regional, global
3. Instrumentation: tension band, 3- and 4-point bending, cantilever beam
4. Physics: Young's modulus, fatigue, durability, stiffness, axial load

II. Pathologic conditions

A. Congenital

1. Split cord malformation, diastematomyelia, spina bifida
2. Chiari, tethered spinal cord
3. Atlas assimilation, Klippel-Feil, butterfly vertebra

B. Deformity

1. Spinal balance: SVA, Pelvic incidence, lordosis, kyphosis, coronal balance
2. Basilar invagination
3. Scoliosis: congenital, adolescent idiopathic, degenerative
4. Spondylolisthesis: Isthmic, degenerative, Meyerding grades

C. Degenerative

1. Disc disease: rupture, collapse, Scheuermann's kyphosis
2. Osteoporosis, osteopenia, metabolic bone disease
3. DISH, OPLL, OLF
4. Central canal stenosis, lateral recess stenosis, foraminal stenosis
5. Radiculopathy, cervical spondylotic myelopathy, neurogenic claudication

D. Infection

1. Osteomyelitis: medical and surgical management
2. Epidural abscess: surgical management

E. Inflammatory

1. Rheumatoid arthritis
2. Ankylosing spondylitis
3. Sacroiliitis
4. Arachnoiditis

F. Neoplasia

1. Primary benign tumors: hemangioma, LCH, osteoid osteoma, osteoblastoma, osteochondroma, aneurysmal bone cyst, giant cell tumor
2. Intramedullary tumors: ependymoma, myxopapillary ependymoma, hemangioblastoma, astrocytoma
3. Extramedullary tumors: nerve sheath tumors, meningioma
4. Primary malignant tumors: osteosarcoma, chondrosarcoma, chordoma, multiple myeloma, Ewing sarcoma
5. Metastatic spine tumors: Assessment of instability: scoring systems, SINS

G. Trauma

1. Spinal cord syndromes: anterior, central, posterior, Brown-Sequard
2. Classifications: ASIA, SLICS, TLICS
3. CVJ: Atlanto-occipital dislocation, occipital condyle fractures, C1C2 rotatory subluxation, Jefferson fracture, Odontoid fractures, Hangman fractures
4. Vertebral injuries: burst, compression, teardrop, chance
5. Facet injuries: unilateral dislocation, bilateral dislocation, perched, fracture
6. Sacral fractures
7. Vertebral artery injuries

H. Vascular

1. Spinal AVMs
2. Spinal AV fistula

III. Clinical evaluation

A. Examination

1. Physical examination
2. Imaging: radiographs, CT, MR, radionuclide bone scan, DEXA scan
3. Laboratory: ESR CRP, HLA B-27, Vitamin D
4. Electrophysiology: EMG, NCV, SEP
5. Intraoperative monitoring: MEP, SEP, spontaneous and triggered EMG

IV. Surgical techniques

A. Posterior approaches

1. Decompressive: Laminectomy, laminoplasty, foraminotomy
2. Osteotomies: Ponte, pedicle subtraction
3. Fusion: Spinous process, laminar, facet, transverse process PLIF, TLIF

B. Lateral approaches

1. Decompressive: transpedicular, costotransversectomy
2. Fusion: LLIF

C. Anterior approaches

1. Decompression/Fusion: ACDF, ACCF, ALIF, OLIF
2. Arthroplasty: cervical, lumbar
3. Anterior osteotomy
4. Vertebral column resection

D. Instrumentation

1. Occipital cervical, C12, anterior odontoid screw
2. Subaxial cervical: interbody grafts and cages, standalone cages, anterior plates, lateral mass screw rod fixation, cervical pedicle fixation, cable techniques
3. Thoracolumbar: Cages, hooks, screws/rods, interspinous spacers
4. Pelvis: screw/rod fixation, SI joint fusion fixation