Family history in developmental dysplasia of the hip: should we follow-up?

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ABSTRACT

Objectives: Developmental dysplasia of the hip (DDH) is an important problem. Ultrasonography (US) is a proper method before 6 months of age. For older children, plain radiographs can be useful. Six risk factors are emphasized: breech presentation, female sex, a positive family history, being first-born, left hip affected, and mode of delivery. In some centers, clinicians prefer to perform a control US examination or pelvic radiographs after 6 months of age for the children having a positive family history. We aimed to evaluate the necessity of control US/direct radiography examinations.

Methods: A total of 205 children with a positive family history for DDH are included. US examinations are performed according to Graf’s method. We have evaluated direct radiographs by using Hilgenreiner, Perkin, and Shenton lines, acetabular angle.

Results: Initial US examinations are performed at a median age of 8.3 weeks. Seventy-four patients (36%) had a repeat ultrasound scan at a median age of 7 months; none of them demonstrated abnormal findings. One hundred and thirty-one patients (63.9%) had control radiographs at a median age of 8.2 months. Shenton line is considered as normal, and the upper femoral epiphysis is located in inferomedial quadrant according to Hilgenreiner and Perkin lines.

Conclusions: A positive family history for DDH may be a less important reason for performing control US or radiographic examination. Patients with a normal screening US result and having risk factors can be discharged from follow up safely, so that unnecessary examinations and family anxiety will be reduced.

Keywords: Developmental dysplasia of the hip, Graf method, ultrasound, family history, follow-up

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Developmental dysplasia of the hip (DDH) is a common and important problem, with a prevalence of 0.1 to 2/1000 children. Delayed diagnosis and treatment can cause premature degenerative joint disorder, functional impairments, chronic pain, permanent disability, etc. Screening with only physical examination provides a correct diagnosis approximately 50% of cases with dislocated hip by the first year of life. Screening with ultrasonography (US) reduces the rates of open reductions and complications by 46% [1-4].

Graf’s US investigation technique is used widely as a screening tool for DDH diagnosis [5]. Screening of all children with US is not widely accepted. It is recommended to perform US to the cases that have a physical examination finding [6, 7]. US is a proper...
method for the children before 6 months of age, because at this time femoral head is largely cartilaginous. For the children older than this, plain anteroposterior pelvic radiographs can be useful [8, 9].

In the literature six common risk factors are widely emphasized for DDH: breech presentation, female sex, family history, first-born, left hip affected, and mode of delivery [10]. Before the usage of US screening, studies reported that the incidence of late DDH is higher in children with a positive family history [11]. In some centers, especially in the ones who are not specifically interested in DDH cases, clinicians prefer to perform a control US examination or pelvic radiographs after 6 months of age for the children having a positive family history for DDH [12].

In the current study, we aimed to evaluate the necessity of control US/direct radiography examinations for the children with a positive family history of DDH. So that, unnecessary examinations and exposure to ionizing radiation might be reduced.

**METHODS**

Approval for this prospective study was granted by the institutional ethics review board. The study was conducted retrospectively, in two different centers. We have retrospectively evaluated 683 children who were screened for DDH. We have excluded the ones with a US examination result other than Graf type 1 hip. We have included the ones with a positive family history and a follow up examination. US results were not normal (Graf type 1) in 81 cases, family history is negative in 77 cases, 320 cases are not reexamined. Finally, 205 children are included into the study.

We have evaluated screening US results, and control US/direct radiography results. US examinations are performed according to Graf’s method (Figure 1). We have evaluated direct radiographs by using Hilgenreiner, Perkin, and Shenton lines, acetabular angle (Figure 2). Patient’s ages and sex, accompanying risk factors, other than family history are also noted.

**Figure 1.** Coronal US view of a normal hip. 1, iliac bone; 2, lower limb of the ilium and bony acetabular roof; 3, cartilaginous acetabular roof; 4, acetabular labrum; 5, cartilaginous part of the femoral head (hyaline cartilage); 6, chondro-osseous junction between the bony part and the cartilaginous part of the femoral neck.
Statistical Analysis

All study information was recorded on patient data sheets, then entered into an Excel (2007, Microsoft Corp., Redmond, WA) spreadsheet for analysis. All data entries were double-checked by one of the investigators. Data were analyzed using Statistical Package for the Social Sciences (SPSS) for Windows 20 (IBM SPSS Inc., Chicago, IL). Normal distribution of the data was evaluated with the Kolmogorov-Smirnov test. Numeric variables that had a normal distribution were shown as mean±standard deviation. The variables that did not have a normal distribution were shown as median (interquartile range). For comparison of the numeric variables between the two groups student’s T test and Mann-Whitney U test were used.

RESULTS

Mean age of the population is 10 months ± 3 weeks. Population consists of 141 (68.8%) girls and 64 (31.2%) boys. The initial US examinations are performed at a median age of 8.3 weeks (range 6.3-12 weeks). 74 patients (36%) have a repeat ultrasound scan at a median age of 7 months (range 6-12 months); none of them demonstrate abnormal US or physical examination findings, and accepted as normal.

One hundred and thirty-one patients (63.9%) have control radiographs at a median age of 8.2 months (range 6-21.2 months). For all of the patients, Shenton line is considered as normal, and the upper femoral epiphysis is located in inferomedial quadrant according to Hilgenreiner and Perkin lines.

Mean acetabular angle is 24.3 ± 0.7. Seven patients (3.4%) have multiple direct radiography examination (2 direct radiographs). We have used the initial examination to calculate mean acetabular angle. Amongst these 7 patients, 4 have multiple risk factors for DDH. Initial acetabular angles of these 7 patients are all higher than 26.4, however their final acetabular angles are within normal limits, lower than 22 (Table 1).

5 patients have multiple risk factors (more than two) (Table 2). Amongst them, only 4 have multiple direct radiography examination (2 direct radiographs). Mean acetabular angle of these 5 patients is slightly higher than whole population, but it is not statistically significant (26.2 ± 0.1 vs. 24.3 ± 0.7, p > 0.01) (Figure 3).

Table 1. Patients having two control radiographs

<table>
<thead>
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<th>Patient no</th>
<th>1st acetabular angle</th>
<th>2nd acetabular angle</th>
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<tbody>
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<td>26.5</td>
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</tr>
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<td>2</td>
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<td>21.8</td>
</tr>
<tr>
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<td>26.7</td>
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<td>21.3</td>
</tr>
<tr>
<td>7</td>
<td>27.1</td>
<td>21.7</td>
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</table>

Table 2. Patients having multiple risk factors

<table>
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<tr>
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<td>25</td>
</tr>
<tr>
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<td>BP, F</td>
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<td>25,3</td>
</tr>
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<td>5</td>
<td>BP, F, DB</td>
<td>27,1</td>
</tr>
</tbody>
</table>

BP = Breech presentation, F = Female, DB = Difficult birth
DISCUSSION

DDH is still a common and important problem. An effective treatment, can prevent permanent disability [13]. The clinical evaluation for DDH is attributed to pediatrics professor Marino Ortolani. However, physical examination is not always enough to diagnose dysplastic, unstable or even dislocated hips. US, which were popularized by Graf in the 1980s, have been widely used to define and detect DDH [3, 14].

A positive family history is thought to be a strong risk factor for DDH, as it is stated in the literature that an abnormal US result is found three times more in children with a positive family history for DDH [15]. When the children is examined with only physical examination, it is found that late dysplasia occurs in 18% of children [11]. This finding creates a clinical habit to perform a radiographic examination between 6-12 months.

Using both US examination and pelvic radiograph is still a method for some clinics. According to data obtained from British Society for Children’s Orthopedic Surgery, 35% of surgeons said that they request a control radiograph from the patients with a normal ultrasound scan [16]. Price et al. found that an abnormal Radiograph is found only 0.5% of 11,000 patients with a normal initial US examination. They stated that a control radiograph is not necessary for patients with a normal US scan [17]. Specifically, some studies investigated the children with a positive family history for DDH to define the necessity of control radiographic examinations. It is stated that residual dysplasia in children with a family history of DDH and a normal hip ultrasound is not found significantly [16, 18]. Our results are consistent with the literature, we have not detected any cases of late DDH, with a normal US result and positive family history.

The acetabular angle measured by using Hilgenreiner line is generally less than 28º at birth. The angle will become smaller by age, and should measure less than 22º at and beyond 1 year of age [19]. All of the children, who were classified as normal at initial US examination, have acetabular angles within normal limits. All of the patients who have more than one control direct radiographs have higher acetabular angles in comparison with the population. It is showing that a relatively higher acetabular angle, even within normal limits, might cause an unnecessary control radiographic examination. In the literature, it is stated that relatively high acetabular indexes come to normal limits in control examinations [12], even in children with risk factors. Our results are consistent with the literature; we cannot detect any late DDH cases in children with a relatively high acetabular angle.

In the literature there is not a similar study examining the possible correlations between presence of the risk factors and acetabular angle values. According to our results, children with multiple risk factors had slightly higher acetabular angles, but this is not a statistically significant difference. This might be the result of our small population. Further studies with larger populations can enlighten a possible correlation.

Limitations

The study has some limitations. First, the retrospective nature of the study is a limitation. Second, we do not have enough cases with multiple risk factors. Control examinations are not the same for all patients (US for some cases, direct radiograph for others).
CONCLUSION

To conclude, having a positive family history for DDH is not a reason for performing control US or radiographic examination. Patients with normal screening US result and having risk factors can be discharged from follow up safely, so that unnecessary examinations and family anxiety will be reduced. If following up is still considered as necessary, US examinations can be performed instead of direct radiographs, as for avoiding ionizing radiation exposure.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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REFERENCES