MANAGEMENT OF THE HIP IN CEREBRAL PALSY
The Revised Australian Standards of Care for Hip Surveillance and their Relevance to Management

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Disclosure Information
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PT, AK: We have no financial relationships to disclose.
KG: Surgeon’s Advisory Board, Orthopediatrics
Disclosure of Off-Label and/or investigative uses:
We will discuss the following off label use and/or investigational use in this presentation:
Botox to lower limb muscles.
Privacy:
We have permission to show the videos used in this presentation.

Learning Objectives
1. Gain knowledge of the evidence for management of hip displacement
2. Understand the rationale and timing of surgical intervention
3. Understand the management of hip displacement in relation to severity of the motor disorder and to other complex and competing needs of the child
4. Gain knowledge about the evidence for long term outcomes of surgical and non surgical interventions

Questions
1. What factors best predict hip displacement in children with CP?
2. What is the role of non surgical management of hip displacement in children with CP?
3. Describe the relationship between GMFCS and the benefits of adductor release.
4. Which surgical intervention has the greatest impact on hip displacement?

What are the effects of hip displacement/ dislocation?

Progressive Musculo-skeletal pathology

- Muscle Contraction
- Primary abnormalities
  - Abnormal Muscle Tone
  - In adequate Muscle Mass
- Developmental Delay
- Activity Limitation
- Muscle Fatigue
- Bony Deformity
- Joint Instability
- Degenerative Arthritis
- Pain
- Effect of Growth
  - Bone
  - Muscle
- Functional Impairment
- Disability

Thomason et al IC 29, AACPDM, 2014
Hip Displacement (MP>30%) & GMFCS

Femoral Geometry

- Bony Anatomy

What we have learnt?

- Epidemiology
  - Hip displacement directly related to GMFCS

- Natural History
  - Femoral geometry FNA high in CP, NSA related to GMFCS
Hip Surveillance: Definition
- Detection of early hip displacement
- By an active screening program

Hip Surveillance: Indications
- Spasticity
  - Reduced abduction range
- Hypotonia
  - Wide abduction
- Delayed walking or inability to walk
- Concern of health care professional
- Concern of parent/caregiver

Hip Surveillance: How?
- Serial monitoring with:
  - Repeated, recorded, physical examination
  - Pelvic radiograph with standardised positioning
  - Gait videos for ambulant patients
- Team approach
- Clear lines of responsibility
- Responsive, first class surgical service

Physical examination
- Hip abduction in flexion & extension
- Hip flexion - Thomas Test
- Femoral neck anteversion
- Hamstrings (popliteal angle)
- Knee extension (capsule)
- Modified Tardieu: contracture or spasticity?

Hip Surveillance: Radiography
- Standardised AP radiograph of pelvis
- Key measurement
- Reimer’s Migration Percentage (MP)

Migration percentage (MP)
- The amount of ossified femoral head which is not covered by ossified acetabular roof
- Percentage of the femoral head lateral to Perkins’ Line
  (Reimers, 1980)
Hip Surveillance Reporting

- Ortho Surgeon
- Physiotherapist
- Rehab Consultant
- Paediatrician
- Families

Hip Surveillance Guidelines

- Based on GMFCS Level
- Initial assessment and radiograph at 12-24 months of age
- Physical examination and radiograph at each assessment
- Verify GMFCS level at each review
- Review until skeletal maturity
- Winters & Gage Type IV hemiplegia surveillance according to this classification regardless of GMFCS

Report

Ortho Surgeon
Physiotherapist
Rehab Consultant
Paediatrician
Families

Hip Surveillance: When?

The development of Australian Standards of Care for Hip Surveillance in Children with Cerebral Palsy: How do we do it?

- Wynter et al
- Endorsed by AusACPDM, 2009
- Based on literature review and expert opinion

Guidelines: Outcomes

- 5 year outcome of state-wide hip surveillance of children and adolescents with CP
- 1115 children 73% population
- 38% discharged
- 62% remain
- 28% MP > 30%
- No child has progressed to dislocation without orthopaedic review

Guidelines

- Based on GMFCS Level
- Initial assessment and radiograph at 12-24 months of age
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Comparison study Norway versus Sweden

Children born 1996-2003
Sweden – Hip Surveillance
Norway standard care
Norway 15% hip dislocation
Sweden 1 child
HS reduced the number of hip dislocations

335 Norwegian children with CP- hip surveillance
First X ray at 3 years
GMFCS I-V
Hip displacement (MP> 33%) in 26% children
4% dislocation
Need for improvement in hip surveillance and timing of intervention

Guidelines: Outcomes

Review of Australian Surveillance Guidelines 2013

Systematic review of current literature
Expert opinion: Orthopaedic survey
Data review
Working Group meeting
  • Identify clinical issues with current Standards of Care

Systematic Review

Evidence of effectiveness of hip surveillance programs
Identify factors associated with progression of hip displacement
Evidence of factors which may inform changes to 2008 Consensus Statement.

Systematic Review: Method

Databases searched
Manual search of reference lists
Inclusion criteria
  • CP
  • Report factors influence hip progression / hip surveillance
  • Reported MP
  • Full published paper available
  • English

Systematic Review: Results

290 papers identified
  • 120 removed at title and abstract review
  • 155 removed after full text review
  • 15 articles included
### Systematic Review: Results

- Hip surveillance is effective
  - Decreased incidence of hip dislocation
- Guidelines supported by evidence
  - Confirmation of relationship of gross motor function to hip displacement
  - Hip ROM: not predictive
  - GMFCS I – elevated MP improves with time
  - Effect of proximal femoral geometry
  - Age and Hip migration: as early as ≤ 2 years age

### Systematic Review: Results

- Hip surveillance guidelines modifications indicated
  - Can progress after skeletal maturity
  - Postural asymmetry
    - pelvis obliquity and scoliosis elevate risk of hip progression

### Orthopaedic survey

**Methodology:**
- Questions targeted to aspects of Standards of Care 2008 under scrutiny
- Participants
  - Orthopaedic Surgeons each state of Australia
  - nominated by the Australian Hip Surveillance Working Group
  - surgical management for children with CP
- 19 surveys distributed

**12 surveys returned**
- 2 years is appropriate age for radiograph
  - GMFCS I/II/III
  - WGH IV 11/12
  - GMFCS II
    - If hips are enlosed and stable surveillance can stop at 10 years 9/12
  - GMFCS III/IV/V
    - Xray frequency appropriate 8/12
    - Can stop at skeletal maturity unless pelvic obliquity/scoliosis or high MP 8/12
    - GMFCS IV & V
      - Can dislocate as adults 8/12

### Working group meeting

- 2 days in Perth
- Review
  - Clinical questions
  - Issues discussed
  - Surveillance data
  - Case reports
  - Ortho Survey
  - Close teamwork!
**Australian Hip Surveillance Guidelines for Children with Cerebral Palsy: 2014**

- Endorsed AusACPDM Feb 2014
- Essentially same
- Changes: Clarification, Extension, New Annotations
- Review in 2019

**GMFCS I**

- Initial clinical assessment and review followed by GPH (should be at least 4 weeks of age)
- GMFCS I can be arrived at by clinical assessment and radiographs
- In GMFCS I, clinical and radiographic assessment is performed in keeping with GMFCS I standards
- Radiographs are not mandatory, but often requested by clinicians

**GMFCS II**

- Hemiplegia WGH Type IV
- GMFCS II can be arrived at by clinical and radiographic assessment
- Hemiplegia WGH Type IV

**GMFCS III & IV**

- GMFCS III & IV can be arrived at by clinical and radiographic assessment
- GMFCS III & IV

**GMFCS V**

- GMFCS V can be arrived at by clinical and radiographic assessment
- GMFCS V
Clarification
- Measuring MP
- Skeletal maturity
- Pelvic obliquity

Extension
- Referral back to surveillance
- After skeletal maturity and transition

New annotations
- Neurosurgical interventions
- Transition
- MCPHCS
- Hip Health
- Interventions

New annotations
- Transition

New annotations
- The Melbourne CP Hip Classification Scale (MCPHCS)

Management of Hip Displacement
- Non-operative options
- Surgical options
  - Preventive
  - Reconstructive
  - Salvage
Management Options: Non-operative

- BoNT-A and bracing
- Stretching and Postural systems/programs
- Standing frames
- Complementary and alternative approaches

Evidence - BoNT-A and bracing

**SHORT-TERM**

- 6/12 BoNT-A injections + SWASH (3 yrs)
- Rate of displacement per year lower in BoNT-A group (2.6 vs 5.7%)
  - Not clinically significant
- Fewer children in the treatment group exited to surgery (11 vs 22)
  - Clinical significance unclear due to short follow-up

**LONG-TERM**

- 10 year follow-up of VIC cohort from RCT
- MP, MCPHCS, surgical requirements?
- No difference between groups at 10 years

Evidence – Postural programs

- Postural management may slow the progression of hip displacement?
  - Night time abduction bracing (Hankinson 2002)
  - Standing frames (Macias 2005)
  - 24-hour postural management (Pountney 2009)
- Small, heterogenous samples (GMFCS)
- Lack of controlled studies
- Long term follow-up required

Evidence – CAM approaches

- Long-term follow-up of children whose parents decline hip surgery to pursue CAM
- Retrospective audit; comparison to surgery when recommended
- Progressive displacement inevitable for non-ambulant children (GMFCS IV & V)
- Pain and eventual surgery despite CAM
Evidence – CAM approaches
• DOUBLE the odds of requiring more invasive surgery

- TWELVE times the odds of a poor outcome after surgery (MCPHCS)

Management Options: Non-operative
• Little evidence that effective for either slowing or preventing displacement
• May be other reasons why these interventions are used or explored:
  - BoNT-A to adductors to reduce scissoring in gait, improve hygiene/personal care
  - Standing frames for social engagement
• Important that parents know that these options will neither help displacement nor make it worse

Management Options: Surgical
Salvage Surgery
• After the horse has bolted…. 

“Preventive” Surgery
• Can we stop this process of worsening subluxation?

Reconstructive Surgery
• Putting all the bits back in the right place….

Principles of surgery
Lengthening of contracted muscles
• Adductors
• Hip flexors- iliopsoas

Correction of bone deformity
• The proximal femur
• The acetabulum

Restoration of normal joint alignment
• Acetabular index
• Migration percentage

Salvage surgery
• Attempt to restore some function

Salvage Surgery
A dysplastic, dislocated hip is a disaster!

...but the options for managing it are not much better!
Salvage Surgery: Evidence

- Evidence base is poor – retrospective, subjective
- Anecdotally:
  - Pain relief uncertain: often delayed, or incomplete
  - High morbidity: HO, proximal migration,
  - High revision rate

Salvage Surgery: Evidence

- Literature review published 2013
- Small number of papers, wide variety of surgical approaches
- **HIGH** complication rates:
  - THR: 29% dislocation rate, 45% heterotopic ossification
  - Arthrodesis: total complication rate 42% (non-union common)
- Delayed an incomplete pain reduction – poorly measured
- Authors stress CAUTION about any conclusion drawn

**Best treatment? Prevention!**

“Preventive” Surgery

- Contracted muscles decrease joint range
- Lengthening them allows more ROM
- More ROM should allow better function

Muscle Surgery for hip displacement
Abduction in Broomstick cylinder casts

Adductor surgery success vs GMFCS

Reconstructive Surgery
- Femoral osteotomy
  - +/- Open adductor lengthening
- Pelvic osteotomy

Femoral Osteotomy
- Correcting the Version
- Restoring the appropriate neck shaft angle

Femoral Osteotomy
- VarusDeRotation
- VDRO
Classification of Hip Morphology

- Quantitative Radiographic Measure
  - MP
- Qualitative Radiographic Features
  - Break in Shenton’s Line
  - Shape of the Femoral Head
  - Development of Lateral Acetabular Margin
  - Presence of Pelvic Obliquity

Classification reliable & valid

Follow up in Hemiplegia

- Follow up in Hemiplegia
- Multilevel Surgery Improves Gait in Spastic Hemiplegia But Does Not Resolve Hip Dysplasia
- Clin Ortho & Related Research 2011; 470: 1294-1302
- 11 children
Follow up in Hemiplegia

- Conclusion
  - Unilateral SEMLS improved gait
  - Persistent hip dysplasia (MCPHCS)
  - Need just one hemi case here

Summary and Conclusion