Treatment of hip dysplasia in children with cerebral palsy

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Why do CP children have problems in the musculo-skeletal system

• Spastic pareses

• Imbalance between muscle groups

• Loss of selective motor control
Clinical problems

- Gait- and sitting problems
- Pain and stiffness
- Scoliosis
- Hip dislocation
Hip joints in CP

normal hips at birth

many develop hip dysplasia and dislocation during childhood
Why should hip dislocation be avoided?

• stiffness contractures

• pain (about 50%)

• pelvic obliquity  scoliosis

• gait and sitting problems
Development of hip dysplasia and its consequences in CP
• What is the **natural history** of hip dysplasia in CP?

• Which **factors** influence the natural history?
Cerebral Palsy Registry

Systematic registration of all children with CP born after

Jan. 1, 2002 in South/East Norway

Radiography of the hip joints

is part of this follow-up program

Aim of hip joint screening is

to avoid hip subluxation and dislocation
Indirect measurement of the femoral head coverage:

**Migration Percentage (MP)**

distance $a$ from lateral tangent of femoral head to Perkins’ line, 
distance $b$ transversal diameter of the femoral head 

$MP = \frac{a}{b} \times 100$
Migration percentage

percentage of femoral head lateral to acetabulum

MP<33 %    normal
MP 33-89 %  subluxation
MP>90 %     dislocation

MP = \frac{a}{b} \times 100
Hip joint screening

CP children born 2002 - 2006

329 children

144 girls (44%) and 185 boys

age: 2.9 år years (0.5 – 7.4) at the first pelvic radiograph
Results

First radiograph

Migration Percentage (MP) (worst side) 20 % (0 – 100)

MP in children with good gait function (no support) 15 %
     “” “” who walk with support 23 %
     “” “” with no gait function 28 %

Increase in MP with reduction of function
Radiographic conclusion

<table>
<thead>
<tr>
<th></th>
<th>percent hips</th>
</tr>
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<tbody>
<tr>
<td>Normal</td>
<td>MP &lt;33 %</td>
</tr>
<tr>
<td></td>
<td>85 %</td>
</tr>
<tr>
<td>Subluxation</td>
<td>33-89 %</td>
</tr>
<tr>
<td></td>
<td>14 %</td>
</tr>
<tr>
<td>Dislocation</td>
<td>≥90 %</td>
</tr>
<tr>
<td></td>
<td>1%</td>
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</table>

15 % abnormal hips already at the primary radiographs
**Natural history related to gait function**

**Increase in MP per year**

during follow-up (mean 2.4 years)

<table>
<thead>
<tr>
<th>Gait Function</th>
<th>GMFCS Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk without support</td>
<td>I/II</td>
<td>0.2 %</td>
</tr>
<tr>
<td>Walk with support</td>
<td>III</td>
<td>1.7 %</td>
</tr>
<tr>
<td>No gait function</td>
<td>IV/V</td>
<td>7.9 %</td>
</tr>
</tbody>
</table>
Conclusions, natural history

• Pronounced trend to lateral migration of hip joints in children without gait function

• Close follow-up is important in this group, first radiograph at age 1-2 years

• Much better prognosis in children who walk, especially those who walk without support
Diplegia, good gait function without support

age 1.5 years

6 years, normal hips
Prophylaxis to avoid hip dislocation

- Non-surgical treatment
  no proven effect

- Surgical treatment
  soft-tissue release
  femoral and pelvic osteotomies
Adductor tenotomy

• Results?

• Predictors for good/poor results?

Adductor tenotomy in spastic cerebral palsy.
Terjesen T, Lie GD, Hyldmo Å, Knaus A.
Acta Orthopaedica 2005; 76: 128-37
Adductor tenotomy  1986-91

• 78 patients   32 girls
• age  8 (1-17) years
• CP: 40 diplegia  38 quadriplegia
Soft tissue release

- **Adductor tenotomy**
  - *add. longus, gracilis*
  - (add. brevis if $<50^\circ$ abduct.)

- **Iliopsoas tenotomy**
  - if flexion contracture

Plaster cast 5 weeks
Migration percentage (MP)

percentage of femoral head lateral to acetabulum

\[ MP = \frac{a}{b} \times 100 \]

- MP < 33 % normal
- MP 33-89 % subluxation
- MP > 90 % dislocation
Radiographic results (worst hip)

follow-up 10 (2 - 17) years

Kalen og Bleck 1985

Good result: MP < 10% increase
Poor: ” ” >10% ”

• Good results 39/53 pat 73%

• Poor ” ” 14 ” 26%
Increase in lateralization after adductor tenotomy

MP increased 1.9 % per year

(natural history: mean 6 % increase per year in bilateral CP)
Patients with good results

- Lower preoperative MP 34% vs 49%
- Lower preop. Acetabular Index 23° vs 27°

Factors without significance:
age, sex, type CP, gait function, radicality of surgery
Good result, from sublux to normal

Boy 4 years, diplegia

10 years after bilat add tenotomy
Good result, from sublux to almost normal

girl 3 years, diplegia,

3 years postop.
readd tenot left

8 years after readd tenotomy
Deterioration from sublux to dislocation

boy 2 years, quadriplegia
no gait function

1.5 years postop

10 years postop
Hip dysplasia **changed side in 5 patients**

- improvement of the worst side, deterioration of the other side
- after bilateral adductor tenotomy, more radical on the worst side

boy 4 years, no gait function

13 years postop
Further surgery

27 patients

because of

• increasing subluxation  14 pas

• clinical indications  13 pas
  (gait function, symmetry)
Deterioration in relation to CP type

MP increase >10 %

<table>
<thead>
<tr>
<th></th>
<th>Diplegia</th>
<th>Quadriplegia</th>
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<tbody>
<tr>
<td>Natural history</td>
<td>34</td>
<td>68</td>
</tr>
<tr>
<td>Adductor tenotomy</td>
<td>16</td>
<td>41</td>
</tr>
</tbody>
</table>

worse prognosis in quadriplegia than in diplegia
Conclusions

• Adductor tenotomy reduces lateralization of the hips

• Good effect in 2/3 of the patients

• Should be done before MP 50%
Severe subluxation and dislocation

Surgical treatment

**femoral osteotomy**, often combined with
**pelvic osteotomy**
Femoral osteotomy

Varization, rotation, and often shortening

boy 4 years

6 years
Pelvic osteotomy

Incomplete; modified Dega osteotomy
bone wedge from femur
no fixation
often hip spica cast postop
## Migration (MP) in relation to type of osteotomies

<table>
<thead>
<tr>
<th>Method</th>
<th>N</th>
<th>preop</th>
<th>follow-up</th>
<th>MP reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral osteotomy</td>
<td>33</td>
<td>65</td>
<td>33</td>
<td>32 %</td>
</tr>
<tr>
<td>mean age 8 yrs, f-up 5 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fem and pelvic osteot</td>
<td>40</td>
<td>82</td>
<td>22</td>
<td>60 %</td>
</tr>
<tr>
<td>mean age 9 yrs, f-up 5 yrs</td>
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**Best correction after combined femoral and pelvic osteotomies**
Radiographic results

- Good: migration percentage at follow-up $< 33\%$
- Fair: $33 – 49\%$
- Poor: $> 50\%$

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<tr>
<th></th>
<th>Femoral osteotomy</th>
<th>Fem and pelvic osteot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td><strong>N</strong></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>58 %</td>
<td>82 %</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>30 %</td>
<td>5 %</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12 %</td>
<td>12 %</td>
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Pelvic osteotomy
Dega procedure
Good outcome

Girl 13 years

postop

6,5 years postop
Failed Dega osteotomy

girl, 8 years, QP, no gait function

4 months postop

2 years postop, no pain, no reoperation
Difficult case

boy, age almost 4 years, sublux of right hip

adductor tenotomy and femoral osteotomy of the right hip (no operation left hip)

2 days postop
age 5.5 years, sublux left hip

femoral osteotomy + adductor tenotomy left

age 7 years, sublux right hip

2 months after pelvic osteotomy
chronic hip dislocation (several years) and severe problems, especially pain

Proximal femoral resection

radical resection of prox femur to 2-3 cm distal to trochanter minor traction 1 weeks postop

boy 15 years 6 months postop
boy, quadriplegia, age 5 years

10 years

1 day postop

Erosions of fem head
PFRIA
Postoperative
first week: traction + abduction plaster
next 2 weeks: ""
Conclusions

• **Adductor tenotomy** bilateral when MP <50 %

• **Femoral osteotomy** when severe subluxation

• **Pelvic osteotomy** in total dislocation and severe subluxation when acetabulum is dysplastic

• **Chronic dislocation**: surgery (prox femoral resection) if severe **pain**