Original article

Congenital dislocation of the knee at birth – Part I: Clinical signs and classification

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A R T I C L E   I N F O

Article history:
Received 11 April 2016
Accepted 12 April 2016

Keywords:
Congenital dislocation of the knee
Genu recurvatum congenitum
Classification

A B S T R A C T

Introduction: Congenital dislocation of the knee (CDK) is rare, and clinical semiology at birth is not always suitably analyzed. Existing classifications fail to guide treatment. The aim of the present study was to develop a CDK classification for the neonatal period.

Hypothesis: A classification based on neonatal severity of clinical signs is easy to implement on simple criteria.

Material and methods: Fifty-one CDKs (40 patients) seen neonatally were included. Three types could be distinguished in terms of reduction and stability: type I, easily reducible CDK, with reduction snap when the femoral condyles pass in flexion, remaining stable in flexion; type II, “recalcitrant” dislocation, reducible by posteroanterior “piston” but unstable, with iterative dislocation once posteroanterior pressure on the condyles is relaxed; and type III, irreducible. The number of anterior skin grooves, global range of motion, flexion deficit and reduction stability were noted for each type.

Results: Mean age at first consultation was 5.6 days (range: 0–30). CDK was type I, II and III in respectively 28, 16 and 7 cases. Number of skin grooves, flexion and baseline range of motion were greater in type I than types II and III.

Conclusion: The present neonatal clinical classification is original, logical and simple. It may be useful for prognosis and guiding treatment.

Level of evidence: IV, single-center retrospective series.

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1. Introduction

Genu recurvatum congenitum covers a variety of clinical entities, from simple hyperextension at birth to irreducible dislocation [1,2]. The present study focused on genuine congenital dislocation of the knee (CDK): posterior antenatal displacement of the femoral condyle with respect to the proximal joint surface of the tibia, excluding simple hyperextension. Femoral condyle displacement is exclusively sagittal, excluding congenital rotational dislocation and subluxation [3]. CDK may be associated with other orthopedic abnormalities: equinovarus club-foot, or congenital dislocation of the hip. It may be idiopathic or syndromic (Larsen’s syndrome, arthrogryposis multiplex congenita, myelomeningocele) [4,5].

Incidence of CDK is 1/100,000 live births [6,7]. Diagnosis is usually made clinically at birth, based on pathologic hyperextension of the knee. There is no consensus on initial classifications; those available [1,2,4,8] all count simple genu recurvatum without dislocation or subluxation as grade 1.

The present study aims to propose an original clinical neonatal classification for CDK. There are semiological similarities with congenital dislocation of the hip: instability, reduction with snap or piston, irreducibility, muscular retraction (quadriceps for the knee, adductors for the hip), restricted range of motion (flexion for the knee, abduction for the hip), and cutaneous folds or grooves [9]. The hypothesis was that a classification based on neonatal severity of clinical signs would be easy to implement on simple criteria.

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http://dx.doi.org/10.1016/j.otsr.2016.04.008
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2. Material and methods

2.1. Patients

Inclusion criteria comprised neonate (0–30 days) with non-treated CDK, in a consecutive series from 1972 to 2006 in a single pediatric orthopedic center, examined by a single senior surgeon (RS).

Forty patients (51 dislocated knees) were included.

2.2. Clinical and radiological neonatal assessment

Reduction and stability criteria distinguished 3 types. Type I is easily reducible CDK, with reduction snap when the femoral condyles pass in flexion, remaining stable in flexion (Fig. 1). Type II is “recalcitrant” dislocation, reducible by posteroroanterior “piston” but unstable, with iterative dislocation once posterior pressure on the condyles is relaxed (Fig. 2). Type III is irreducible dislocation (Fig. 3).

Fig. 1. Type I, reducible; presence of anterior skin folds and grooves.

Fig. 2. Type II, recalcitrant: a: lateral view in maximum flexion; no reduction of dislocation, and flexion limited (5–10°); b: reduction possible with digital pressure on femoral condyles; flexion reaches 50°, but reduction is unstable.

Fig. 3. Type III, irreducible: a: absence of anterior skin grooves, and posterior protrusion of femoral condyles; b: dynamic radiographs (flexion –30°, hyperextension +100°): irreducible dislocation.

Initial examination also noted:

- the number of transverse anterior skin grooves (Fig. 1);
- range of motion (hyperextension, maximum flexion, and global range: flexion + extension).

Radiologic assessment comprised AP and lateral knee views in flexion and maximum extension.

CDK was secondary to a general pathology in 16 patients (31%). There was ipsilateral foot deformity in 6 limbs and ipsilateral dislocation of the hip in 10 (Table 1).

2.3. Statistics

Statistical analysis used Chi² and Kruskal-Wallis tests, on StatView software (SAS, Cary, NC, USA), with a significance threshold of 0.05.

3. Results

Mean age at first consultation was 5.6 days (range: 0–30). CDK was type I, II and III in respectively 28, 16 and 7 knees (Table 1).

All type-I knees showed 2 to 4 anterior skin grooves (Fig. 1).

Fourteen type-II knees (87.5%) showed 1 to 3 grooves, while the other 2 had none. Type-III knees had no grooves (Fig. 3a).

Table 2 shows ranges of motion. Flexion fell significantly between type I (mean: 85°), II (34°) and III (−5°). Extension ranged between 30 and 100°, with significant difference according to type. Global range of motion was significantly greater in type I than types II or III (P<0.001).
Table 1
Classification of congenital dislocation of the knee in neonatal period and associated pathologies.

<table>
<thead>
<tr>
<th>Type (n knees)</th>
<th>Etiology n knees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I reducible (28)</td>
<td>Isolated 9</td>
</tr>
<tr>
<td></td>
<td>Syndromic 4</td>
</tr>
<tr>
<td></td>
<td>Isolated foot abnormality 5</td>
</tr>
<tr>
<td></td>
<td>Isolated hip instability 9</td>
</tr>
<tr>
<td></td>
<td>Abnormality of 1 foot and 1 hip 1</td>
</tr>
<tr>
<td>Type II recalcitrant (16)</td>
<td>Isolated 6</td>
</tr>
<tr>
<td></td>
<td>Syndromic 6</td>
</tr>
<tr>
<td></td>
<td>Isolated foot abnormality 2</td>
</tr>
<tr>
<td></td>
<td>Isolated hip instability 2</td>
</tr>
<tr>
<td></td>
<td>Abnormality of 1 foot and 1 hip 0</td>
</tr>
<tr>
<td></td>
<td>Isolated 0</td>
</tr>
<tr>
<td>Type III irreducible (7)</td>
<td>Syndromic 6</td>
</tr>
<tr>
<td></td>
<td>Isolated foot abnormality 0</td>
</tr>
<tr>
<td></td>
<td>Isolated hip instability 0</td>
</tr>
<tr>
<td></td>
<td>Abnormality of 1 foot and 1 hip 1</td>
</tr>
</tbody>
</table>

Table 2
Initial ranges of motion (RoM) according to type.

<table>
<thead>
<tr>
<th>Initial RoM</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion,°</td>
<td>85 (10–140)</td>
<td>34 (10–110)</td>
<td>−5 (−35–18)</td>
</tr>
<tr>
<td>Hyperextension,°</td>
<td>52 (30–90)</td>
<td>51 (30–80)</td>
<td>61 (30–100)</td>
</tr>
<tr>
<td>Global RoM,°</td>
<td>131 (60–210)</td>
<td>81 (40–140)</td>
<td>50 (15–85)</td>
</tr>
</tbody>
</table>

Table 3
Classification of congenital dislocation of the knee in neonatal period and associated syndromes.

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthrogryposis</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Larsen’s syndrome</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Marfan’s syndrome</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ehlers-Danlos syndrome</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

Associated syndromes were found in all types (Tables 1 and 3), with occasional association of types I and II (2 isolated dislocations, 2 arthrogryposis, 1 Marfan syndrome and 1 Larsen syndrome).

4. Discussion

Over the last 6 years, only 1 article on CDK has been published in a reference journal [4]. To our knowledge, the present study reports the largest single-center series. Bensahel et al. [8], in 1989, analyzed a larger series of patients (46 children), but theirs was a multicenter series with great heterogeneity, and in which age at inclusion was not specified. The second original point in the present study is its description of clinical assessment in the neonatal period.

Leveuf and Pais [10], in 1946, published a 3-group classification of CDK, in which group 1 included hyperextension without dislocation (simple genu recurvatum). Likewise, Finder [2], in 1964, published a 5-group classification, in which only groups IV and V comprised genuine dislocation. One interest of the present classification is to focus exclusively on genuine dislocation. In 1967, Laurence [1] published a classification founded on retrospective assessment of the success or failure of non-operative treatment, distinguishing “good responder” and “recalcitrant” knees. Although this classification should only be used retrospectively, after treatment has shown its result, it was recently applied prospectively to classify knees at birth [6]. Finally, Abdelaziz and Samir [4], in 2011, published a classification based on ranges of motion, without reference to tibiofemoral joint relations and thus including non-dislocated knees. It should also be borne in mind that syndromic cases may involve 2 different grades of CDK, which argues against classification by etiology.

The present original classification groups CDK logically on neonatal clinical examination ahead of any treatment. It borrows from congenital hip dislocation semiology, etiology often being very similar [11]. Its prognostic value is based on semiology comparable to that used in congenital dislocation of the hip [9]. In the hip, it is agreed that easily reducible dislocation that is stable in abduction can respond to simple day-care (swaddling, harness, splint, etc.), whereas irreducible hip dislocation almost always requires surgery. The intermediate cases, with difficulties of reduction stabilization, raise treatment problems.

The prognostic value of the present classification is reinforced by two other clinical factors:

- that flexion is more impaired in type III than type II and less impaired in type I corresponds to quadriceps retraction. Like in impaired hip abduction (corresponding to adductor retraction), this sign indicates the duration of in utero dislocation [1];
- the number of anterior skin grooves (absent in type III and greater in type I than type II) is a major prognostic factor: the greater the number of anterior skin grooves, the more recent the in utero origin of dislocation, while absence of grooves indicates long-standing dislocation [6–8].

Disclosure of interest

The authors declare that they have no competing interest.

References