ORTHOPAEDIC SURGERY FOR THE LOWER LIMBS IN CHILDREN WITH CEREBRAL PALSY

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I. GENERAL
   A. Treatment Goals
      i. Maximize function
      ii. Delay/avoid surgery when possible
   B. Optimizing outcome requires optimizing biomechanical alignment
      i. All joints affect all other joints in all planes
      ii. Lever arm dysfunction important in neuromuscular patients
   C. Non-surgical treatments
      i. Bracing
      ii. Stretching
      iii. Physical therapy
      iv. Botulinum toxin (off label indication)
   D. Operative intervention
      i. “The decision is more important than the incision” -- Mercer Rang
      ii. Typical indications
         1. Age: 7 – 10 years
         2. Wait until child has plateaued for ~ 6 months
         3. Non-operative interventions will not suffice
      iii. Single event multilevel surgery (SEMLS), addressing all bone and soft tissue
           issues at one time, is the standard of care
         1. Gait analysis is performed pre-op, when available
            a. Objective evaluation of multiple levels in multiple planes
            b. Optimizes outcome
            c. Decreases rate of reoperation

II. HIP PROBLEMS
   A. Hip flexion contractures
      1. Static and dynamic measures are not well- correlated
         i. 50% with HFC > 10°, do not walk with excessive hip flexion (Rethlefsen et al. J Pediatr Orthop 2010)
         ii. Main problem is crouch, though crouch is often seen in the absence of
             hip flexion contracture (HFC)
      2. Consider surgery (psoas recession) if HFC >10° and significant hip
         flexion in stance
         i. May do this through adductor incision if adductors require lengthening
B. Hip adduction contractures
1. Problems
   i. Scissoring
   ii. Troubles with diapering & hygiene
2. Differentiate between dynamic scissoring and fixed contracture
   i. Surgery
      a. Adductor longus is typically tightest
      b. Gracilis often needs lengthening
      c. Brevis and magnus rarely need lengthening (esp. in GMFCS I-III)
         i. Obturator neurectomy should be avoided (to avoid “frog” positioning of hips)

III. KNEE PROBLEMS
A. Hamstring contracture/knee contractures
1. Flexion contractures are much more common than extension contractures (exception: near drowning survivors)
2. Problems
   i. Crouch
   ii. Difficulty sitting is rare for knee flexion contracture < 90°, but common with knee extension contractures
3. Treatment
   i. Conservative: stretching, knee immobilizers, botulinum toxin (off label indication)
   ii. Surgery (“Dosing” is critical)
      a. Hamstring lengthening (HSL)
         i. Avoid overlengthening (results in recurvatum and often in stiff knee gait)
         ii. Recurvatum much more common with medial/lateral lengthening than isolated medial lengthening
         iii. Do not check popliteal angle following HSL intra-op (due to increased risk of neuropraxia)
         iv. Some authors prefer hamstring transfer, but this remains controversial
      b. Guided growth (anterior hemiepiphysiodesis of distal femur) – for knee contractures if sufficient remaining growth
         i. May use plate/screw construct or just screws
            a. Screws only constructs seem to have less pain and are less expensive
            b. Usually 1-3° of correction per month
         ii. May be combined with patella tendon advancement (PTA)
      c. Distal femoral extension osteotomy (for more severe deformities and/or insufficient growth remaining)
         i. Shortening of femur decreases risk of neurovascular injury
         ii. Better results when combined with PTA
B. Stiff-knee gait
   1. Interferes with foot clearance in swing phase
   2. Often due to rectus spasticity
   3. Consider surgery (distal rectus femoris transfer) if following criteria are ALL met:
      i. Excursion from stance to swing < 50° or delayed timing of peak knee flexion in swing
      ii. EMG shows rectus is overactive in swing phase
      iii. GMFCS I or II function

IV. Ankle/Foot problems
   A. Equinus
      1. Important to make sure:
         i. Whether equinus is dynamic or due to static contracture
      2. Be sure that toe-walking is due to equinus and not knee and/or hip flexion
         i. Toe-walking in AFO’s is a tip-off that knee/hip are issues rather than heelcord
      3. Avoid surgery whenever possible (by using stretching, braces, serial casting...)
         i. Heelcords are better a little tight than a little loose
         ii. Calcaneus gait more common with age (even without previous surgery)
         iii. Calcaneus reported in up to 30-40% of patients following heelcord surgery
            a. Rate much lower with gastroc recession than TAL
   B. Varus
      1. Contributors
         i. Anterior tibialis ~ 1/3 of cases
         ii. Posterior tibialis ~ 1/3
         iii. Anterior & Posterior tibialis ~ 1/3
      2. Differentiate between flexible and rigid deformities
      3. Surgery
         i. Balance soft tissues
         ii. Bony surgery also needed for rigid deformity
   C. Valgus
      1. Differentiate pes valgus from ankle valgus
         i. Clinical exam – lateral malleolus should be distal to medial malleolus
         ii. AP ankle x-ray – if clinical exam suspicious for ankle valgus
            a. If “normal” ankle, distal fibular physis is at level of ankle joint
      2. Often associated with tight gastrocnemius and peroneals
      3. If surgery is needed, calcaneal osteotomies help preserve hindfoot motion
      4. Talonavicular fusion may be needed for severe midfoot break
      5. Once the hindfoot valgus is corrected, assess for midfoot/forefoot supination
         i. If fixed supination present, then perform medial column plantarflexion osteotomy
V. LEVER ARM DYSFUNCTION

A. General
1. Problematic due to abnormalities in balance, strength and coordination
2. Surgery may be needed to address lever arm dysfunction due to torsional deformity, foot deformity and/or hip subluxation

B. Long bone torsion (femur and/or tibia)
1. Consider osteotomy if torsion persists and interferes with function
2. Femoral osteotomy
   i. Comparable results for proximal and distal osteotomies
   ii. Proximal osteotomy indicated if:
      1. Coxa valga, and/or
      2. Hip subluxation
   iii. Surgical correction should be 1.5 – 2:1 of what is deemed clinically
3. Tibial osteotomy
   i. Distal osteotomy is much safer than proximal osteotomy
   ii. Fibular osteotomy is not needed for rotational correction
   iii. Surgical correction should be 1:1

REFERENCES (1-25)


