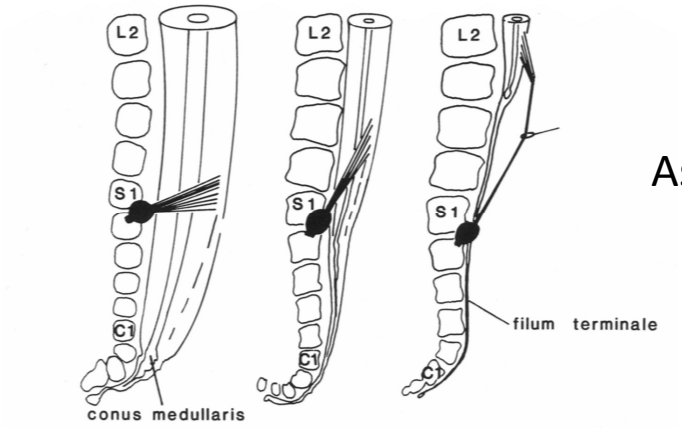
Growth of the Spinal Cord and when the Intraspinal Pathology should be addressed

Nejat Akalan, MD, PhD
Department of Neurosurgery
Hacettepe University, Ankara

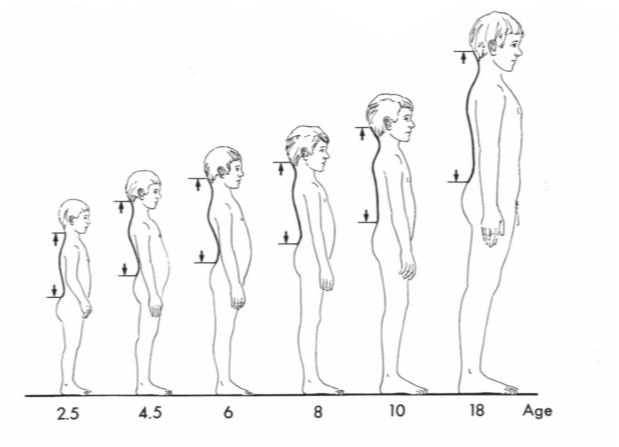
Spinal cord growth

Embryonic period



Asymmetrical

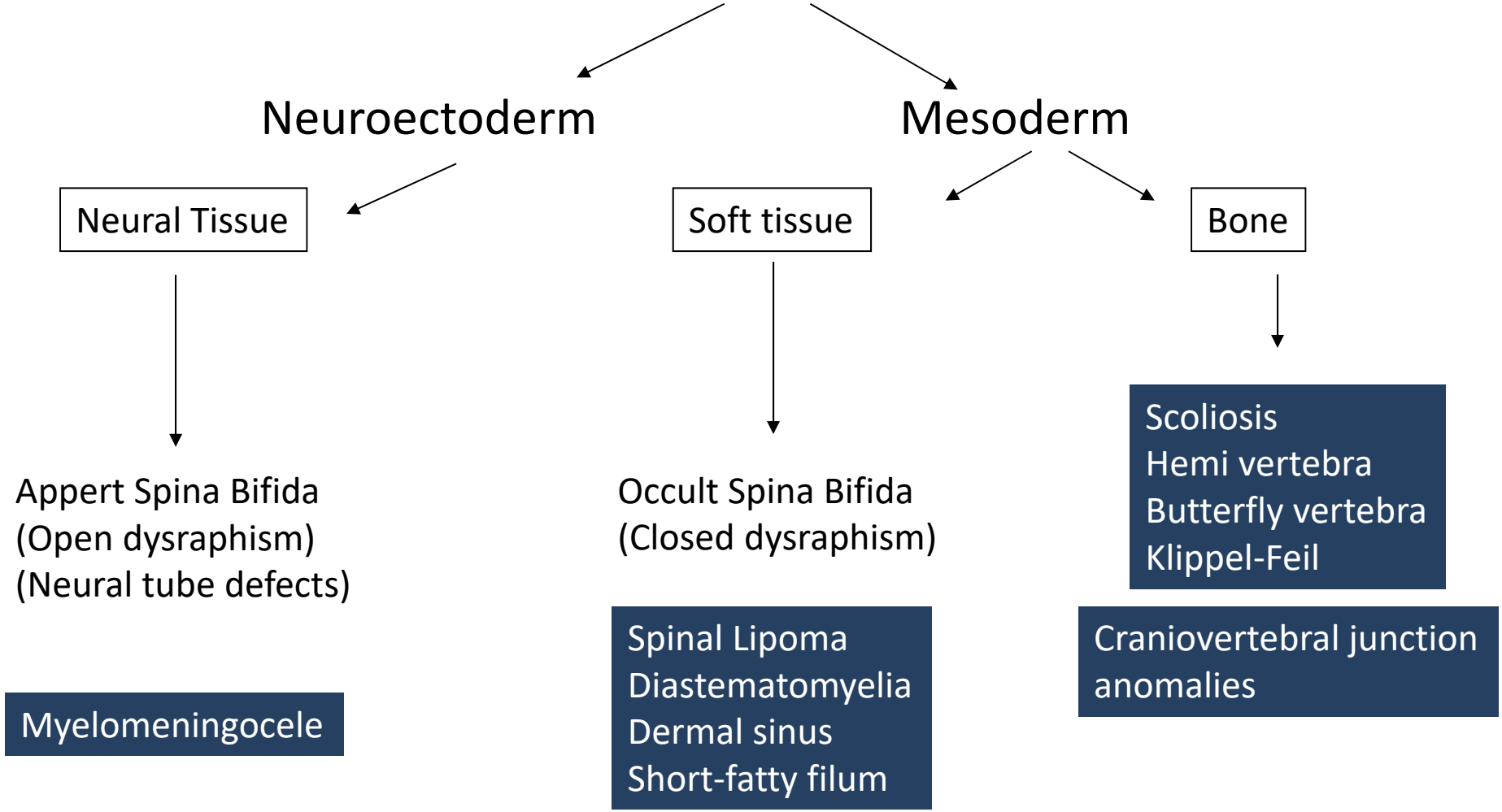
Post-natal period



Both the spine and the spinal cord lengthen by an order of magnitude during growth

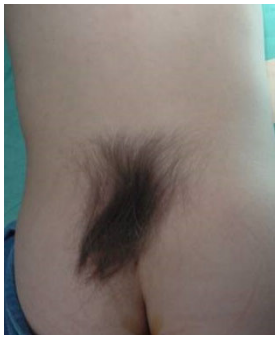
- Congenital spinal anomalies and “tethered cord”, definitions
- Surgical intervention, why and when?
- Intraspinal anomalies associated with scoliosis
- Algorithms for treatment

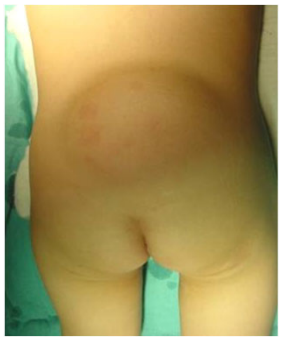
Congenital Spinal Anomalies

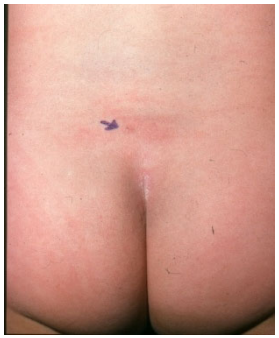


Occult Spina Bifida
(Closed dysraphism)

Spinal Lipoma
Diastematomyelia
Dermal sinus
Short-fatty filum



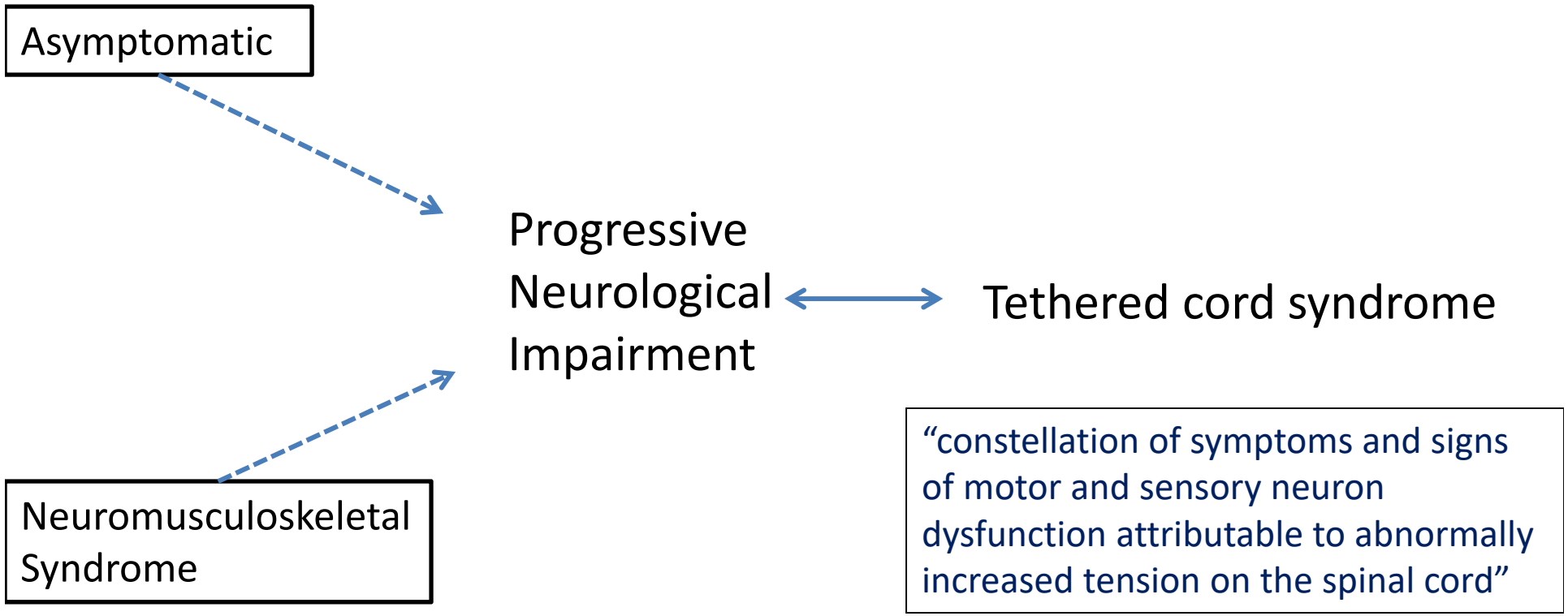




Asymptomatic

Progressive
Neurological
Impairment

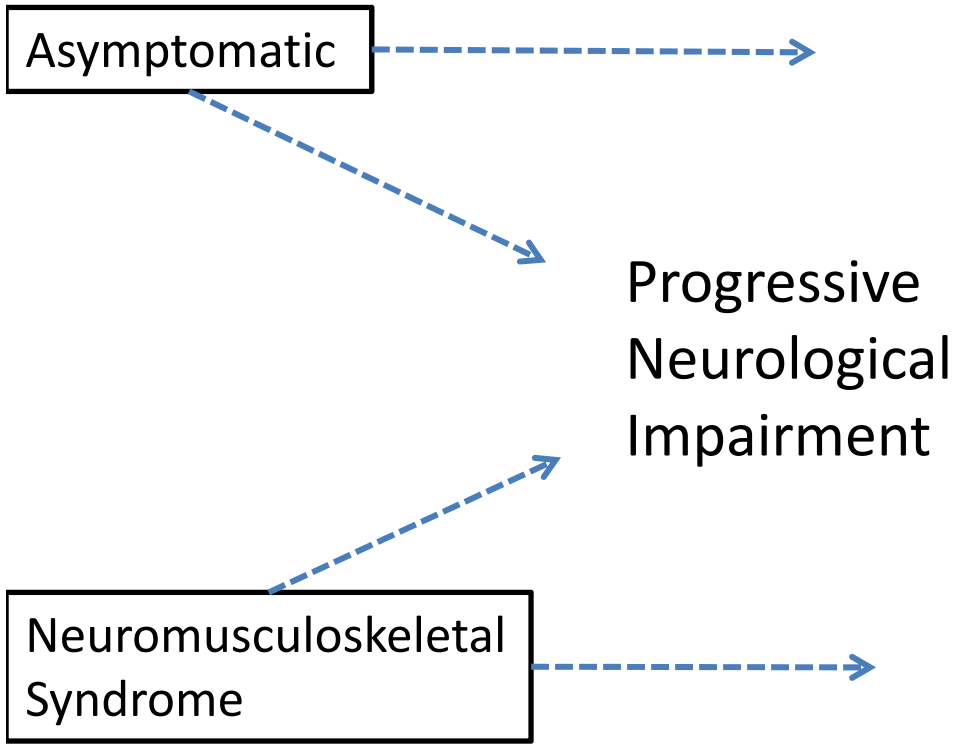
Neuromusculoskeletal
Syndrome


Asymptomatic
Neuromusculoskeletal Syndrome
Progressive Neurological Impairment
Tethered cord syndrome
"constellation of symptoms and signs of motor and sensory neuron dysfunction attributable to abnormally increased tension on the spinal cord"

Tethered Cord Syndrome

symptoms	signs	radiological features
back pain bladder dysfunction	leg weakness atrophy loss of dtr's sensory loss	lipomyelomeningocele lipoma of the terminal filum thickened terminal filum
	progressive scoliosis equinovarus equinovalgus	low-lying conus

Surgery



Prophylactic

Prevent deterioration

Reversal of the symptoms

Decision for intervention

Unclear Definition of the Syndrome

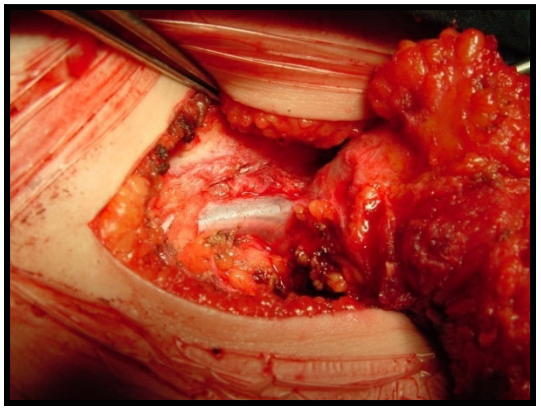
Unknown Natural History

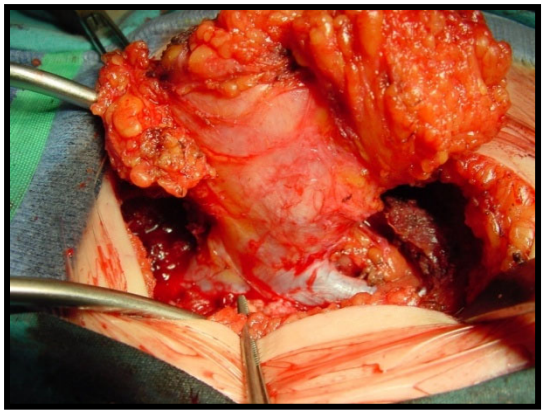
Uncertain Pathogenesis

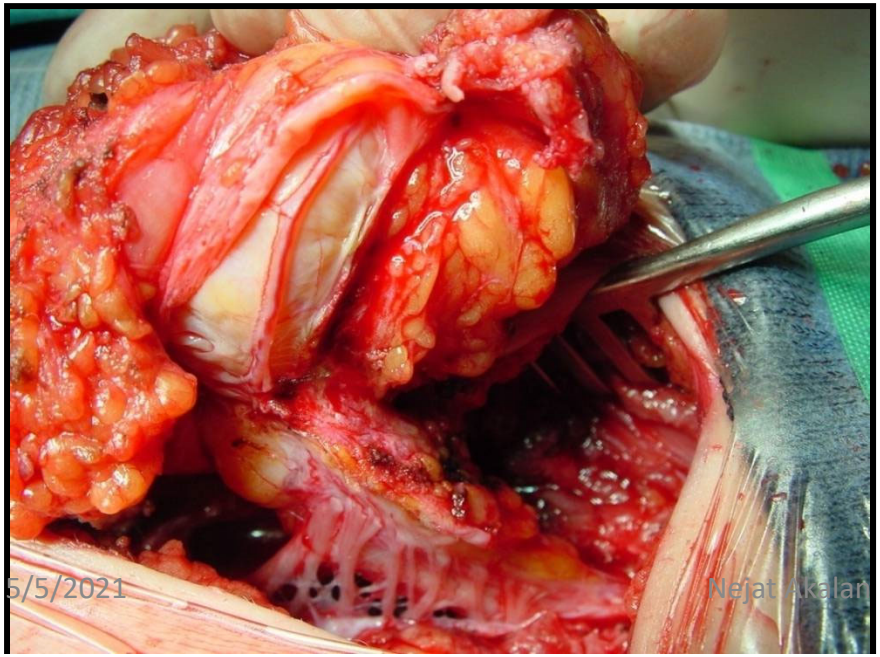
Lack of Accurate Clinical or Diagnostic Tests

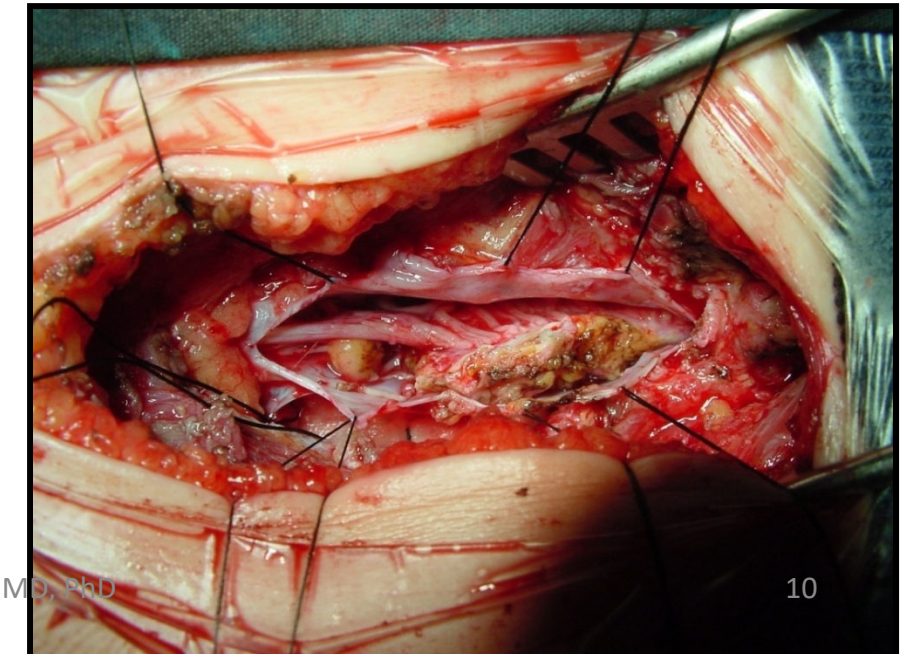
Surgery

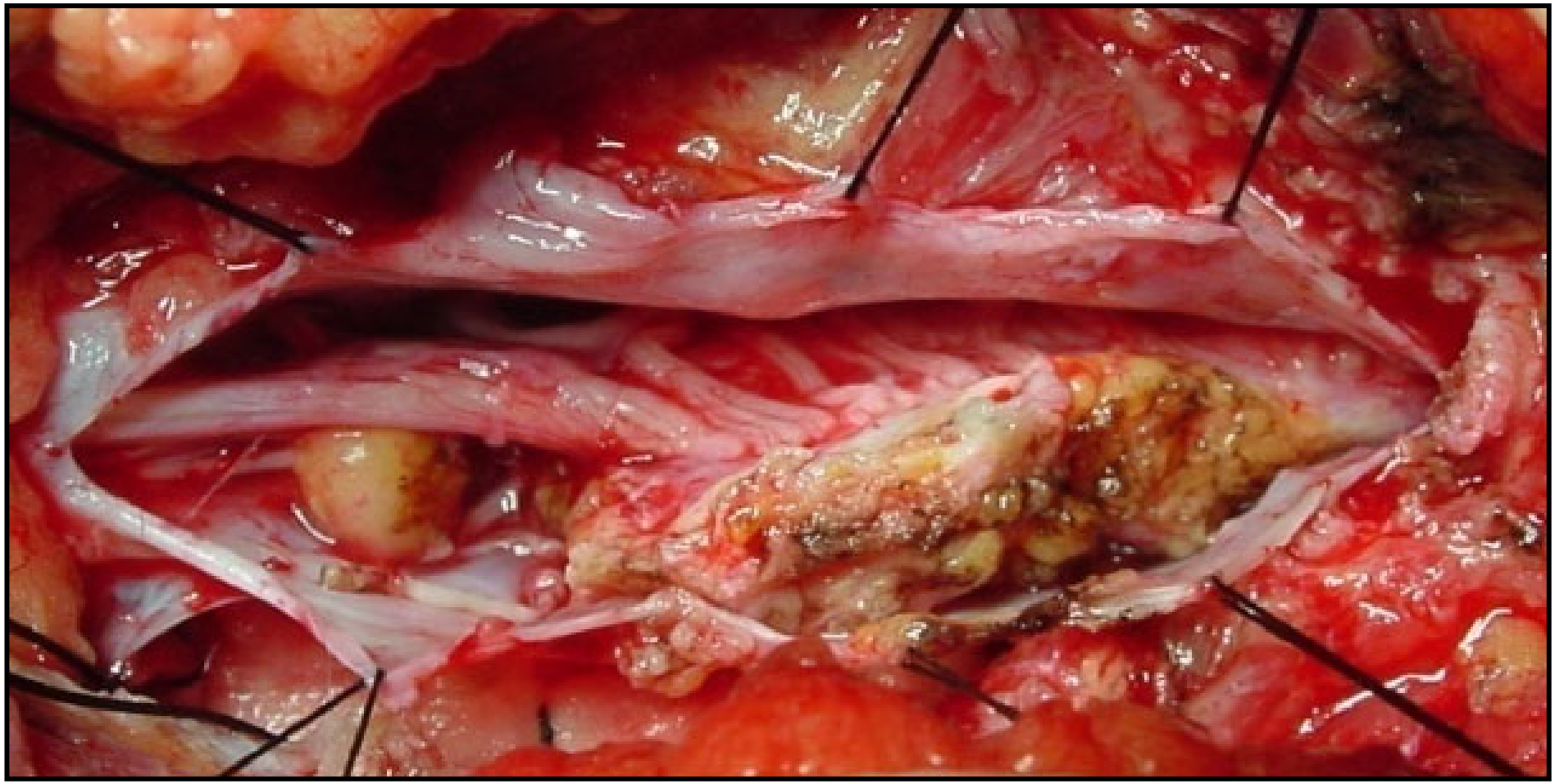
Decompression and Untethering











terminal filum, nerve root, dentate ligaments, dura

Spinal Malformations and Scoliosis

"20–58% of cases of congenital scoliosis associated with intraspinal abnormalities"

Related to spinal malformation

Co-existing pathology

Spinal Malformations and Scoliosis

Occult spinal dysraphism

Diastematomyelia
(Split-cord malformations)

Syringomyelia

İdiopathic
Chiari malf.

Appert spinal dysraphism

Myelomeningocele

Vertebral anomalies

Failure of formation
Failure of segmentation

Decision making

Stable vs.
progresive

Casual relationship

Primary aim

Sequence and timing

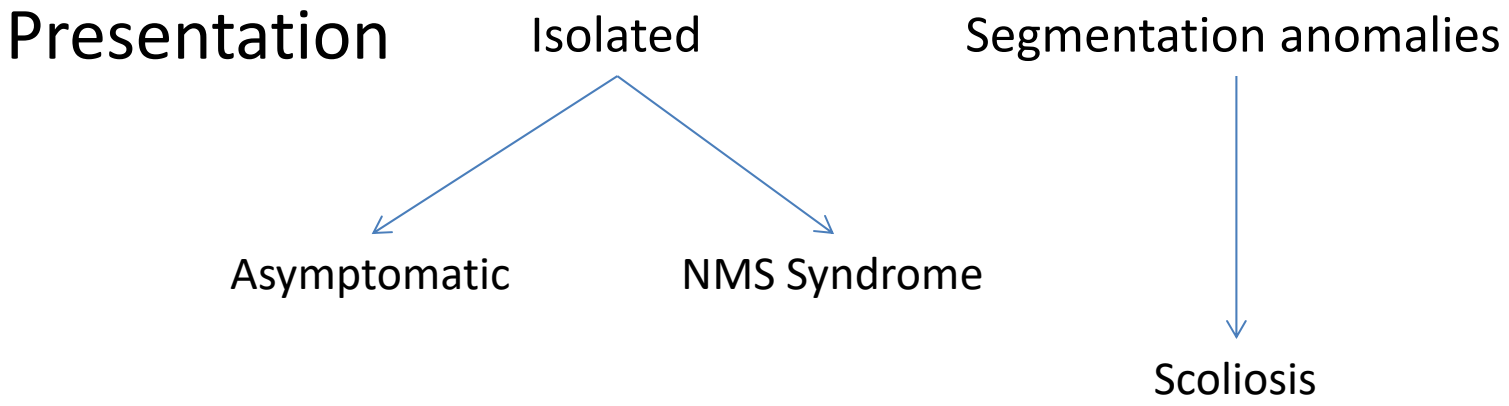
Diastematomyelia
(Split-cord malformations)

SCM I and II

An adhesion between the ectoderm and endoderm leads to an endomesenchymal tract that bisects the spinal cord.

frequent association with secondary spinal anomalies

Diastematomyelia (Split-cord malformations)

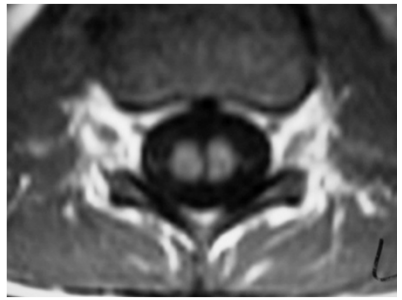


Scenario 1

Incidental

Normal N&P Exam.

Isolated SCM I or II



Tethering ?

Axial growth ⟷ Age

Unclear Definition of the Syndrome

Unknown Natural History

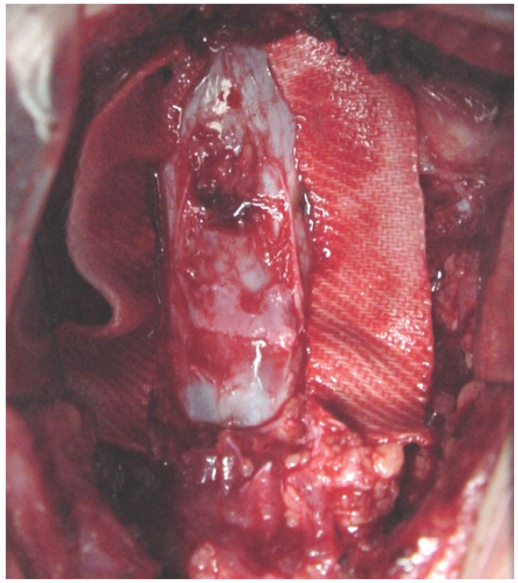
Uncertain Pathogenesis

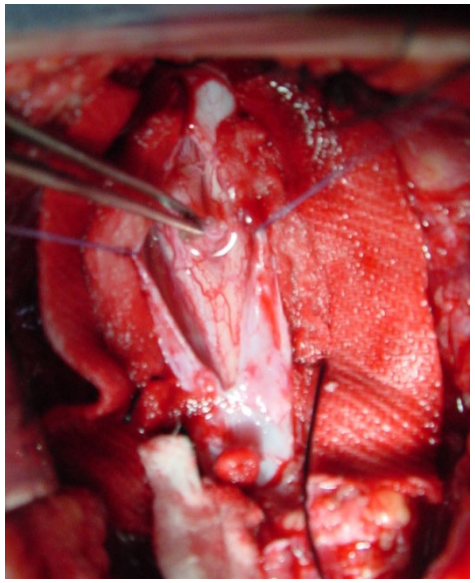
Lack of Accurate Clinical or Diagnostic Tests

Scenario 2

Isolated +NMS Syndrome → Stable

Isolated +NMS Syndrome → Progression ?





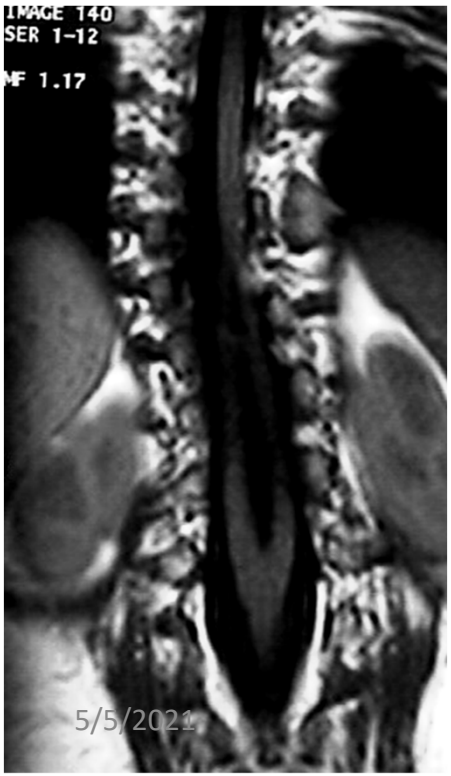
Scenario 3

Scoliosis

Stable

Progressive

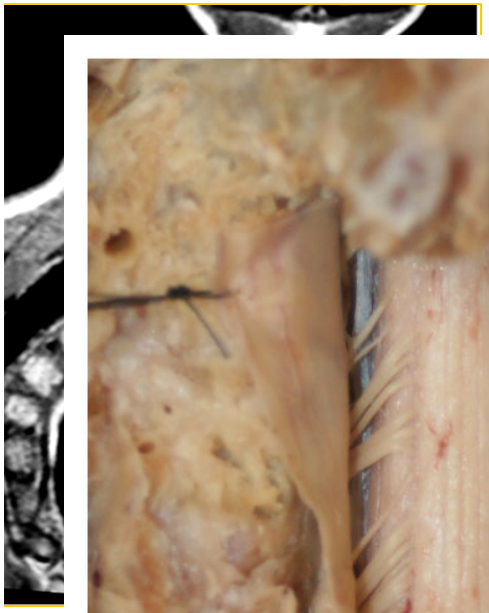
Prophylactic ?

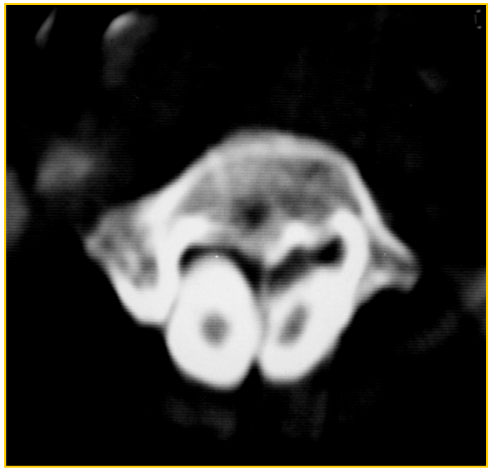


Spinal deformity
&
SCM

Correction → Neural compromise due to traction

→ Untethering



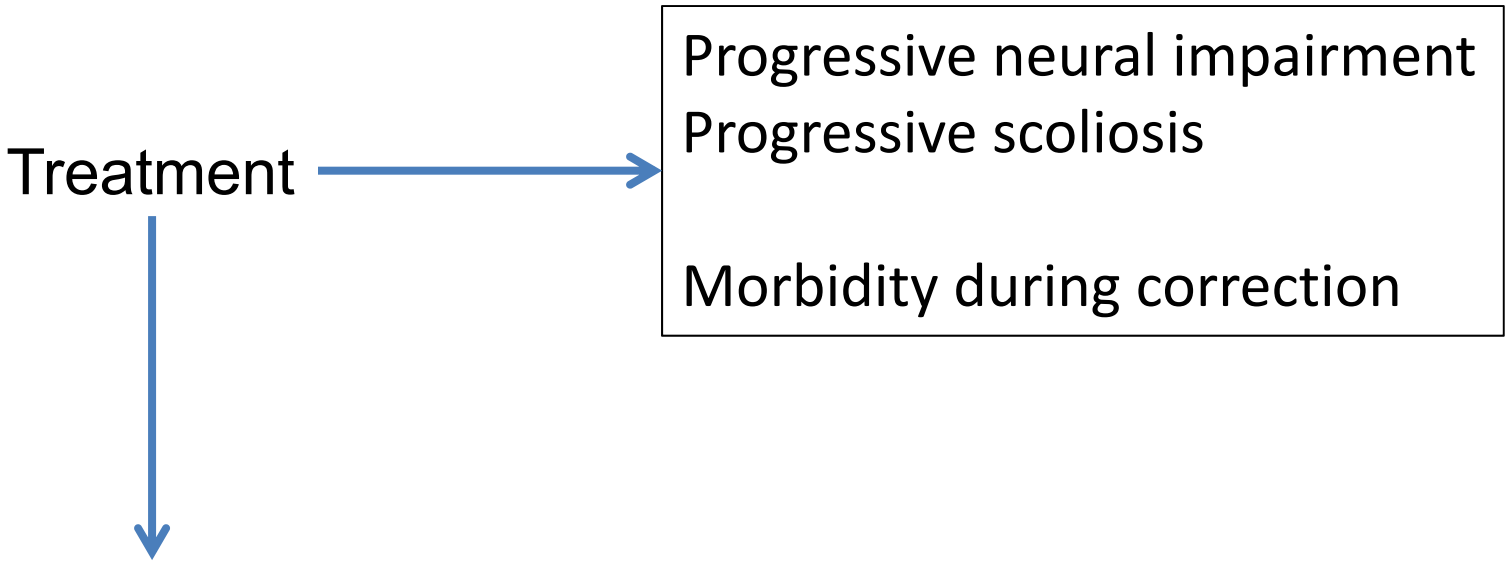


Syringomyelia

Longitudinal cavitations within spinal cord

- Posterior fossa pathology
  - Chiari malformations
  - Craniovertebral junction anomaly
- Assoc. with spinal dysraphism
- Idiopathic
- Inflammatory
- Traumatic

Syringomyelia



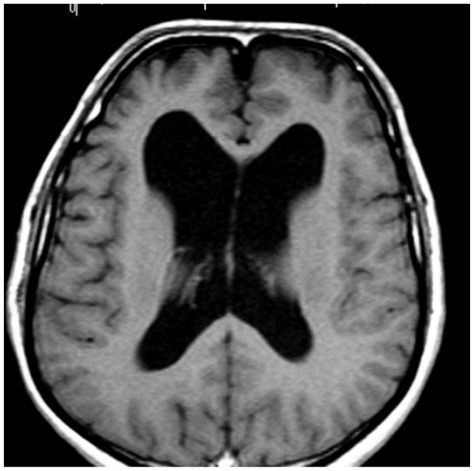
Aims to reverse the pathophysiological mechanism

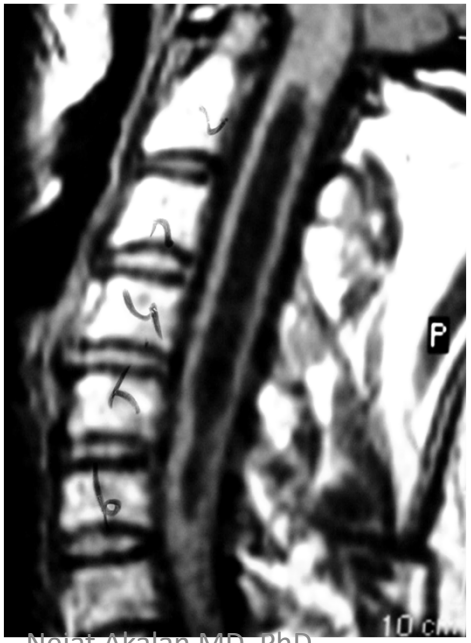
Treatment

+ Hydrocephalus

Shunt

Follow-up (MR)





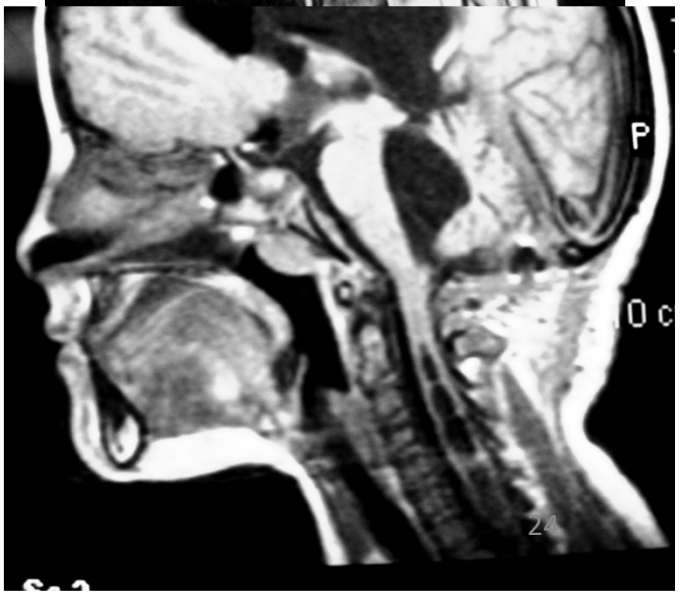
Treatment

Hydrocephalus

Chiari I-II

Shunt

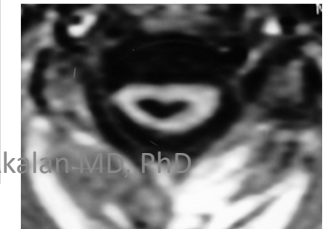
Decompression

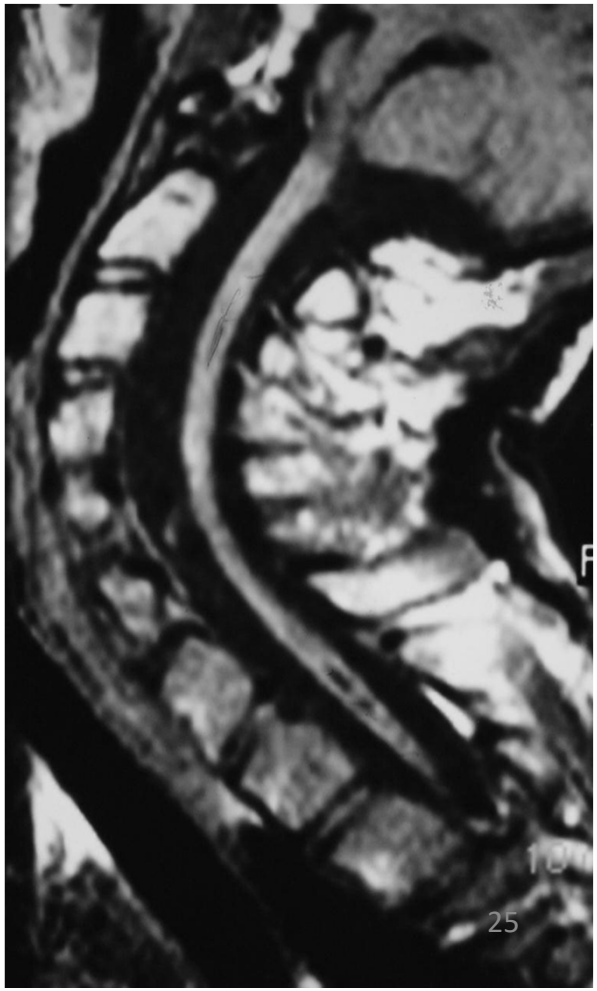


Treatment

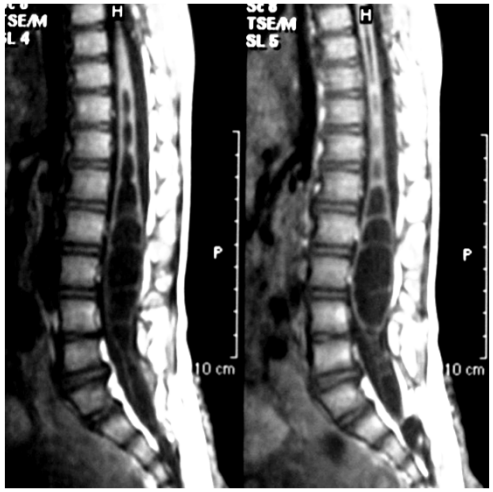
Craniovertebral junction anomalies

Decompression + Fusion



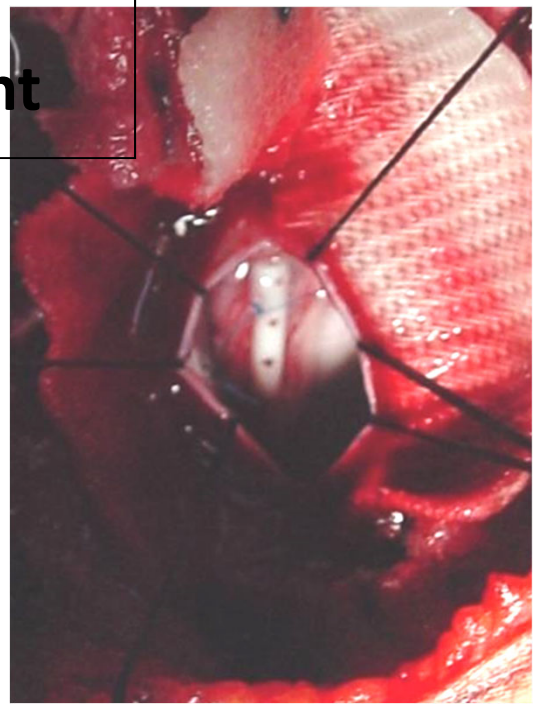


İdiopatic (?)

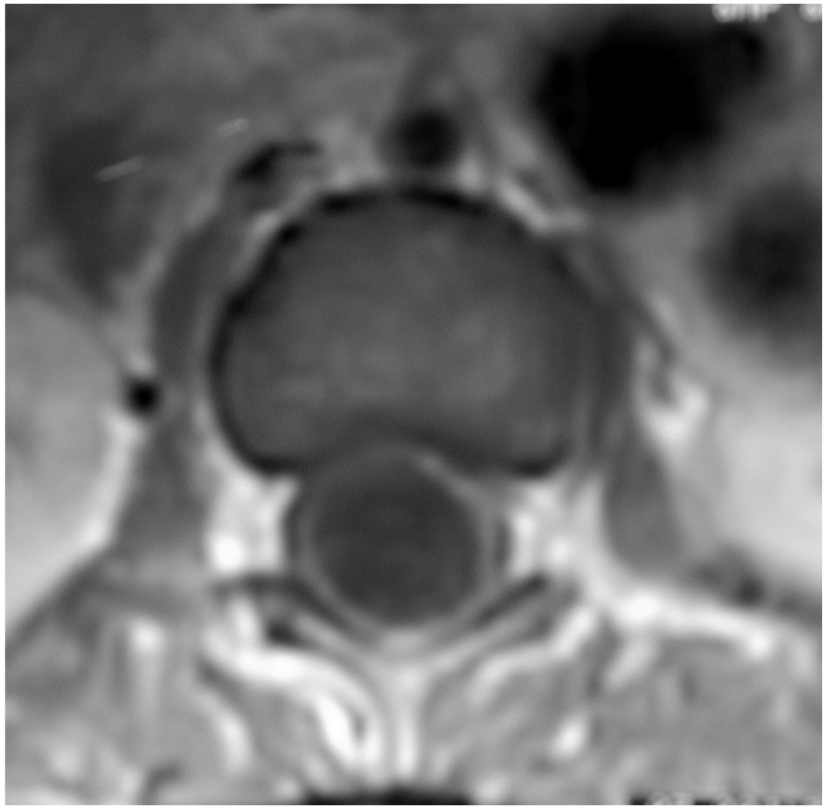


Syringo-subarachnoid,

Syringo-peritoneal shunt



Syringomyelia and scoliosis



Surgery for syrinx

Follow-up

Correction

- Defining the casual relationship is the key for appropriate sequence of the surgical approach in complex spinal malformations
- There is not enough scientific evidence to validate the contemporary practice in treating joint neurosurgical and orthopedic malformations