

Maximizing Ambulatory Potential in Spina Bifida

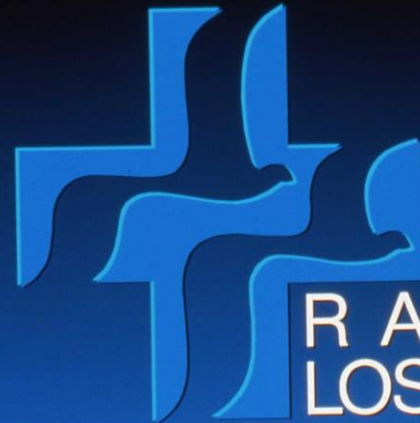
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University of California, Irvine

25 April 2015

Disclosure

- Consultant, MediCrea Spine
- I have no potential conflicts with this presentation

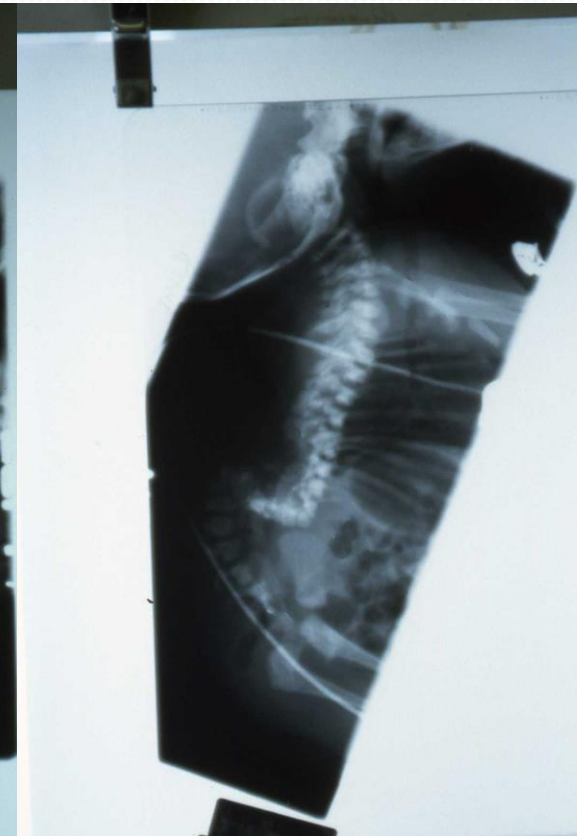
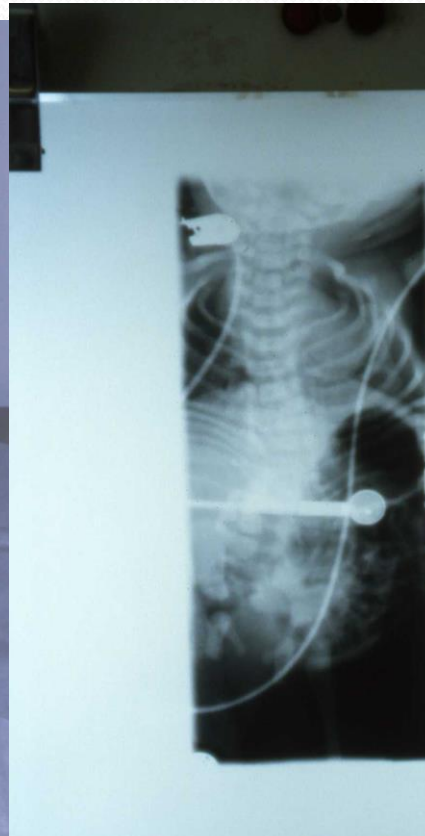


RANCHO
LOS AMIGOS
MEDICAL CENTER



Myelodysplasia

- Congenital defects of the vertebrae with neural element abnormalities



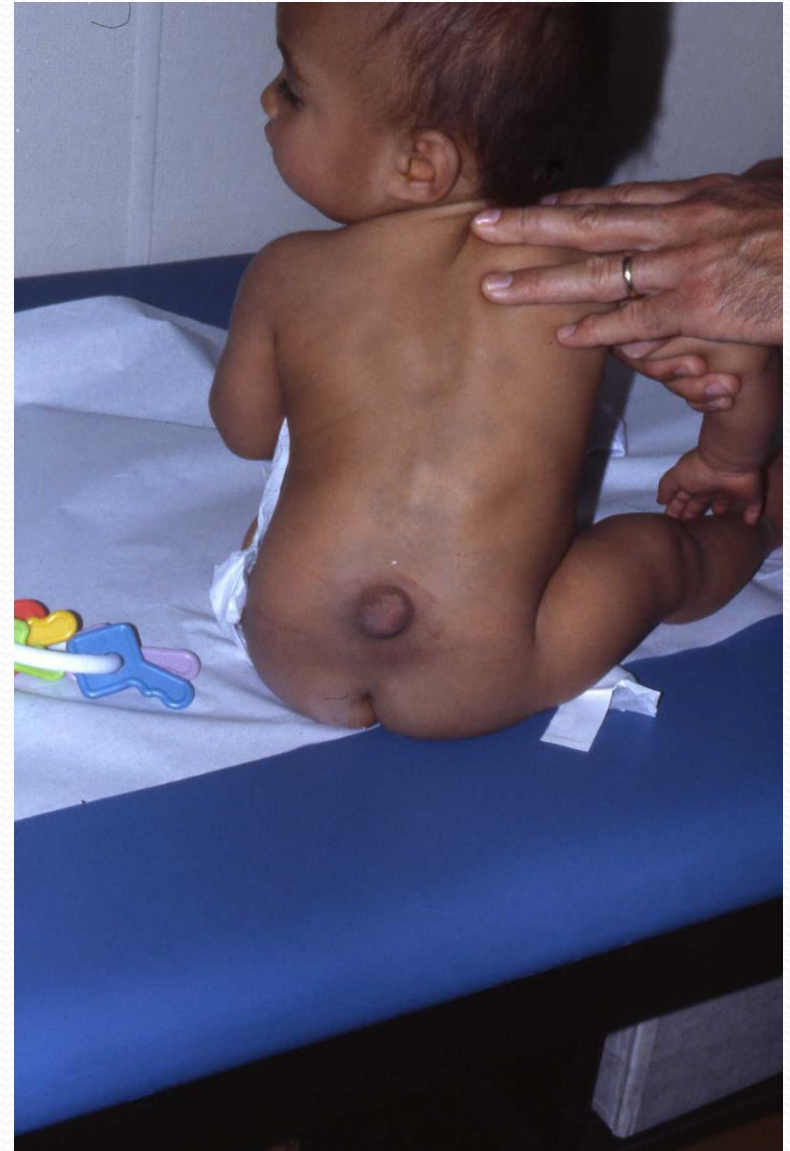
Myelomenigocele

- Exposed neural elements



Meningocele

- Vertebral arch defects
- Protrusion of meninges
- Intact overlying skin



Caudal Regression Syndrome

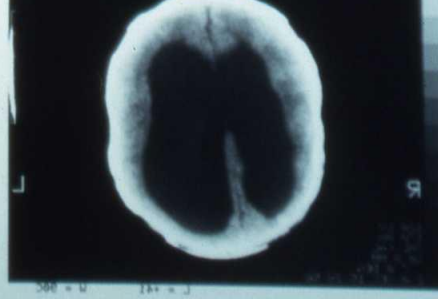
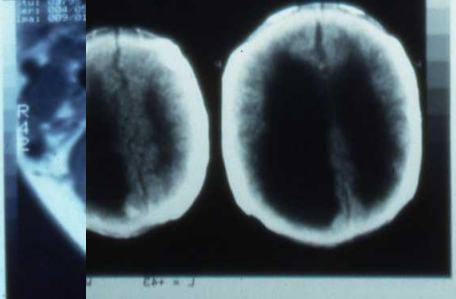
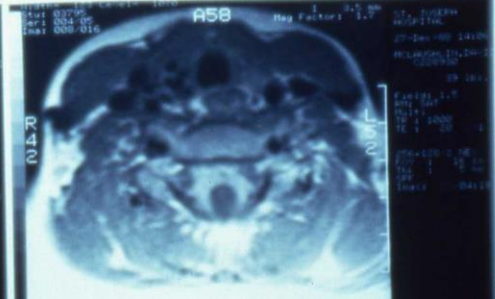
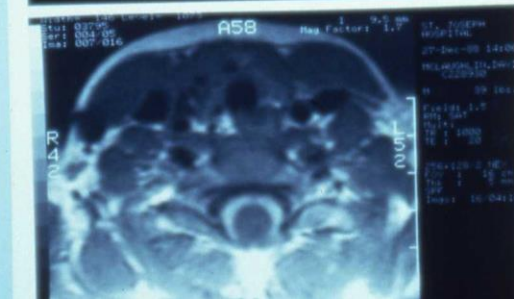
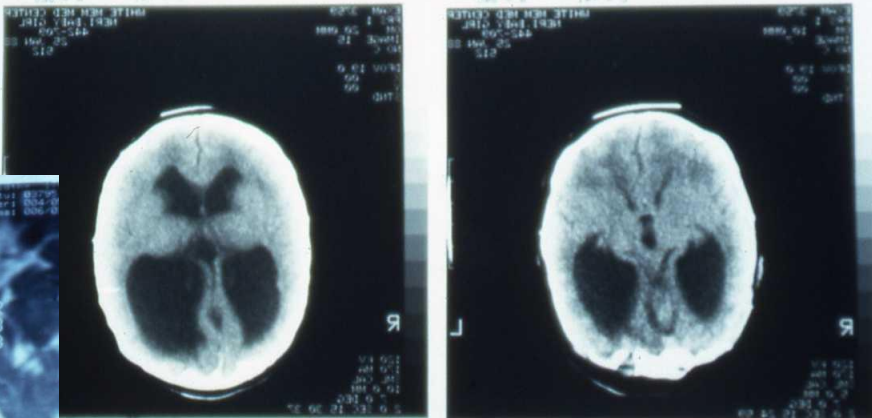
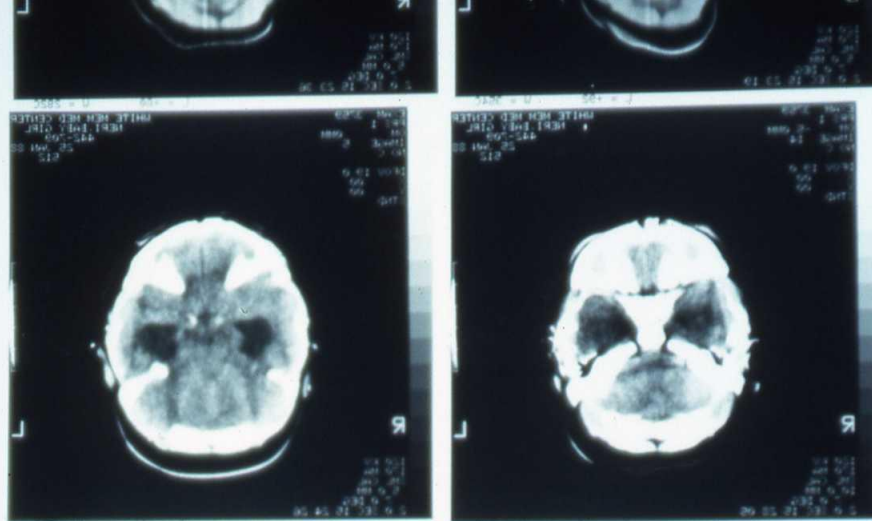
- Lumbar / sacral agenesis
- Cloacal exstrophy
- Myelocystocele
complex spinal dysraphism
5% of all covered spina bifida
50% associated with cloacal exstrophy
all with hydrocephalus and hydromyelia



Associated Neural Axis Deformities

- Arnold Chiari malformation
- Hydrocephalus
- Hydromyelia
- Syringomyelia
- Arachnoid cyst
- Diastematomyelia
- Spinal cord tethering
- Leptomyelolipoma





Associated Musculoskeletal Deformities

- Paralysis
- Positioning
- Muscle imbalance
- Spasticity
- Mixed tone: spastic and flaccid



Motor Imbalance

- Asymmetry
- Absence of motors
- Position / gravity





Interdisciplinary Team

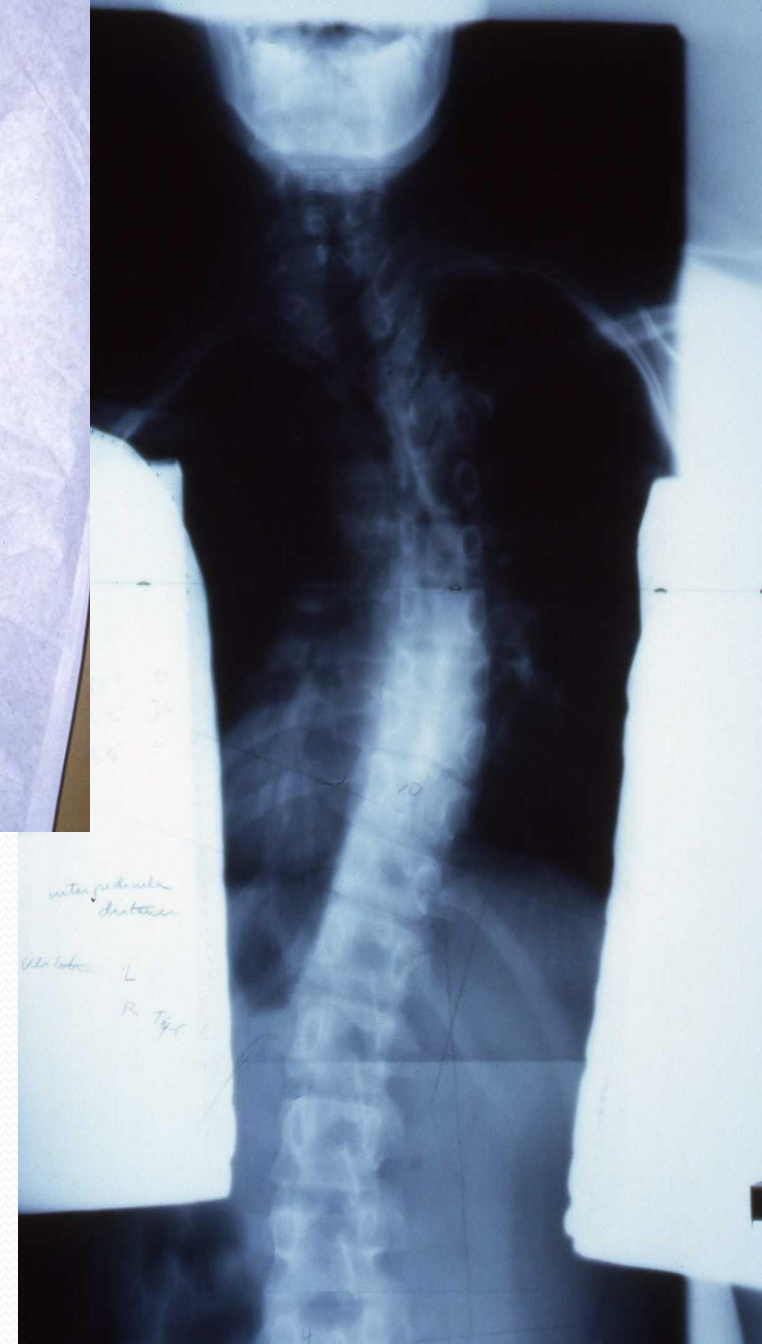
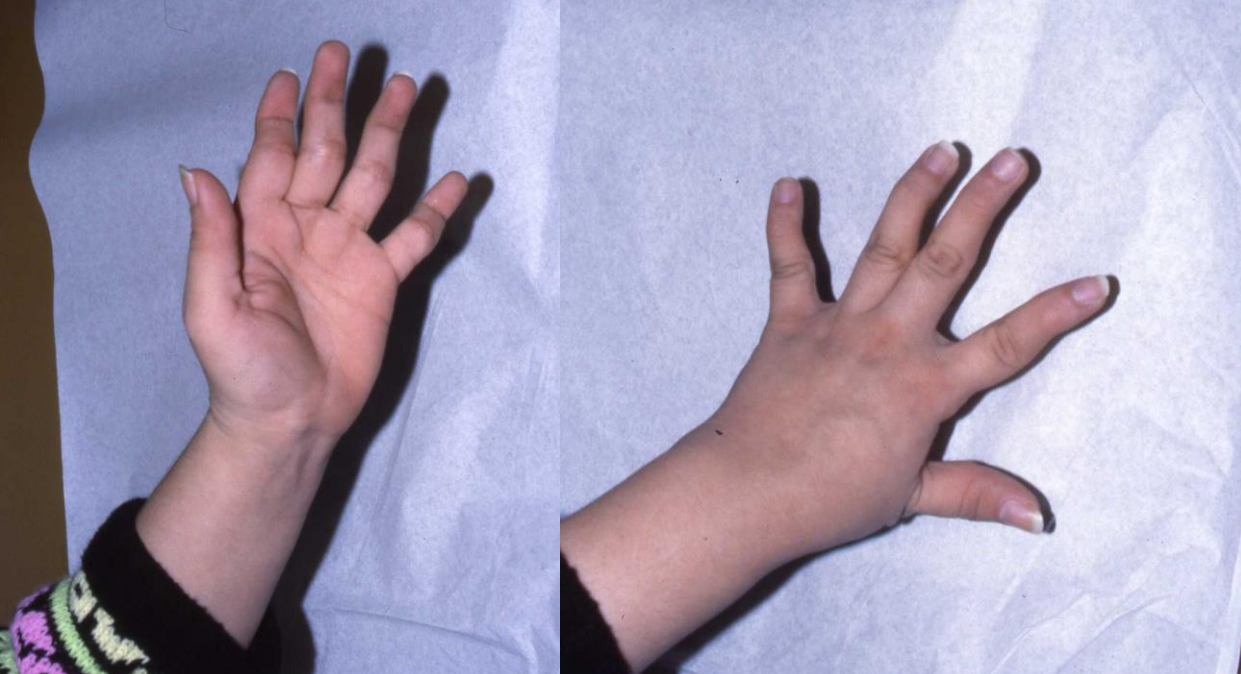
- Nurse practitioner / case manager
- Orthopaedic surgeon
- Pediatrician
- Neurosurgeon
- Urologist
- Physical therapist
- Occupational therapist
- Orthotist
- Psychologist
- Social worker
- Dietician

Goals of Interdisciplinary Management

- Mainstream children
- Develop independence
- Competence in the community
- Personality development
- Transition into adulthood

Be Aware of Fluctuating CNS Pathology

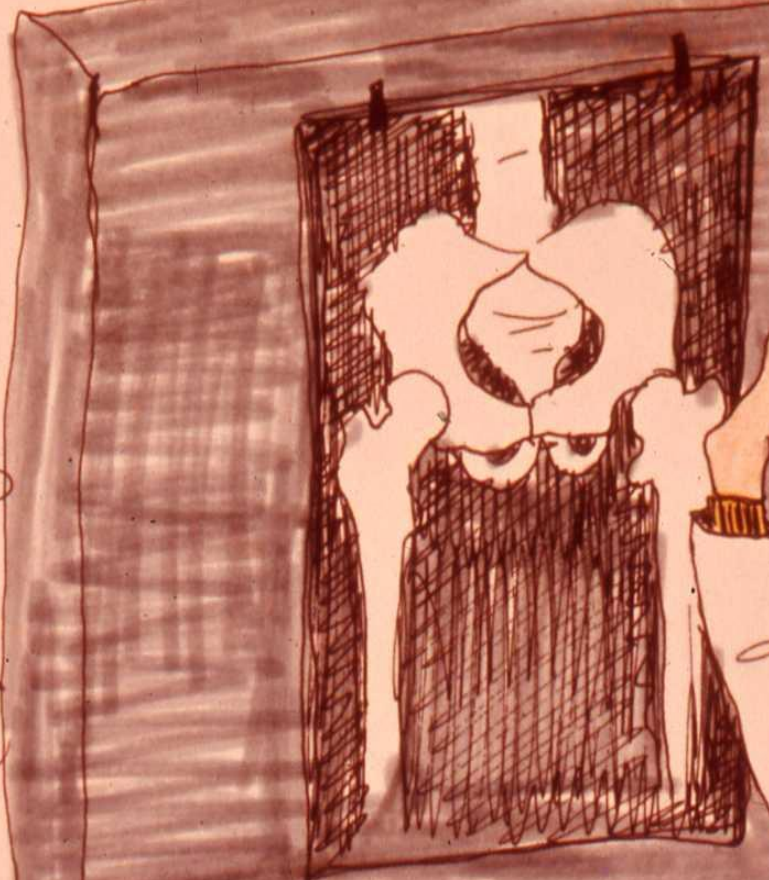
- Functional deterioration
- Progressive weakness
- Spasticity
- Scoliosis above the dysraphic defect
- Cognitive impairment
- Foot deformity
- Intrinsic hand atrophy
- Neurogenic bladder changes



Orthopaedic Surgery Evaluation

- Scoliosis Xrays: sitting, standing, supine
- CT spine
- Xrays of hips, knees, feet: standing, supine
- Scanogram
- Bone age
- Dexa bone densitometry

TREAT THE PATIENT NOT THE X-RAY



Orthopaedic Intervention

- Correction spinal deformity
- Hip management
- Knee management
- Correction of foot deformity to facilitate orthotic management
- Orthotic collaboration



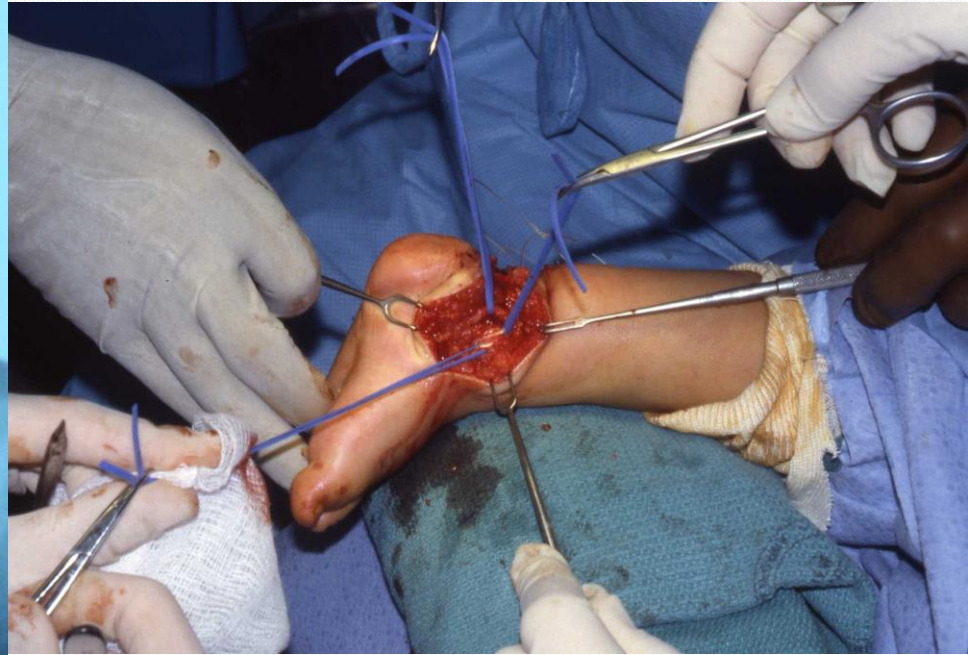
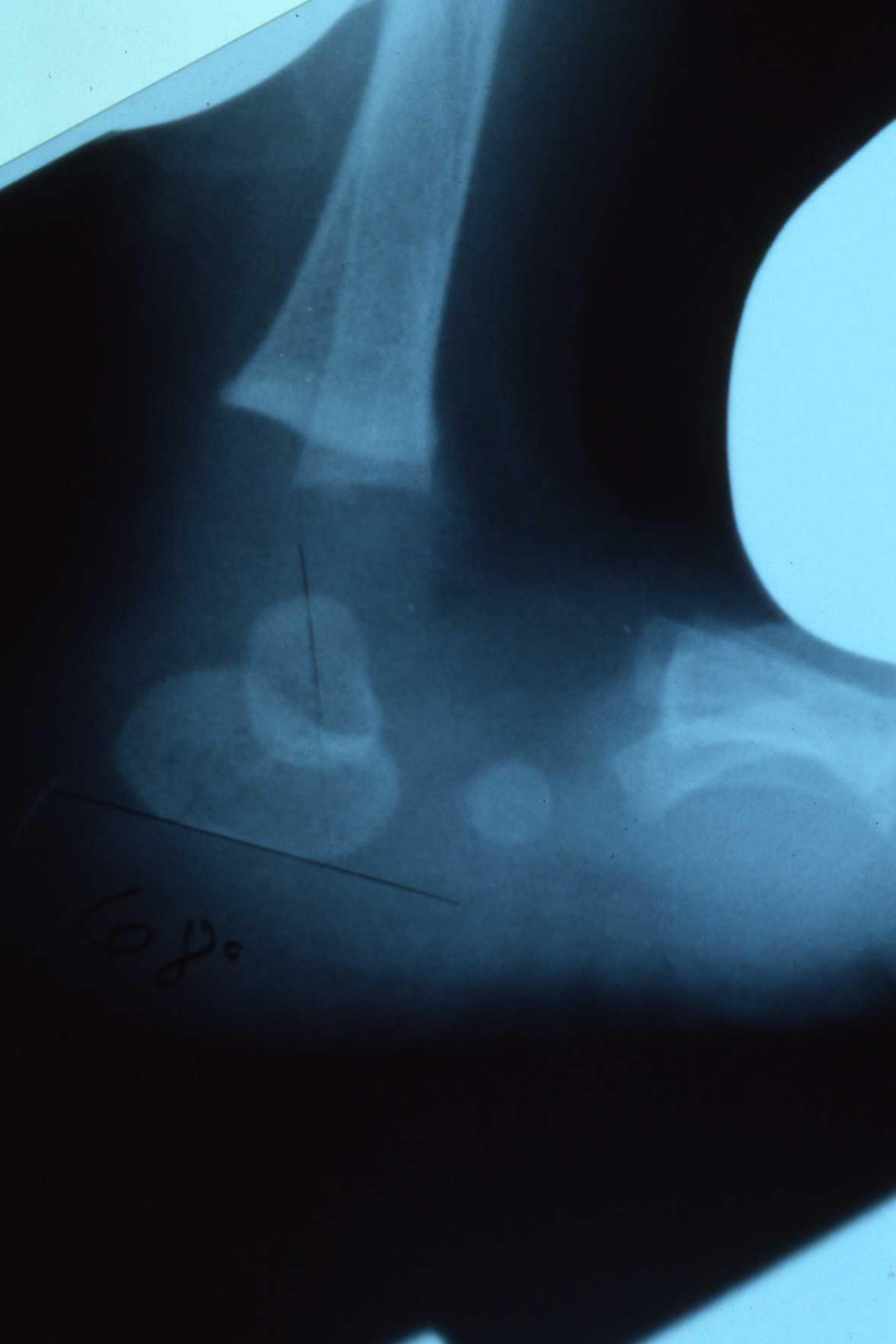




4 AUG. 1992
RIGHT







What problems are unique to the child with Spina Bifida?

- What is the most significant physical impairment leading to the inability to maintain ambulatory status?
- What is the most significant physical impairment leading to the inability to maintain independent sitting activities?

Define Neurologic Levels

- Thoracic
- High Lumbar
- Low Lumbar
- Sacral

Ambulators

- Straight spine
- Level pelvis
- Extended hips / knees

Wheelchair

- Straight spine
- Level pelvis
- Mobile hips
- Knee flexion
- Shoeable feet

Criteria for ambulation

Power

- Antigravity muscles
 - Hip extensor $> G+$
 - Knee extensor $> F+$
 - Tricep surae $> F+$

Criteria for ambulation

Range of motion

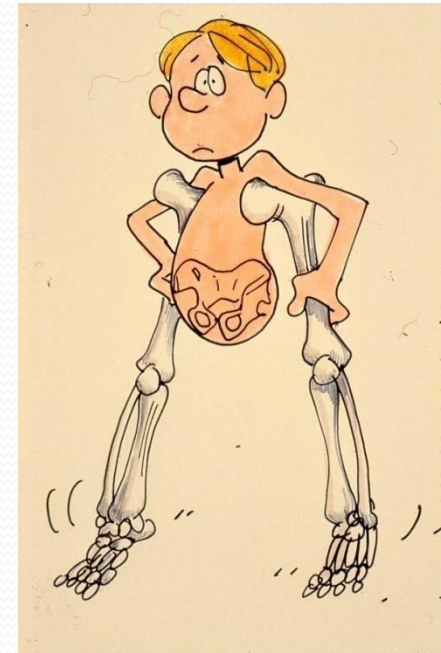
- Hip flexion contracture < 30 degrees
- Knee flexion contracture < 20 degrees
- Braceable hindfoot



Criteria for ambulation

Crutchable upper extremities

- Shoulder depressors > G+
- Good grip
- Full elbow extension
- Teres major
- Pectoralis major
- Latissimus dorsi



Priority for ambulation

- Energy efficiency
- Safety
- Speed
- Appearance



Significant physical impairments leading to the inability to maintain ambulatory status

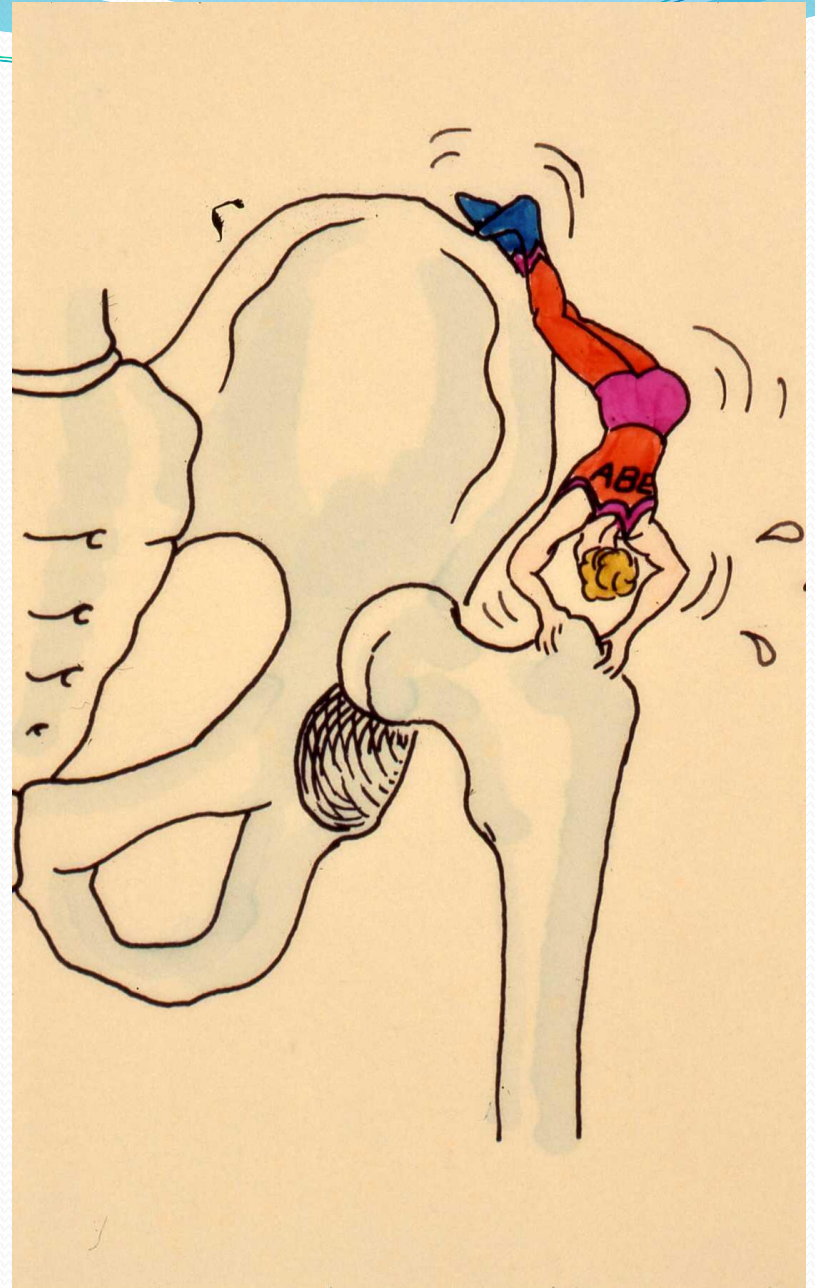
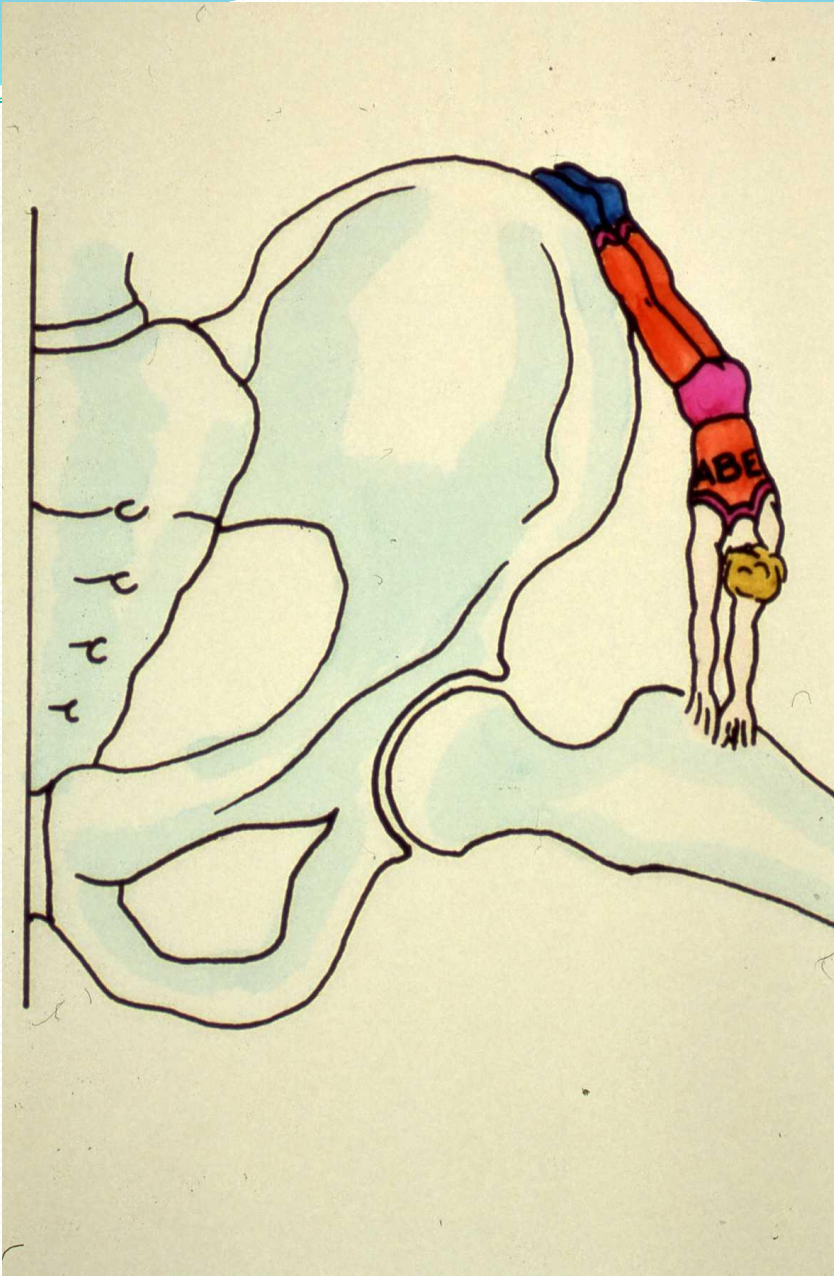
- Gluteus medius lurch, lateral trunk lean
- Crouched gait
- Knee valgus (internal knee adductor moment)
- Knee flexion contracture
- Tibial torsion
- Ankle calcaneal deformity

Etiologic factors resulting in crouched gait

- Anatomic (structural)
- Neurologic (paralytic)
- Spinal cord pathology (fluctuating level, spasticity)

Anatomical (structural)

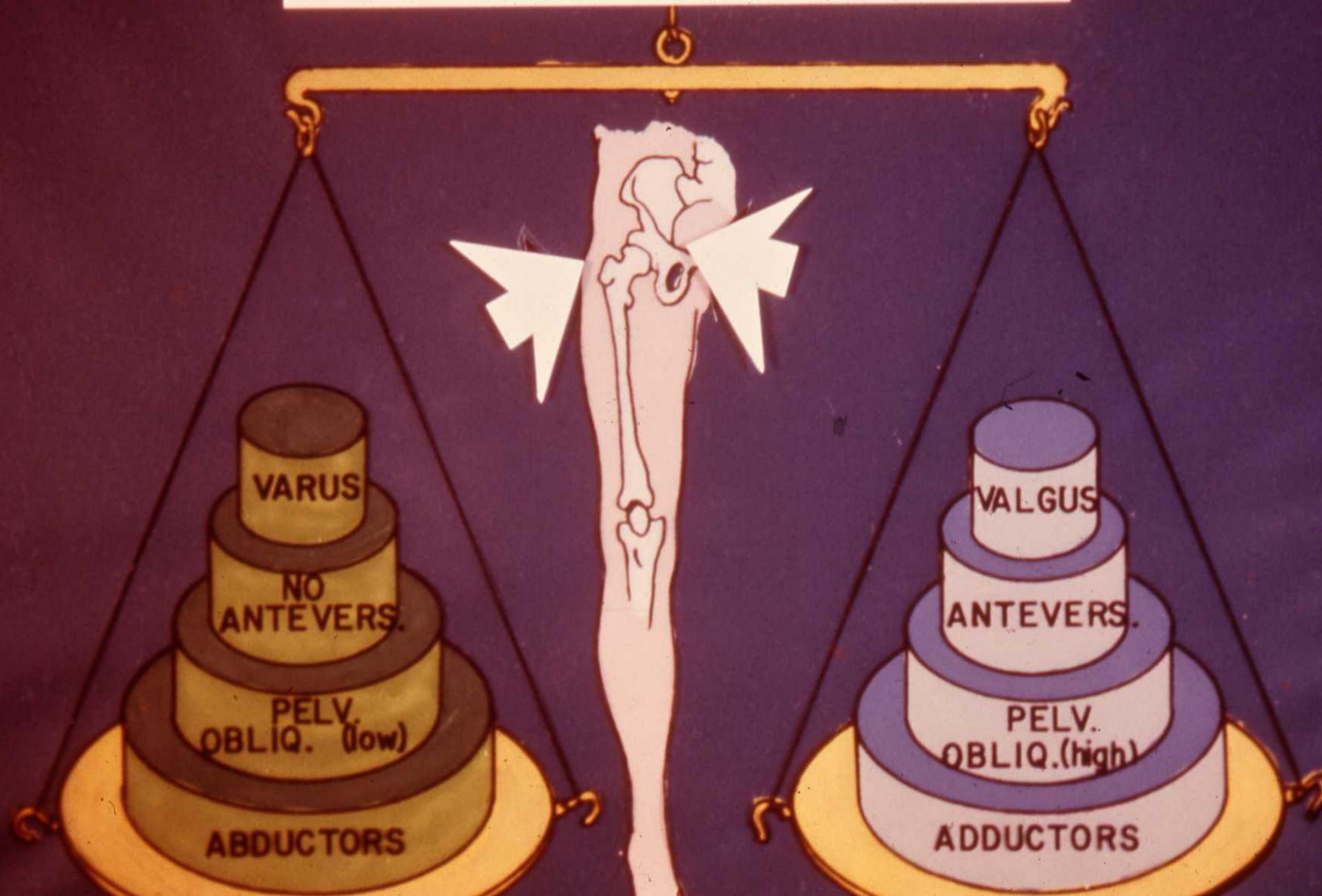
- Hip flexion contracture / lumbar kyphosis
- Knee flexion contracture
- Short fibula
- Ankle calcaneal deformity
- Rotational malalignment



Neurologic (paralytic)

- Absence of hip abduction
- Maintenance of hip flexor and quadriceps strength with loss of hip extension and triceps surae power
- Neuropathic joint, absence of proprioception

BALANCE OF FORCES



Spinal cord pathology

- Hydromyelia
- Syringomyelia
- Diastematomyelia
- Arnold-Chiari malformation
- Spinal cord tethering
- Leptomyelolipoma
- Arachnoid cyst




Knee functional consequences

- Lack of plantar flexion strength → excess knee flexion
- Increased pelvic transverse motion → increased transverse knee motion
- rotatory instability → medial laxity



Orthotic management

- Rigid ankle to prevent dorsiflexion
- Prevent foot pronation, ankle eversion
- Position ankle in mild plantarflexion
- Ground (floor) reaction  tibia posterior
- Extend to toes with metatarsal pad to prevent toe clawing and protect insensate skin
- Rear walker assistance









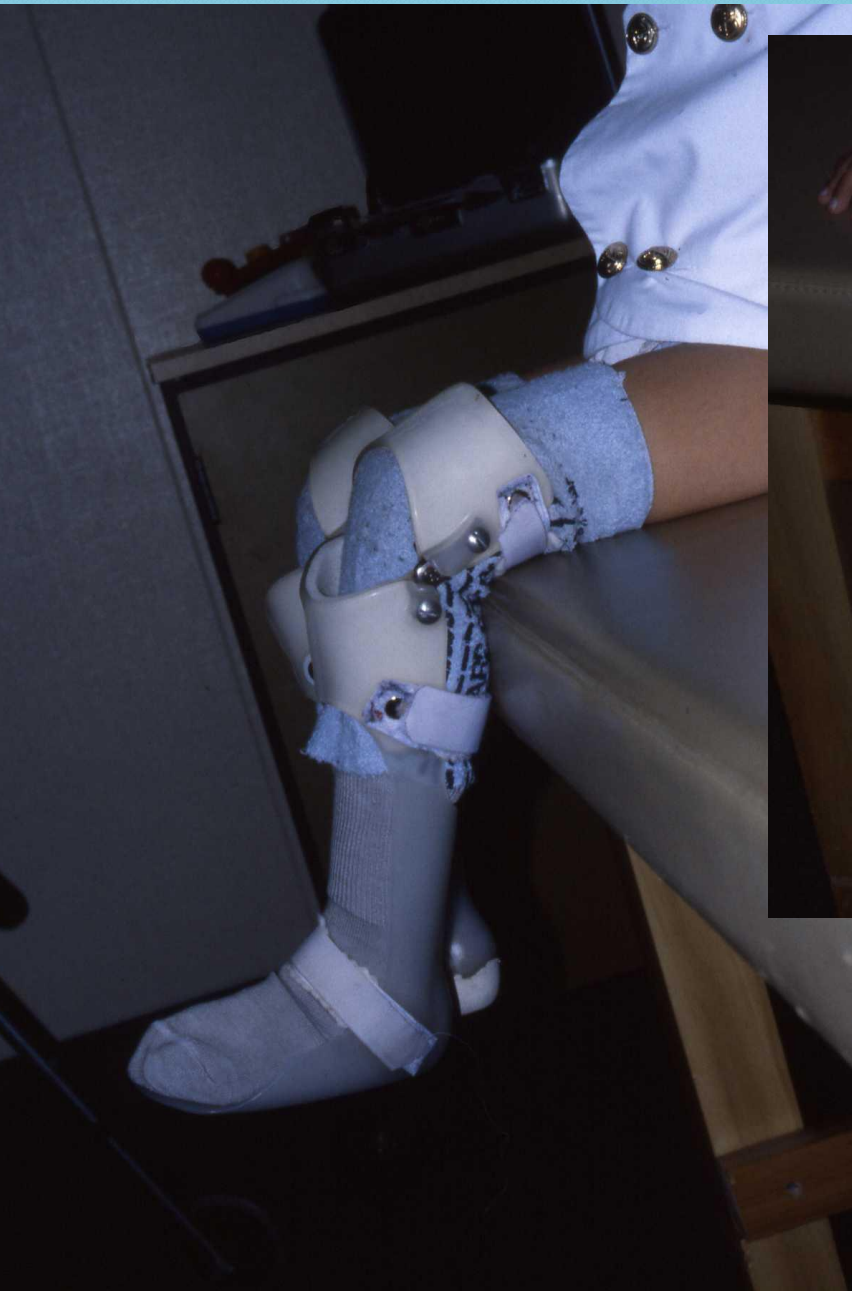
Knee flexion contracture

- Consider surgical intervention > 20 degrees
 - hamstring lengthening
 - iliotibial band lengthening
 - posterior knee capsulotomy
 - guided growth with anterior hemi-epiphysiodesis
- Gradual orthotic correction with adjustable locked articulated ground reaction ankle foot orthotic system

Anterior hemi-epiphysiodesis





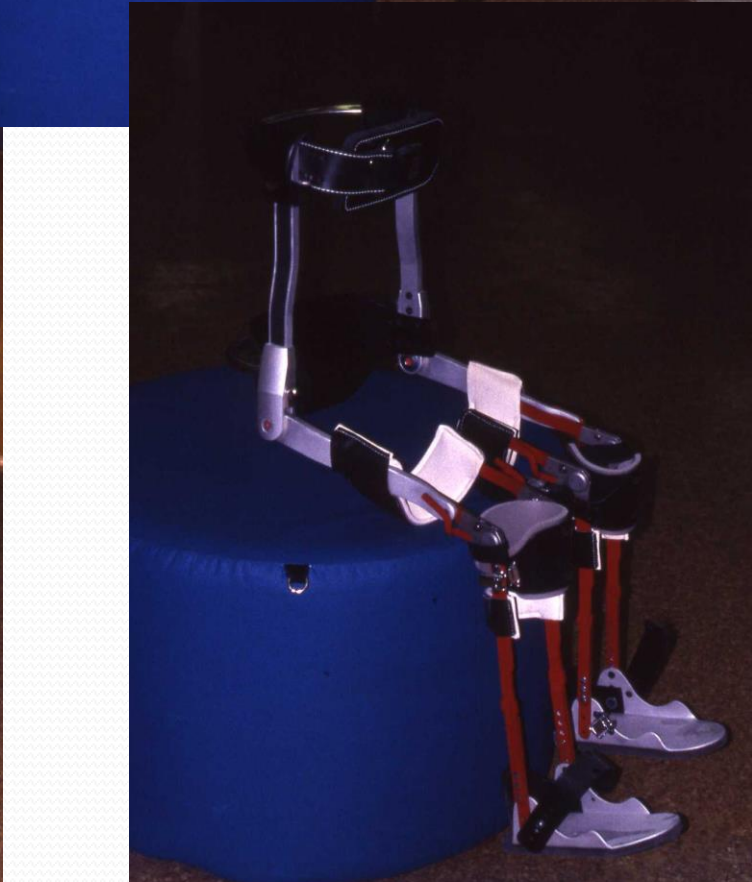


Hip flexion contracture

- Consider abandoning ambulatory program
- Surgical intervention > 30 degrees
 - tendon lengthening
 - hip capsulotomy
 - reduction unilateral hip dislocation
 - augment muscle power
- Proning program
- HKAFO, RGO, parapodium, standing frame





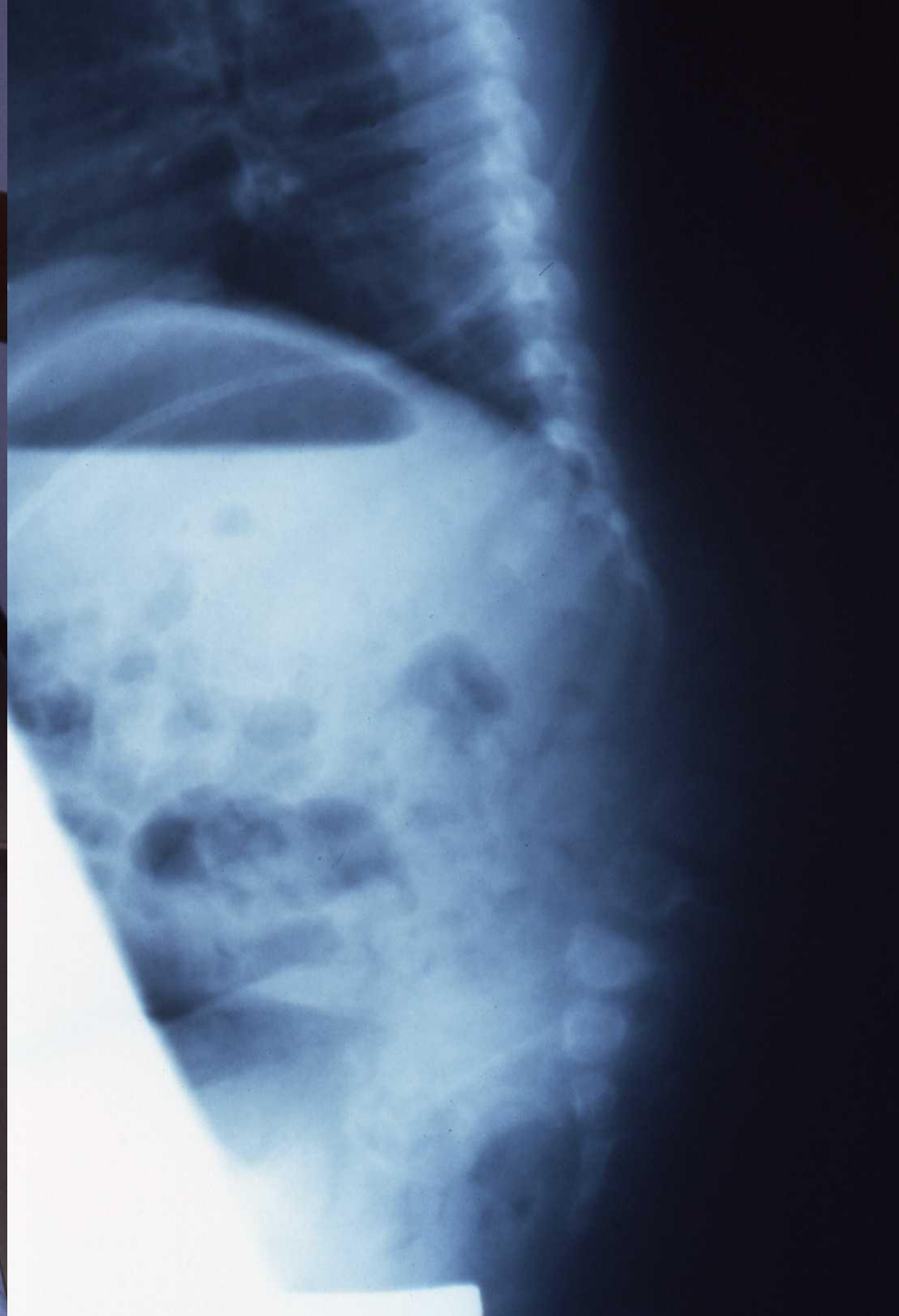


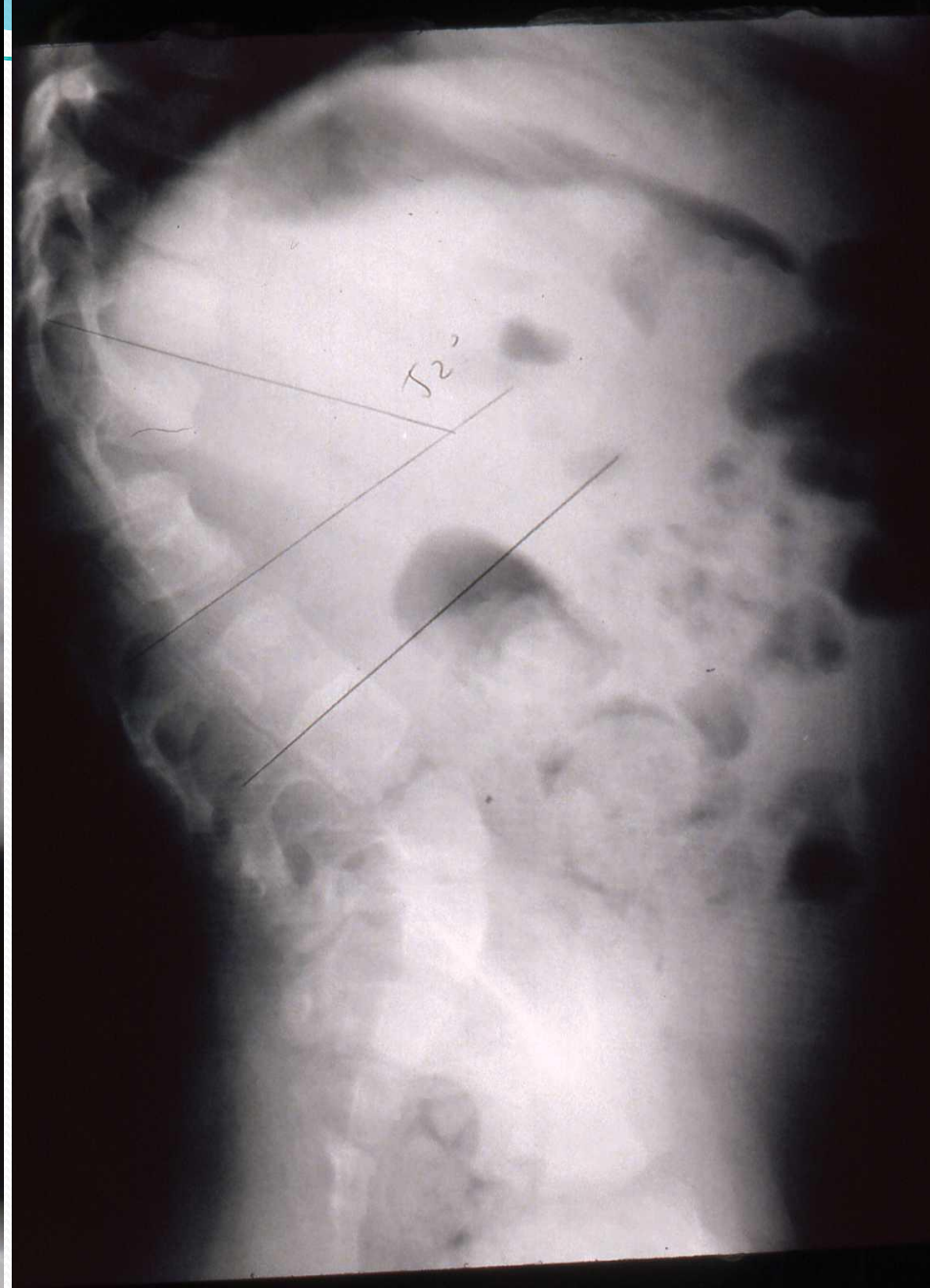
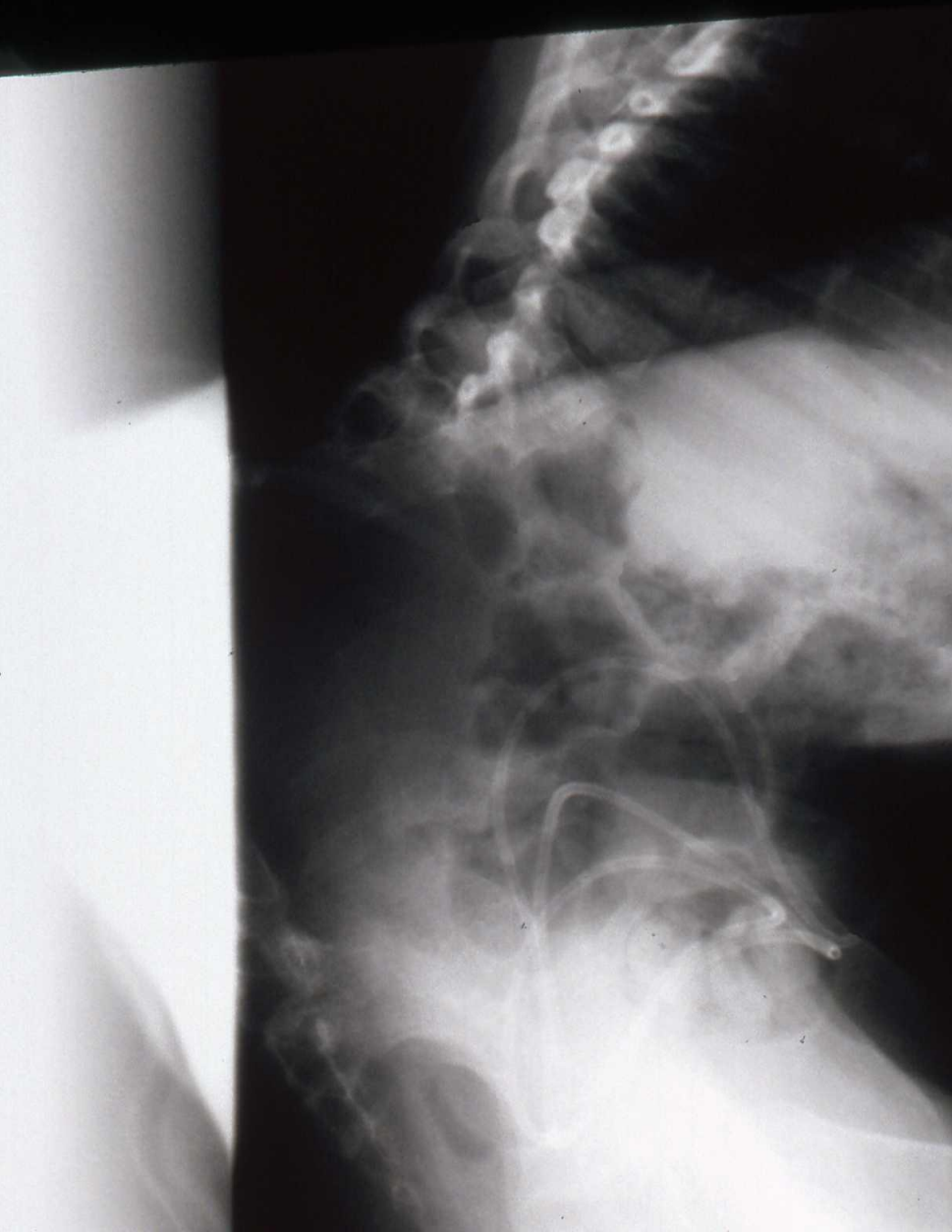




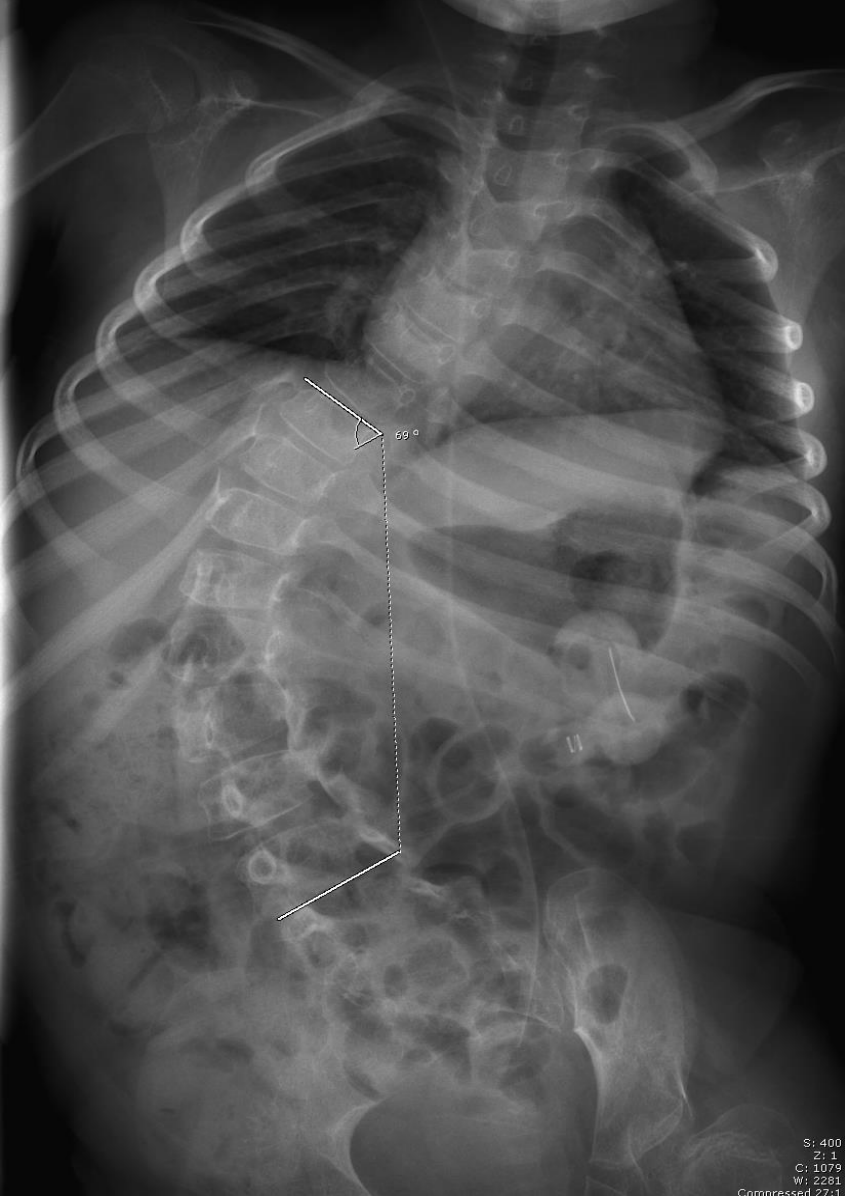
Significant physical impairment leading to inability to maintain independent sitting activities

- Lumbar kyphosis
- Pelvic obliquity
- Hip contractures





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L



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IM: 1



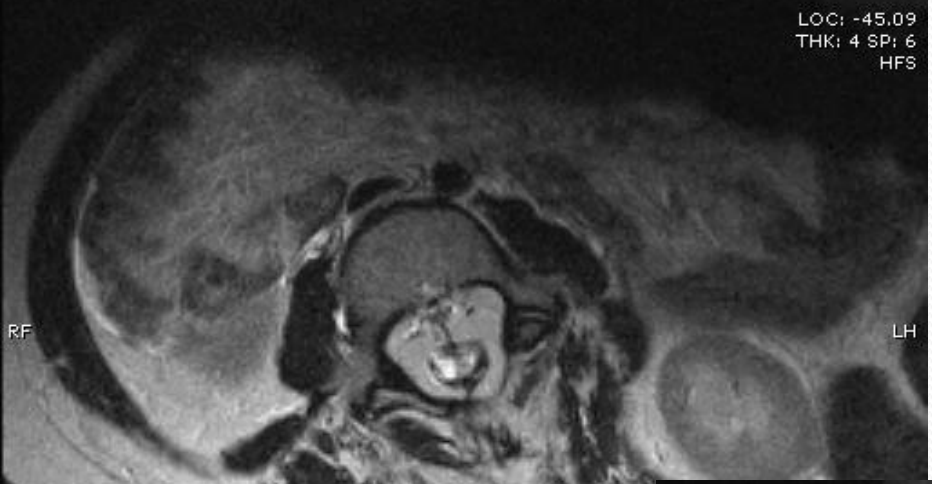
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10 YEAR
F

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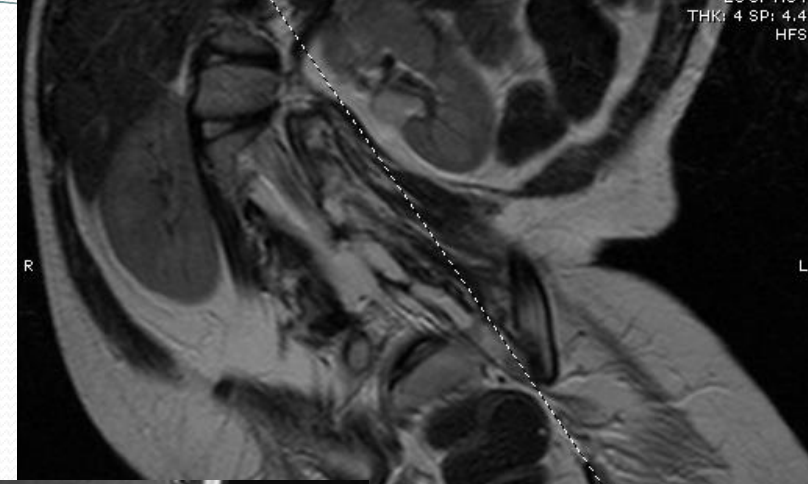


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10 YEAR
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H

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LOC: 7.34
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HFS



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DFOV: 26x26cm
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10 YEAR
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HFS



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FL

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4/12/2000
10 YEAR
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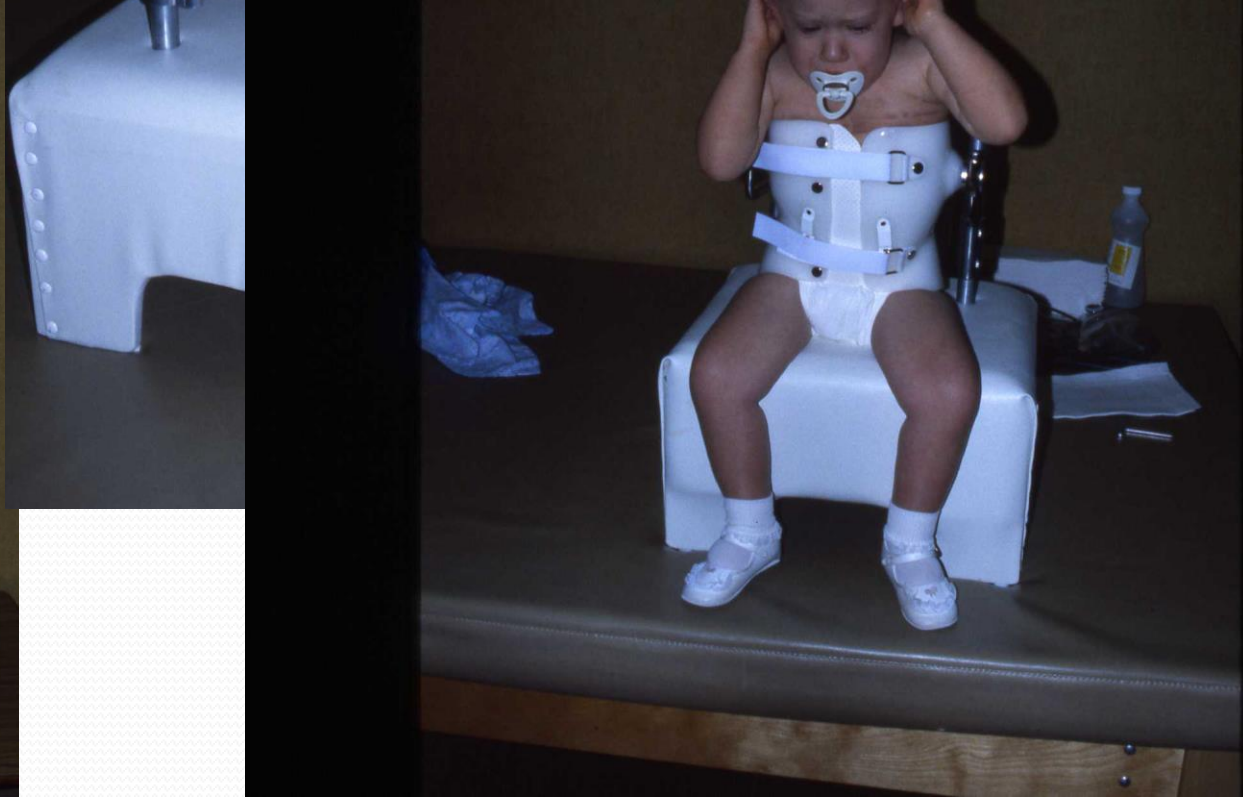
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Spinal orthotic management

- Suspension TLSO
- Wheelchair seating systems



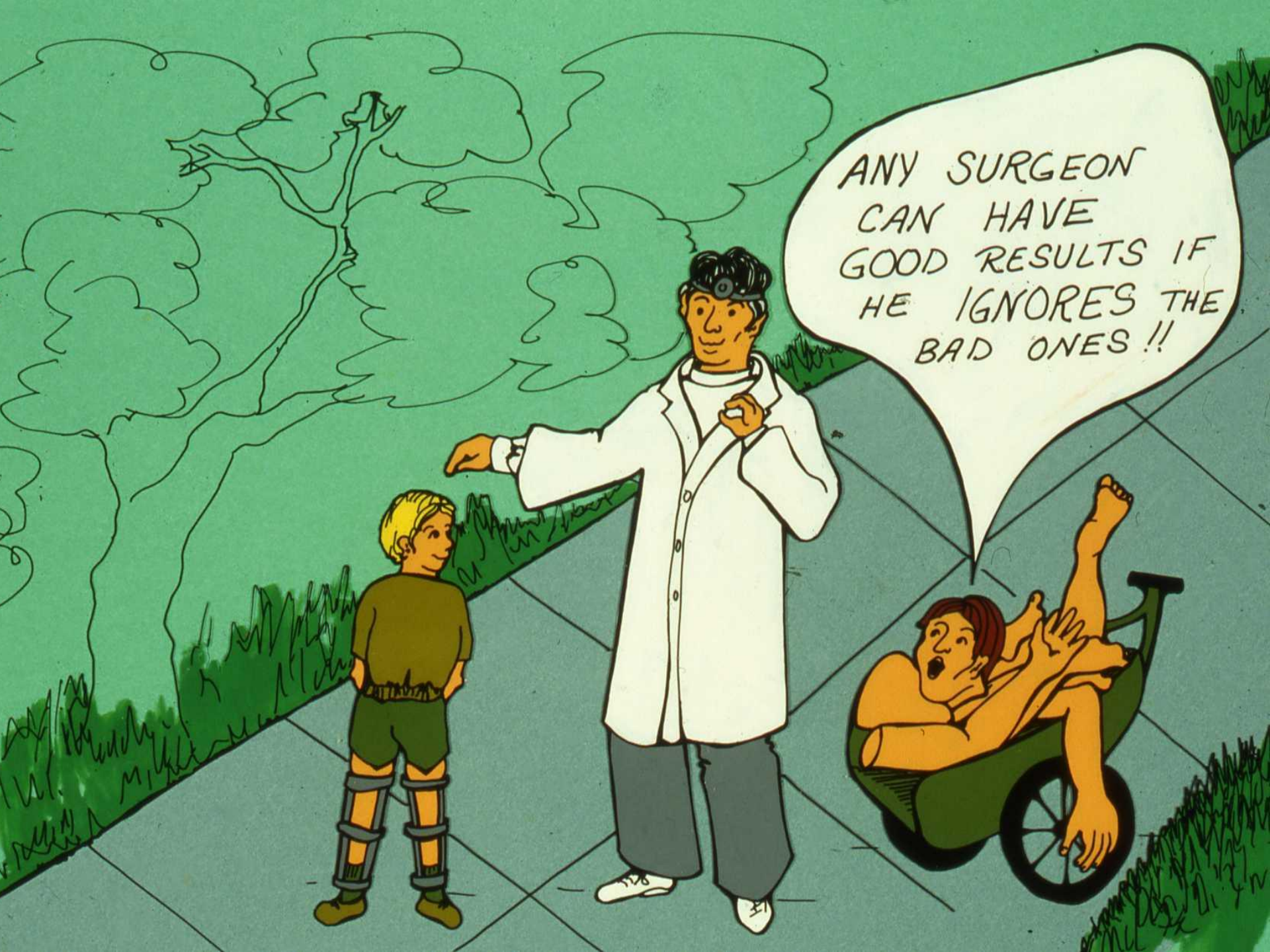






Prevention of deformity and loss of functional skills

- Early aggressive management
- Orthotic management coincidental with initiation of ambulatory skills
- Protect insensate skin
- Routine thorough neurologic re-evaluation
- Interdisciplinary care
- Surgery only to facilitate orthotic management



ANY SURGEON
CAN HAVE
GOOD RESULTS IF
HE IGNORES THE
BAD ONES !!