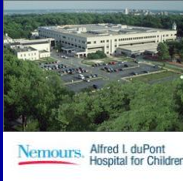


Positioning for Children with Cerebral Palsy Pre and Post Orthopaedic Surgeries

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Cerebral Palsy

- Collection of motor disorders resulting from damage to the brain that occurs before, during, or after birth.
- Resulting in poor coordination, poor balance, or abnormal movement patterns or a combination of these characteristics
- Not Progressive
- Congenital CP – exists from birth – largest proportion of cases

Common CP Complications

- Spine Abnormalities
 - CP Scoliosis
 - Dorsal Rhizotomy
- Spasticity Management
 - Baclofen Pump
- Spastic Hip Disease – 90% of children with a gross motor classification system of a 5 (transported in a manual wheelchair) have an incidence of hip displacement
 - Femoral Osteotomies
 - Hip Muscle Releases (used to halt or prevent subluxation)
- Foot and Ankle Abnormalities
 - Achilles Tendon Lengthening
 - Triple Arthrodesis
 - Lateral Column Lengthening
- G I Issues
 - G-Tube Placement

CP Scoliosis

- Predominant in children with total involvement quadriplegia and specifically, those not able to walk. The severely involved children have a 75-85% chance of developing severe scoliosis
- Scoliosis can be:
 - Single thoracic or double thoracic and lumbar with a level pelvis (most common in ambulatory patients)
 - Long thoracolumbar or C-Shaped curves with a pelvic obliquity (most common in dependent patients)
 - Hypolordosis or Kyphoscoliosis
- Scoliosis is caused by poor muscle control, poor coordination, or asymmetrical muscle pull

CP Scoliosis

- Rarely present in early childhood
 - Small, flexible curves
 - Stiff, structural curves w/ rapid progression – usually associated with a congenital syndrome
- Middle Childhood
 - Postural scoliosis or kyphosis
 - Little progression, remains flexible
 - Address with seating adaptations
 - Beware: thoracolumbar curves with rotation

CP Scoliosis

- Adolescent growth spurt
 - Progression of scoliosis increases dramatically
 - Rate: 2-4° per month
 - Magnitude: 60-90° range
 - Stiffness of structural curve follows in 6-12 months
- Realization of problems related to scoliosis
 - Sitting, head control, arm use, skin breakdown
- Adults: continued progression
 - 40° curves progressed 4° per year
 - 40° curves progressed to a mean of 80°

Miller, *J Ped Orthog*, 1996
Saito, et al, *Lancet*, 1998
Majid, et al, *Spine* 1997

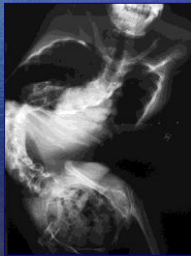
CP Scoliosis Indications

- Consideration of the child's remaining growth
- Severity and stiffness of the curve
- For a child that has a lot of growth remaining, the curve may be allowed to progress further up to 90 degrees if it is not too stiff; because after the PSF is performed spinal growth will stop.
- Usually performed between the ages of 10-15; If the curve becomes too large or too stiff, it will necessitate two operations
- Ultimately, the goal is to correct malalignment so the child will sit straight with a normal appearance.
- Curves between 60-90 degrees are considered candidates for fusion

Clinical Evaluation

Nutritional Status

Pulmonary Status

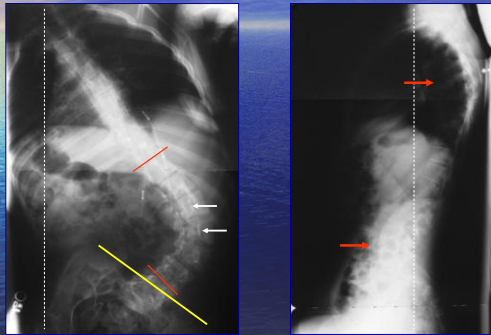


Clinical Evaluation

Curve Flexibility

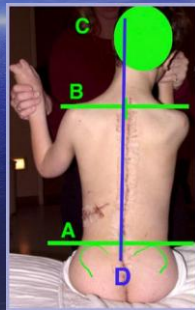


Radiographic Evaluation



Treatment Goals

- Trunk alignment
 - A. Pelvis level
 - B. Shoulders level
 - C. Head above trunk
 - D. Shoulders midline over pelvis
- Sagittal balance
 - Body weight onto proximal thigh
 - Head upright
- Comfortable sitting
- Patient / Caretaker satisfaction



Treatment Alternatives

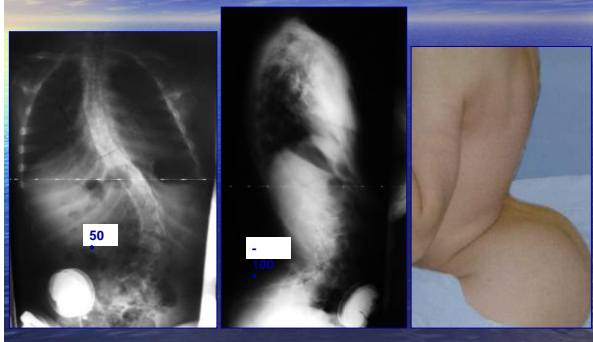
- Bracing with a TLSO
- Seating system
- Therapy
- Electrical stimulation
- Botox
- Surgery

Treatment Alternatives - Seating

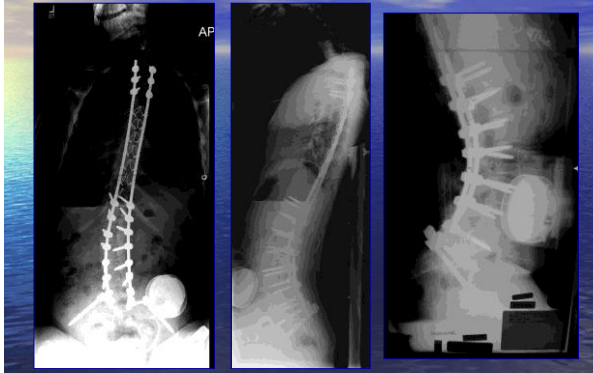
- Adapt wheelchair with offset chest laterals
- 3 point pressure to address sitting balance
- Holmes, *Clin Biomech*, 2003
 - Studied 3 configurations
 - 35% correction with offset laterals in a 3 point force system
- Wheelchair should be the primary seating device

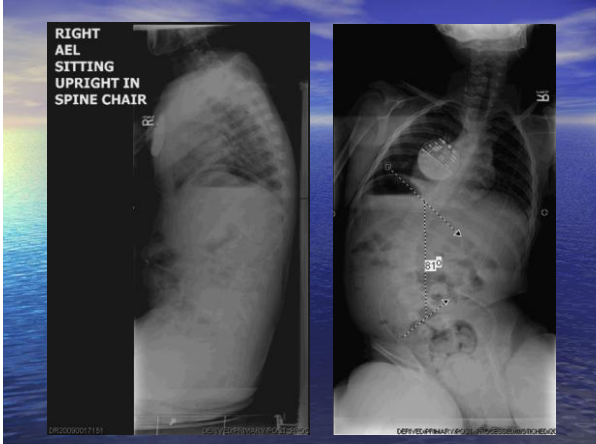


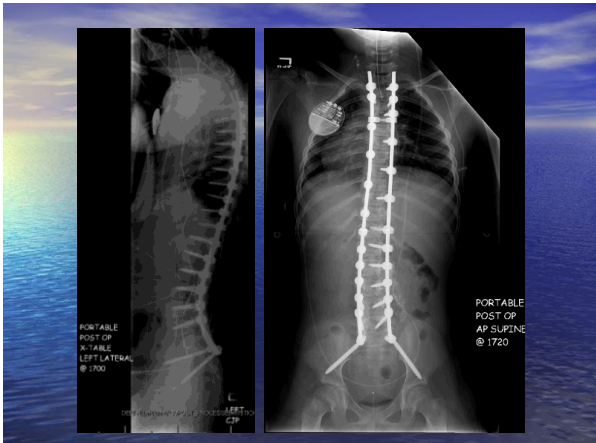
17 yo ♂ CP, Neuromuscular Lordoscoliosis



17 yo ♂ CP, Neuromuscular Lordoscoliosis







Surgical Treatment - Goals

Figure 1. A 15-year-old boy with quadriplegic pattern CP has a severe scoliosis (A) and severe kyphosis (B). One week after unit rod instrumentation the boy's posture is corrected and he can sit independent with no lateral curvature (C) and normal sagittal plane alignment (D).

Tsirikos A, Lipron G, Dabney K et al. *Spine* 2008

CP Scoliosis

- Seating and Positioning Mods
 - Raising the backrest / Headrest
 - Total back height increases between 1” -4”
 - Removing any “pre-surgery” molded system
 - Adjust Lateral supports
 - Accommodate seat depth
 - Adjust joystick placement on power wheelchair including anterior or distal direction as well as armrest height
 - Monitor pressure at top and base of spinal fusion – increased prominences may occur which may indicate a back cutout

Dorsal Rhizotomy

- Correct spasticity – younger children between the ages of 3-7 who are able to walk but are significantly limited in their walking by spasticity
 - Parents temperament is really the major indication – parents willing to take risks and try the newest techniques will be much more inclined to choose Rhizotomy
- The last Rhizotomy that was done here was in 1997. We use the Baclofen pump now. The general trend has been away from Rhizotomy although there are still a few places doing them, it really is an operation whose risk/benefit ratio is not good.

Dorsal Rhizotomy

- Reduced risk of spinal deformities in later years
- Decreased post-rhizotomy motor weakness
- Reduced hip spasticity by sectioning the first lumbar dorsal root
- Shorter-term, less intense back pain
- Earlier resumption of vigorous physical therapy

Dorsal Rhizotomy Complications

- Spotty sensory loss in the lower extremities
- Hypersensitivity of the feet
- Will not completely eliminate all the spasticity, nor will it fix any underlying orthopedic abnormalities
- Although it may reduce the overall number of orthopedic procedures required in a lifetime, it will not eliminate the need for orthopedic procedures in the future

Spasticity

- Spasticity is the most common motor disorder and is seen in approximately 2/3 of those with CP. Dystonia has been effectively treated with IBP but not ataxia, athetosis, or myoclonus
- Baclofen Trial
 - involves a lumbar puncture and injection of an intrathecal baclofen test dose; Spasticity scores are recorded pre-injection and at 2 hr intervals post injection for up to 8 hours; If the trial is felt to be beneficial, then surgery for the placement of the pump is the next step; Patients that have had a spinal fusion surgery cannot undergo a trial, but they can have the pump implanted.

Spasticity Management

Muscle Lengthening Physical Therapy
Selective Dorsal Rhizotomy Wheelchair Seating
Intrathecal Baclofen Therapy
BOTOX Tendon Transfer Braces
Bone and Joint Surgery

Botulinum Toxin (BOTOXTM)

- Localized spasticity problem without contracture
- 3 to 4 month effect, may repeat
- Our typical indications
 - Young child with gastrocnemius spasticity
 - Young child with hamstring spasticity
 - Neck extensor posturing
 - Dystonic arm posturing
 - Buy time before surgery, see effect
 - Postoperative spasm

Intrathecal Baclofen Therapy Spastic Quadriplegia CP Non-Ambulator



Intrathecal Baclofen Therapy

- Outpatient trial
- ITB pump implanted – general anesthesia
- Started on 1.5x test dose over 24 hrs.
- 3 day hospitalization
- Combined with other orthopaedic procedures
- Followed closely, dose adjusted over a 2 week period



Intrathecal Baclofen Therapy



Intrathecal Baclofen

- Baclofen Pump
- VDRO Surgery



Intrathecal Baclofen Therapy

Outcomes

- Reduces upper & lower extremity tone
- Improves function
- Improves gait, endurance, energy expenditure
- Alleviates pain, improves comfort
- Communication and speech
- Eases/facilitates care
- Feeding, nutrition & weight gain
- Improves health-related quality of life

Intrathecal Baclofen

- Seating and Positioning Mods
 - Seatbelt placement usually is changed so as not to go over the pump site
 - Seat to back angle may need to be adjusted for comfort and tone reduction (if it was less than 90 degrees)
 - Long term - changes in tone may necessitate need for different positioning components (headrest, abductor/hip guides). Overall tone will decrease.

Intrathecal Baclofen Therapy

- Expensive
- Frequent follow up / refill
- High complication rate
 - 25% catheter complications alone
 - \$50 million cost (Medtronic, Inc. data)

Spastic Hip Disease

- Research
 - Progressive subluxation and dislocation of the hip are related to the severity of spasticity and are major complications in those patients, causing functional deterioration, stiffness, difficulty in positioning and pain
 - Once a hip develops significant subluxation, stabilization cannot be achieved without a VDRO to decrease anteversion

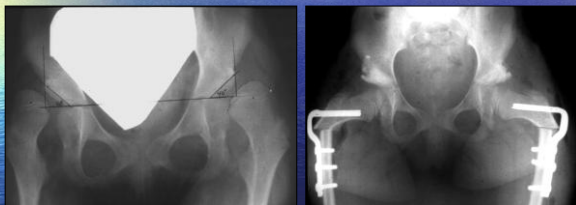
Spastic Hip Disease

- VDRO (Varus Derotational Osteotomy)
- Correct hip subluxation or dislocation
- Involves cutting and repositioning the femur in order to place the ball of the femur more directly into the socket
- Often the leg is slightly shortened, which in turn makes the hamstring muscle feel looser.

Spastic Hip Disease

- If only one hip is corrected...
 - Unilateral hip surgery alters the forces of pelvic alignment which can lead to destabilization of the contralateral hip.
- We *almost always* do both hips to maintain symmetry of motion, posture and length. It makes sitting much easier, seating less complicated and there is less risk of the hip re-dislocating

Spastic Hip Disease: Reconstruction



Preop

Postop

Spastic Hip Disease & Baclofen



Spastic Hip Disease

- Seating and Positioning Mods
 - Removal of hip guides
 - Change armrests from T-arm or dual post to a flip back locking armrest
 - Re-positioning seatbelt to prevent shearing along incision
 - Shorten seat depth to accommodate shorter femur; if just one hip is done, may need to cut back one side of cushion to accommodate both leg lengths which will now be different
 - May no longer need an abductor but may need adductors

Hip Muscle Releases

- Three major reasons why children with CP may require this surgery
 - Prevent hips from dislocating
 - A child usually under age 8 will be examined and when the hip muscles are noted to be tight and an x-ray demonstrates mild hip subluxation, the spastic muscles should be released
 - Help a child who is walking but whose feet cross
 - Because the muscles are tight when the legs are spread apart, they work to keep the feet constantly crossed and tangled while the child is walking.
 - Most common between the ages of 5-10
 - To allow for toileting and perineal care
 - Because the muscles become so tight and spastic
 - Most common age is between 12-20
 - Involves lengthening selected groups of the groin muscle (usually the adductor longus and the gracilis). Muscles are completely cut and allowed to retract

Hip Muscle Releases

- Seating and Positioning Mods
 - Adjust the size of abductor to keep legs midline



Foot / Ankle Surgeries

- When an AFO is no longer keeping the foot flat for the purposes of standing in a stander, or for keeping their feet flat on a wheelchair legrest.
- Achilles Tendon Lengthening
 - Soft tissue surgery
 - This procedure allows the most controlled lengthening of the whole tendon and muscle area.
- Triple Arthrodesis and Lateral Column Lengthening
 - Bony surgery for optimal foot alignment
 - Ankle is fused in one position
 - Weight bearing - discretion of the surgeon

Foot / Ankle Surgeries

- Seating and Positioning Mods
 - Adjust the angle of the footplate to accommodate 90 degree ankle flexion
 - May be in short leg casts for 4-6 weeks post surgery

G-Tube Placement

- If aspiration is causing recurrent pneumonias or chronic congestion
- A Gastrostomy is a tube that goes directly into the stomach through the skin, allowing the person to be fed without having to swallow

G-Tube Placement

- Gastrostomy feeding tube



G-Tube Placement

- Seating and Positioning Mods
 - Chest harness adjustment
 - Seatbelt adjustment
 - Seat to back angle adjustment
 - Patient may have a significant weight gain in the months following the surgery
 - May need to accommodate seating width by widening hip guides
 - May need to grow the frame and seating of the wheelchair
 - May need to adjust laterals for increased width

When Surgical Intervention Does Not Occur



Wound Care for Children with CP

- Why do “wounds” occur
 - Increased Tone –
 - unlikely to get a sore from pressure;
 - more likely to get a pressure sore from shearing
 - Prominent Coccyx / Sacral Area
 - Fluctuating tone can cause shearing along coccyx/sacral area with the backrest (if coccyx is prominent)
 - Solution (cut out area on bottom of back)

Wound Care for Children with CP

- Orthopaedic Surgery
 - VDRO’s, Spinal Fusion’s or any surgery that can “re-orient” the pelvis, changes the pressures distributed on the IT’s as well as the Coccyx and sacral areas

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Thank You
