Selective Dorsal Rhizotomy:

A MULTIDISCIPLINARY APPROACH TO IMPROVING GAIT IN CHILDREN WITH CEREBRAL PALSY WITH RHIZOTOMY: PATIENT SELECTION, SHORT-TERM OUTCOMES AND LONG-TERM OUTCOMES

AACPD 71st Annual Meeting
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Objectives

- Describe characteristics of patients that are consistent with a predictable positive result following SDR.
- Learn the benefits of a multidisciplinary collaborative evaluation in these patients.
- Explore the techniques of rhizotomy and the benefits of utilizing a selective approach in the procedure.
- Review the post SDR short and long term outcomes data.
Why SDR?

- SDR is safe
- SDR rarely worsens gait function when candidates are chosen following careful selection parameters
- SDR is effective at reducing spasticity of cerebral origin
- SDR is permanent
- SDR almost always improves efficiency of gait
- SDR helps reduce the number of orthopedic procedures that need to be performed in order to keep these patients walking

Definitions of abnormal tone

- Hypertonia
  - Abnormally increased resistance to externally imposed movement about a joint. It may be caused by spasticity, dystonia, rigidity, or a combination of features
  - By definition excludes resistance to movement imposed by joint, ligament, or skeletal properties

- Spasticity
  - A velocity dependent resistance to muscle stretch

- Dystonia
  - Involuntary alteration in the pattern of muscle activation during voluntary movement or maintenance of posture
  - With or without hypertonia

- Rigidity
  - Common in adults (parkinsonism), rare in children; resistance to passive movement is not dependent on velocity

  - Task Force on Childhood Motor Disorders 2003
Mechanisms of abnormal tone

Pyramidal or Extrapyramidal

Pyramidal
- Upper motor neurons
- Primary motor area of cerebral cortex
- Internal capsule
- Cerebrum

Primarily Spasticity

Extrapyramidal
- Internal capsule
- Tegmentum
- Globus pallidus
- Subthalamic nuclei
- Substantia nigra

Dystonia, Rigidity, Athetosis, Chorea

Pyramidal
- Periventricular Leukomalacia

Extrapyramidal
- Global or watershed injuries

Spasticity

Dystonia, Rigidity, Athetosis, Chorea
Multidisciplinary Approach

- Physical Therapy Evaluation including video
- Gait Lab Evaluation
- Social Work Consult
- Psychology Consult
- Spasticity Clinic Evaluation
  - Pediatric Neurosurgery
  - Pediatric Orthopedics
  - Pediatric Physiatry

"Checks and Balances"
IC 14 - A MULTIDISCIPLINARY APPROACH TO IMPROVING GAIT IN CHILDREN WITH CEREBRAL PALSY WITH RHIZOTOMY: PATIENT SELECTION, AND OUTCOMES

Physical Therapy Evaluation

- GMFCS
- Equipment
- ROM
- Strength/Selectivity
- Contracture/Deformity
- Tone
  - Ashworth scores
  - Dystonia
  - Interference w/ function
- GMFM
- Subjective Behavior Evaluation

Physical Therapy Video

- Rolling
- Prone on Elbows
- Supine to Sit
- Crawling forward and backward
- Quadraped to side-sit – both sides
- Tall kneel and knee walking
- Kneel to stand
- Sit to stand
- Walking
- Running
- Stairs
- Other
Multidisciplinary Approach

- Physical Therapy Evaluation including video
- Gait Lab Evaluation
- (Social Work Consult)
- (Psychology Consult)
- Spasticity Clinic Evaluation
  - Pediatric Neurosurgery
  - Pediatric Orthopedics
  - Pediatric Physiatry

Accredited Motion Labs by The Commission of Motion Laboratory Accreditation

- A I duPont Hospital for Children, Wilmington, DE
- Children's Hospital of Colorado, Aurora
- Children's Hospital of Los Angeles, CA
- Connecticut Children's Medical Center, Farmington
- Gillette Children's Specialty Healthcare, St. Paul, MN
- Hospital for Special Surgery, New York, NY
- Mayo Clinic, Rochester, MN
- MossRehab and Albert Einstein Healthcare Network, Elkins Park, PA
- Shriners Hospital for Children, Philadelphia, PA
- Shriners Hospital for Children, Salt Lake City, UT
- Shriners Hospital for Children, Spokane, WA

www.cmlainc.org/AccreditedLabs.html
Gait and Motion Analysis

- Helps quantify and localize areas of spasticity
- Helps identify non-spastic tone patterns (dystonia, athetosis, etc.)
  - Evaluates for evidence of primitive stepping patterns in gait that truly represent mass flexion-extension patterns
- Quantifies energy expenditure in gait
- Kinematics of typical gait patterns responsive to SDR can be seen – flat knee curves and plantar flexed ankles at IC

Gait Analysis Resources

- www.cmlainc.org/AccreditedLabs.html
- www.gcmas.org/
Multidisciplinary Approach

- Physical Therapy Evaluation including video
- Gait Lab Evaluation
- Social Work Consult
- Psychology Consult
- Spasticity Clinic Evaluation
  - Pediatric Neurosurgery
  - Pediatric Orthopedics
  - Pediatric Physical

"Checks and Balances"

Clinic Appointment

- Nurse evaluation
  - review the medical record with family
  - review current medications
  - review interim history
- Review of MRIs, radiography, gait analysis results, PT eval and video
- Multidisciplinary Clinic Evaluation
  - Neurosurgery
  - Orthopedics
  - Psychiatry

- History Review
  - identify family expectations of visit
- Focused Physical Exam
  - ROM
  - Spine exam
  - Torsional measurements/joint health
  - Spasticity (Other abnormal tone)
  - Selectivity
  - Strength
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- Multidisciplinary Discussion

- Team convenes outside of the patient's clinic room to collaborate on findings and to develop an agreed upon plan

- Selection
What crucial information does gait analysis provide regarding spasticity management decision-making?

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Candidacy for SDR

- Prematurity with periventricular leukomalacia
- Hypertonia 2° spasticity
- Energy inefficiency
- Antigravity muscle strength
- "Adequate" motor control and selectivity
- Severe contractures not present (4 -7 y/o)
- Psychosocial factors -- adequate cognitive function and motivation