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Diversities of neck-shaft angle of proximal femur in patients with spina bifida

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- Discloses a financial relationship with Merck Pharmaceuticals speaker honorarium related to Doctor-Patient relationship.
30-50% of children with spina bifida have subluxation and dislocation of the hip joint at the age 2-3 years (Bulent Erol, 2005)

60-70% of children with spina bifida have deformation of the proximal femur (Sharrard, 1964)
The aim of the study

• Assess the diversity of neck-shaft angle of proximal femur in children with spina bifida
Materials and methods

• **414** children with spina bifida were examined during the period of 2006-2016 years

• **Exclusion criteria:**
  - Children < 3 years of age and > 18 years
  - Contractures of the hip joint, that couldn't be X-rayed in the standard anterior-posterior plane
  - Spasticity of the lower limbs
### Levels of muscle function by Sharrard

<table>
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<tr>
<th>Level</th>
<th>Muscle power</th>
<th>Neurosegmental level</th>
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| 1     | Weakness of intrinsic foot muscles  
      | Good-to-normal foot plantar flexion (grade 4–5) | S2 |
| 2     | Fair or less foot plantar flexion (grade≤3)  
      | Fair or better knee flexion (grade ≥ 3)  
      | Poor to fair or better hip extension and/or hip abduction (grade ≤ 2–3) | S1–L5 |
| 3     | Good-to-normal hip flexion and knee extension (grade 4–5)  
      | Fair or less knee flexion (grade ≤ 3)  
      | Trace of hip extension, hip abduction, and below-knee muscles | L4–L3 |
| 4     | No knee extension activity  
      | Poor or less hip flexion (grade ≤ 2)  
      | Fair or good pelvic elevation | L2–L1 |
| 5     | No muscle activity in the lower limbs; No pelvic elevation | Thoracic |

**Thoracic**

**World Congress**
Function levels by Mark Hoffer criteria (1973)

1 level

2 level

3 level

4 level

Non-function ambulator

Household ambulator

Community ambulator

Non - ambulator
The Twente Lower Extremity Model

Consistent Dynamic Simulation of the Human Locomotor Apparatus

paralysis of hip abductors in children with myelomeningcele

Marijke D. Klein Horman
NSA according to age in patient with SB

• 828 hips in patients with spina bifida
• normal NSA - 126 (15.2%)
• Increased neck-shaft angle (coxa valga) – 678 (82%)
• decreased neck-shaft angle (coxa vara) - 24 (2.8%)
NSA according to neurosegmental level

![Bar chart showing NSA values for different neurosegmental levels: Thoracic, L1-L2, L3-L4, L5-S1, and S2. The values decrease from Thoracic to S2.]
NSA according to function levels

Non-ambulator
Non-function ambulator
Household ambulator
Community ambulator

NSA
Patients with neurosegmental level L5-S1

19 patients with L5-S1 neurosegmental levels, non-functional ambulators

23 patients with L5-S1 neurosegmental levels, household ambulators

First group

Second group

NSA
Femoral Neck Abnormalities

- In 24 (2.8%) hips decreased neck-shaft angle.
Femoral Neck Abnormalities in Spina Bifida

Type A – widening of physis and varus deformity

Type B – narrowing of the femoral neck, resulting in a typical mushroom appearance
Proximal femur – mushroom appearance
narrow valgus neck
3 types according to Weisl classification:

1) spontaneous separation of upper femoral epiphysis;
2) spontaneous fractures of the neck of the femur;
3) iatrogenic avascular necrosis of upper femoral epiphysis.
Coxa vara paralitica

The radiographs of patient L., Spina bifida; thoracic neurosegmental level; Coxa vara paralitica bilateralis. A. At age of 2 years; B. 10 years; C. CT-scan at 10 years.
Coxa vara paralitica

The radiographs of patient B., diagnosis: spina bifida; neurosegmental level L1-L2; Coxa vara paralitica bilateralis as the results of fracture of the femoral neck.
A. – at the age of 7; B. – 10 years
Coxa vara paralitica

The radiographs of patient S., 4 years; diagnosis: spina bifida; neurosegmental level L3-L4; bilateral dislocation of the hip; Coxa vara paralitica bilateralis as the result of avascular necrosis of femur head.

A – x-ray of the hip joints in anteroposterior projection
B - arthropneumo(roentgeno)grammes in anterior-posterior plane
C - arthropneumo(roentgeno)grammes in Lauenstein plane. The «two-humped» femur head bilateral.
Conclusions

- NSA in children with SB has wide range of variations with tendency to coxa valga in the majority of patients
- Age-matched NSA correlates with neurosegmental level; ambulatory status in walking children doesn’t influence NSA directly
- Coxa vara is relatively rare variant of deformity in children with SB which should be taken into account for differential diagnostics and management to avoid unnecessary treatment
Thank you for your attention!