The Hip in the Spastic Child: Orthopaedic Perspective

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GMFCS

- Hip problems are closely related to GMFCS status.
- The GMFCS is the most reproducible and useful CP classification.

- **GMFCS Level I**
  Children walk indoors and outdoors and climb stairs without limitation. Children perform gross motor skills including running and jumping, but speed, balance and co-ordination are impaired.

- **GMFCS Level II**
  Children walk indoors and outdoors and climb stairs holding onto a railing but experience limitations walking on uneven surfaces and inclines and walking in crowds or confined spaces.

- **GMFCS Level III**
  Children walk indoors or outdoors on a level surface with an assistive mobility device. Children may climb stairs holding onto a railing. Children may propel a wheelchair manually or are transported when traveling for long distances or outdoors on uneven terrain.

- **GMFCS Level IV**
  Children may continue to walk for short distances on a walker or rely more on wheeled mobility at home and school and in the community.

- **GMFCS Level V**
  Physical impairment restricts voluntary control of movement and the ability to maintain antigravity head and trunk postures. All areas of motor function are limited. Children have no means of independent mobility and are transported.
The hip in ambulatory patients – typically GMFCS 1-3

- Scissoring
  - adductor tightness

- Pseudoscissoring
  - knee flexion/femoral anteversion
Femoral Anteversion
Nonambulatory CP hip

- Pain common in more responsive patients as they age.
- Some minimally responsive children become painful.
- Most orthopedists recommend surgery on subluxated or dislocated hips in young children but wait for symptoms in older patients.
Risk Factors for Hip Displacement in Children With Cerebral Palsy: Systematic Review

Blazej Pruszczyński, MD,* Julieanne Sees, DO,† and Freeman Miller, MD‡

Background: When hip displacement in children with cerebral palsy (CP) is identified early, treatment is more successful. The standard test is a radiograph of the pelvis measuring the migration index (MI). Our study aims to review published literature progress from subluxation to dislocation. In early stages of hip subluxation, children may have no signs of pain or discomfort, and pain may be present with the dislocation of the hip.3,4 The prevalence of complete dislocation has been reported to be between 10% and 15%.5,6 sub-

Conclusions: Applying a practical surveillance program for children with CP can prevent hip dislocation, provide early treatment, and ultimately lead to consistently better outcomes than those of neglected hip dislocations. The GMFCS level has a strong impact on subluxation risk and that the risk continues to the end of growth.

Level of Evidence: Level III—systematic review.

Key Words: cerebral palsy (CP), migration percentage (MP), subluxation, dislocation, gross motor function classification system (GMFCS), radiograph (J Pediatr Orthop 2016;36:829–833)

spasticity as the hip migrates laterally.11 The Gross Motor Function Classification System (GMFCS) categorizes the ambulatory ability and motor function of children with CP for surveillance for impending deformities, such as progressive hip disease.12

The treatment of hip displacement in children with CP is less invasive and more successful in hips with less hip degenerative change and less displacement. In addition, pain from degenerative changes may be prevented. When the hip is highly dislocated and the patient has been exposed to the pain for a longer time, surgical results are much more likely to be inadequate. Moreover, it is important to understand the natural history of the hip displacement and the role of the various factors that lead to the progression of the condition.
**Grade I: Normal Hip – Migration Percentage <10%**
1. Shenton’s arch intact
2. Femoral head round (within 2mm using Mose circles)
3. Acetabulum – normal acetabular development with a normal horizontal sourcil, an everted lateral margin and normal tear drop development
4. Pelvic obliquity less than 10 degrees

**Grade II: Near Normal Hip – Migration Percentage ≥10% ≤15%**
1. Shenton’s arch intact
2. Femoral head round or almost round
3. Acetabulum – normal or near normal development
4. Pelvic obliquity less than 10 degrees

**Grade III: Dysplastic Hip – Migration Percentage >15% ≤30%**
1. Shenton’s arch intact or broken by less than or equal to 5mm
2. Femoral head round or mildly flattened
3. Acetabulum normal or mildly dysplastic including blunting of the acetabular margin and a widened tear drop
4. Pelvic obliquity less than 10 degrees

**Grade IV: Subluxated Hip – Migration Percentage >30% <100%**
1. Shenton’s arch broken by more than 5mm
2. Femoral head variable deformity – Appendix 1
3. Acetabulum variable deformity – Appendix 2
4. Pelvic obliquity variable – Appendix 3

**Grade V: Dislocated Hip – Migration Percentage ≥100%**
1. Shenton’s arch completely disrupted
2. Femoral head variable deformity – Appendix 1
3. Acetabulum variable deformity – Appendix 2
4. Pelvic obliquity variable – Appendix 3

**Grade VI: Salvage Surgery**
1. Valgus osteotomy
2. Arthrodesis
3. Excision arthroplasty (Castle) ± valgus osteotomy (McHale)
4. Replacement arthroplasty
Hip Screening

- Several Protocols Exist
- Criteria based on GMFCS, Age, Migration Index
- Winter pattern in hemipligia
FIG. 1. Measurement of migration percentage (MP) and acetabular index (AI). H, Hilgenreiner’s horizontal line between triradiate cartilages. P, Perkin’s line drawn perpendicular to the H-line at the lateral margin of the acetabulum. The MP represents that portion of ossified femoral head that has migrated laterally beyond Perkin’s line. MP = A/B × 100%. The AI is measured in degrees.
American Academy for Cerebral Palsy and Developmental Medicine

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**Notes re: Initiation**
- If CP is diagnosed or suspected after age 2 but before 4 years, begin surveillance immediately. Do not wait until 4 years of age.
- If CP is diagnosed or suspected after age 2, immediately begin a 3-monthly schedule for a minimum of 24 months.
- If CP diagnosed or suspected after age 2 but before age 4, begin surveillance immediately.

**Frequency Modifiers**
- Do not reduce from previous higher frequency if:
  1. 24 months of surveillance have not yet been completed based on a child’s surveillance start date;
  2. Stability is not yet achieved over a period of 2 years. Stability is defined as < 10% change in MP over a 12 month period; or
  3. MP > 30%.
- In the presence of pelvic obliquity associated with clinical or radiographic evidence of increasing scoliosis, the hip(s) continue to be at risk and should ideally be monitored even beyond skeletal maturity.

**Discharge**
- Discharge if MP ≤30% at age 10 (unless WGN Gait Type IV).
HIP SURVEILLANCE
at your fingertips.

One in three children with cerebral palsy will
develop hip problems. Early detection through
a "Hip Surveillance Program" can preserve a
child’s function and prevent pain. Learn how
to implement a Hip Surveillance Program for a
child with cerebral palsy with HipScreen, a
free app developed by physicians specializing
in cerebral palsy.

EASY TO USE...
with a just a little help!

TUTORIALS
Prevention of hip displacement in children with cerebral palsy: a systematic review

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AIM To conduct a systematic review and evaluate the quality of evidence for interventions to prevent hip displacement in children with cerebral palsy (CP).

METHOD A systematic review was performed using American Academy of Cerebral Palsy and Developmental Medicine (AACPDM) and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology. Searches were completed in seven electronic databases. Studies were included if participants had CP and the effectiveness of the intervention was reported using a radiological measure. Results of orthopaedic surgical interventions were excluded.

RESULTS Twenty-four studies fulfilled the inclusion criteria (4 botulinum neurotoxin A; 2 botulinum neurotoxin A and bracing; 1 complementary and alternative medicine; 1 intrathecal baclofen; 1 obturator nerve block; 8 positioning; 7 selective dorsal rhizotomy). There was significant variability in treatment dosages, participant characteristics, and duration of follow-up among the studies. Overall, the level of evidence was low. No

INTERPRETATION The level and quality of evidence for all interventions aimed at slowing or preventing hip displacement is low. There is currently insufficient evidence to support or refute the use of the identified interventions to prevent hip displacement or dislocation in children and young people with CP.
Natural History

• Long term follow-up of dislocated hips show pain in more intelligent patients.
• But, minimally responsive children MAY become painful.
• Early treatment is more predictable than late treatment.
• Recurrence more common with higher GMFCS
• Most orthopedists recommend surgery on subluxated or dislocated hips in young children but wait for symptoms in older patients.
Hip procedures – Traditional Approach

- Young children (3 or less):
  - Adductors
  - Adductors, psoas and hamstrings
- Child (3-5yrs)
  - Varus derotational osteotomies
- Older child (6 yrs-closed TRC)
  - Add pelvic procedure
- Salvage
  - Girdlestone, inteposition arthroplasty, valgus osteotomy, THA or hemiarthroplasty
- More recent evidence – Do Everything Early
Technique
After adductor lengthening:

Most spastic hip will not require an open reduction after the shortening.
If the hip reduces well, a 90 degree plate with the hip reduced and placing the guide pin parallel to TRCs is simple.
Dega – Aluminum retractors are helpful
Conclusions: Among nonambulators, the available literature suggests that FHR, VO, and THA may be superior at relieving pain than arthrodesis. FHR had the lowest absolute percentage of complications; however, no significant differences in complication rate or pain relief were found in nonambulators undergoing FHR or VO. Most of the complications for VO were implant related, and potentially amenable to hardware removal versus complications in FHR, which were related to the procedure itself such as proximal migration and heterotopic bone formation. THA in nonambulators was associated with complications such as dislocation and revision. Arthrodesis in nonambulators was associated with >100% complication rate and inferior pain relief compared with other procedures. Ambulatory patients had excellent pain relief with THA; however, the complication rate is higher than can be expected with non-neurological populations. Insufficient data exist to support use of other salvage procedures in ambulators. These conclusions should be interpreted with caution as all studies involved level IV evidence.
Is it really the hip that hurts?
Salvage Options
Hip Salvage

• Be sure it is the hip that hurts
• Take your choice on procedures (except fusion)
• Heterotopic bone can be a problem with resection.
• If you resect, do it BIG!
  – Castle not Girldleston
Summary

• In ambulatory children, make sure scissoring is from the adductors and not rotation.

• GMFCS 4, 5, and Winter 4 are at highest risk of subluxation or dislocation and pain.

• Use screening protocols.

• If you operate, be more rather than less aggressive – you can help.

• Reoccurrence happens – especially with GMFCS 5.

• All salvage procedures have complications.