Evolution of late presenting developmental dysplasia of the hip and associated surgical procedures after 14 years of neonatal ultrasound screening

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Between 1985 and 1998, 12 331 patients were included in the general neonatal ultrasound hip screening programme for developmental dysplasia of the hip (DDH). Patients who needed treatment (604) were compared with a second group of 73 unscreened children treated conservatively and surgically for DDH.

The incidence of Graf sonographic hip types IIc to IV varied throughout the observation period. Femoral and pelvic osteotomies were almost entirely restricted to the unscreened group of patients. The six to ten per year recorded in the period 1985 to 1990 declined subsequently to three or less per year. The yearly admissions to hospital fell noticeably after six years of screening. Late presentations of DDH were reduced to three or less per year from 1990 to 1994, none between 1995 and 1998 and one or two per year from 2000.

We conclude that general neonatal sonographic hip screening can reduce significantly surgical procedures, hospitalisation and late presentation of DDH.

The use of ultrasound for the diagnosis of developmental dysplasia of the hip (DDH) in newborns was introduced by Graf in 1980.1 The main aim of any ultrasound screening programme for DDH is to reduce the number of patients presenting late and to avoid extensive and frequently costly treatment. Another important outcome measure is reduction of the number of surgical interventions for the condition. There is considerable controversy with regard to selective ultrasound screening of so called ‘at risk’ newborns or the general ultrasound screening of all newborns.2-4 Several authors have reported that selective screening of ‘at risk’ babies fails to avoid late presentations, while others report a reduction in the numbers.3-6 General ultrasound screening of the hips of all newborns has been shown to result in a lower rate of missed hips and surgical procedures but a higher treatment rate.7-9 The cost efficiency of general screening is also controversial. Rosendahl et al10 stated that there was no reduction of cost but Grill and Müller7 concluded that there was.

This study presents the effects of a programme of general sonographic screening on the treatment of DDH since 1985 in an area where our department has been the sole reference hospital for this condition.

Patients and Methods

Routine general ultrasound screening was introduced to the region in 1985. The aim was to screen all newborns born at the three different hospitals in the area. The hips of all children born at the Department of Obstetrics of the University Hospital were clinically and sonographically investigated shortly after birth. Referral to the ultrasound clinic in our Orthopaedic Department for screening as soon as possible after birth was offered to all other newborns. A 12-week check was routinely made on all babies who had normal initial sonograms.

Between 1985 and 1998, 12 331 newborns were included in the study and 27 961 ultrasound examinations were undertaken. Of the screened hips, 2.4% had DDH. The sonographic appearance of the hip was classified according to Graf1 and his treatment recommendations were adopted. The indications for treatment were based solely on the type of hip found on ultrasound, regardless of additional clinical findings such as instability or abduction contracture. The α-angle was the decisive sonographic measure.1 All hips classified as type IIc or worse were treated. Unstable dysplastic hips were managed in an abduction-flexion splint. Type III and IV hips, with a significant contracture of the hip adductors were initially placed in overhead traction followed by increasing hip abduction to reduce the hip. This was followed by plaster immobilisation for six to 12 weeks.
During the same period a second group of patients treated for DDH was identified. This comprised 73 patients under the age of 16 years who had never had sonographic screening of the hip. These patients were treated by both the conservative methods described above and surgical procedures to reduce the dysplastic or dislocated hip joint. Among the operations undertaken were open reduction through the Ludloff medial approach, intertrochanteric varus and derotation, femoral osteotomies and acetabuloplasties predominantly of the Salter or Dega type.

All patients diagnosed with DDH after the sixth month of life were defined as late presentations, and their numbers recorded throughout the observation period (1985 to 1998) and, in addition, up to 2002.

**Results**

In the sonographic hip screening group 18 157 (73.6%) were Graf type Ia and b, 5919 (24%) type IIa and 592 (2.4%) type IIc or worse. This distribution of hip types resulted in a treatment rate of 49 per 1000. The incidence of hip types IIc or worse varied throughout the observation period (Fig. 1). Only four patients in this group required surgical treatment.

In the 73 patients who had no ultrasound screening, 25 closed and eight open reductions were carried out. Of the bony procedures required, 20 were pelvic osteotomies and 20 were proximal femoral osteotomies. All patients who had overhead traction, an operation or a plaster change were admitted to hospital and treated as inpatients. The distribution of these procedures between the two groups is shown in Figure 2. Among the 12 331 patients in the screened group 32 needed 56 admissions, whereas among the 73 patients in the unscreened group 105 hospital admissions were necessary.

There was a decline in the need for surgical procedures for DDH during the study period. Between 1985 and 1990 this varied from six to ten, but the true effect of ultrasound screening could be observed from 1991 onwards, when the number of surgical procedures fell to between zero and three per year (Fig. 3).

The number of late presentations also declined. Between 1995 and 1999 no late presenting patients were identified.
Routine ultrasound examination of the hips of every newborn at four to six weeks of life was introduced in this country in 1996. This has led to a more widespread application of the method in our area resulting in a higher number of physicians involved in ultrasound screening and possibly a loss in experience and quality compared with previous years.

**Discussion**

The main aim in the early management of DDH is the reduction of late presentation to as near zero as possible. Although ultrasound has become the best tool for the early diagnosis, there is no general agreement as to most satisfactory screening programme. Two methods of sonographic screening of the newborn hips have been widely discussed 1) selective screening shortly after birth of babies ‘at risk’ of DDH, and 2) general screening of all babies at the age of four to six weeks and screening of babies with risk factors immediately after birth. Our study is based on 14 years experience of general sonographic screening of the newborn hip in a region where the Orthopaedic Department was the sole reference centre for treatment of DDH in the area. This makes the data more reliable and valid than in areas with multiple treatment centres. The distribution of the Graf hip types in this study is comparable to that in

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**Table I.** Survey of the distribution of Graf hip types in different major studies from German speaking countries on general ultrasound screening

<table>
<thead>
<tr>
<th>Authors</th>
<th>Number of newborns screened</th>
<th>Graf type (%)</th>
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<tr>
<td>Langer 22</td>
<td>1460</td>
<td>75.8</td>
<td>23.3</td>
<td>0.8</td>
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<tr>
<td>Exner 23</td>
<td>615</td>
<td>84.7</td>
<td>13.0</td>
<td>2.3</td>
<td></td>
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<tr>
<td>Pauer et al 24</td>
<td>7399</td>
<td>84.4</td>
<td>13.4</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Dorn 25</td>
<td>8221</td>
<td>72.5</td>
<td>25.6</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Tönnis et al 6</td>
<td>2587</td>
<td>67.3</td>
<td>30.0</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>De Pellegrin 26</td>
<td>1000</td>
<td>74.6</td>
<td>22.6</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Ganger et al 21</td>
<td>1292</td>
<td>50.1</td>
<td>47.9</td>
<td>2.0</td>
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</tr>
<tr>
<td>Deimel et al 27</td>
<td>2317</td>
<td>71.3</td>
<td>25.5</td>
<td>2.2</td>
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<tr>
<td>Weitzel et al 28</td>
<td>19536</td>
<td>43.8</td>
<td>53.2</td>
<td>3.0</td>
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<tr>
<td>Falliner et al 29</td>
<td>6548</td>
<td>84.6</td>
<td>14.3</td>
<td>1.1</td>
<td></td>
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<tr>
<td>This series</td>
<td>12331</td>
<td>73.6</td>
<td>24.0</td>
<td>2.4</td>
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other studies of sonographic screening for DDH in this country (Table I). The variation in the incidence of Graf type IIc to type IV hips in their studies is small. Similar numbers have been reported in a Norwegian study on general ultrasound screening.

The incidence of abnormal hips in studies with selective ultrasound screening is different from those with general sonographic screening. The difficulty in comparing these studies is that most of the data refer to normal, abnormal and treated hips rather than using the Graf classification (Table II).

The results of our study underline the considerable potential of general sonographic screening to reduce the need for inpatient treatment and surgical procedures. Similar results have been reported by Grill and Müller from Austria and Falliner and Hahne in Germany. Screening became effective in our study after five to six years. The reasons why general screening did not lead to an immediate drop of late presentations may be lack of acceptance by parents and physicians when screening started and difficulties in interpreting the pathological findings. This may be attributed to the ‘learning curve’ for general ultrasound screening. The success of ultrasound screening is based on the ability to detect early DDH which would otherwise present late. Our study demonstrated a marked reduction in late presentations but the occasional patient did present late despite screening. This is in accordance with the results of previous studies of general ultrasound hip screening.

Rosendahl, Markestad and Lie compared groups of children without ultrasound screening, with those undergoing either selective or general ultrasound screening. The group with general screening had the smallest numbers of late DDH and lower figures for conservative and surgical treatment. We feel that this justifies the higher initial cost and splintage rate by avoiding the problems and expense of managing patients who present with late DDH.

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References


