Developmental dysplasia of the hip: why are we still operating on them? A plea for institutional newborn clinical screening

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ABSTRACT

Introduction: Developmental dysplasia of the hip (DDH) is a common orthopaedic condition at birth. Non-surgical management with Pavlik harness can effectively treat DDH with early clinical diagnosis at newborn, but open surgeries continue to be performed. We aimed to elucidate the reasons for this.

Methods: A retrospective review was performed of all open surgeries related to DDH from 2006 to 2016. Patients were either born at our institution (Group 1) or outside of it (Group 2). All Group 1 newborns were routinely screened for DDH at birth.

Results: 27 patients (Group 1: n = 5; Group 2: n = 22) presented at 25 ± 19 months old. Left-sided DDH (n = 21; 77.8%) and girls (n = 22; 81.5%) were more common. Mean age at surgery was 40 ± 31 months. The most commonly performed procedure was soft tissue release open reduction with acetabuloplasty (n = 20; 74.1%). Gender, site, median age at presentation and surgery, and prevalence of risk factors were matched for both groups. Both groups were mostly made up of late presenters (presenting after three months) (p = 0.68), with a few patients having had prior treatment (p = 0.64). Newborn screening was the only variable with statistical difference between the groups (p < 0.01).

Conclusion: Lack of institutionalised newborn clinical screening appears to be the root cause for the late presentation of DDH leading to open surgeries for its management. We recommend quality institutionalised newborn clinical screening to reduce the number of late presentations leading to open surgeries for DDH.

Keywords: developmental dysplasia of the hip, newborn screening, open reduction
INTRODUCTION

Developmental dysplasia of the hip (DDH) is one of the commonest hip abnormalities found at birth.\(^1\) It is a well-established risk factor for early-onset osteoarthritis of the hip and hence the resultant arthroplasty.\(^1\)

Screening at birth using Ortolani’s\(^2\) and Barlow’s\(^3\) tests, henceforth to be referred to as ‘newborn clinical screening’ in this study, allows for the early diagnosis of DDH, with excellent sensitivity and specificity in experienced hands.\(^4,5\) The success rate of intervening early with conservative treatment, such as the Pavlik harness, has been reported to be as high as 96.7%, with the rate of avascular necrosis as low as 0%.\(^6\) Such early diagnosis and conservative treatment has been reported to reduce the rate of surgery required for DDH, or even obviate the need for invasive procedures.\(^7\)

Rates of all types of open surgery for DDH have been reported to be reduced significantly with effective institutional newborn clinical screening programmes.\(^8\) At our institution, all newborns are screened by neonatology physicians and referred to orthopaedics upon clinical suspicion of DDH (Fig. 1). Clinical suspicion of DDH at birth refers to anything other than a normal finding of the hips at birth during clinical screening, such as a positive Ortolani’s or Barlow’s test, hip laxity and hip clicks. A formal diagnosis is only given if the referred orthopaedic surgeon finds a positive Ortolani’s or Barlow’s test. In the absence of positive Ortolani’s or Barlow’s test, but findings of hip laxity and hip clicks as well as the presence of risk factors at the neonatal clinical screening, a hip ultrasonography is performed at age 6–8 weeks and the child is referred to orthopaedics upon findings of dysplasia. We define hip laxity as clinically not an obvious Ortolani’s or Barlow’s test, yet one that is not entirely normal. Treatment with Pavlik harness according to the algorithm in Fig. 1 is then followed.
We have an average of 12,000 live births annually at our institution. A preliminary internal five-year review of the DDH institutional newborn clinical screening and treatment protocol revealed that 177 orthopaedics referrals were made for suspected DDH, with 124 patients being diagnosed with DDH finally. Of these, only one patient required open reduction. Despite the purported success of early diagnosis and treatment, we continue to anecdotally perform surgeries related to DDH frequently.

Previously, Sanghrajka et al\(^8\) found that open surgeries for DDH continued to be performed due to late presentation secondary to failure at the level of newborn screening. The study was limited to a five-year review in a Caucasian population. Such findings have yet to be determined elsewhere.

The present study aimed to review open surgeries for DDH at our institution with regard to the indications for surgery. We hypothesised that a lack of institutionalised newborn clinical screening would be the root cause for open surgeries for DDH. The findings would help to guide future improvement in the management of DDH and reduce the need for preventable open surgery.

**METHODS**

This was a retrospective study performed at KK Women’s and Children’s Hospital, Singapore, the nation’s largest tertiary-level public paediatric hospital. The electronic surgical records between 1 May 2008 and 30 June 2016 were searched for institutional codes of procedures describing open reduction of the hip. Paper surgical records were then searched from 1 July 2006 to 30 April 2008 for operative procedures involving at least an open reduction of the hip related to DDH. All diagnosis of DDH was made by at least a senior specialist consultant with ample clinical experience.
The exclusion criteria were non-DDH hip dislocations, such as cerebral palsy, teratologic hip dislocation, fracture, tumour, septic arthritis, global developmental delay and slipped capital femoral epiphysis. Patients were grouped into those born at our institution (Group 1) and those born outside of our institution (Group 2).

Data collected included patient demography, presenting complaint, birth location (within institution, national or international), comorbidities, risk factors of DDH, whether there were any previous treatments and the presence of institutional newborn screening. Data was analysed qualitatively and quantitatively. Fisher’s exact test was used to test for significance between the categorical samples, with the significance level set at \( p < 0.05 \). Ethical approval was obtained from the institutional review board before commencement of the study.

**RESULTS**

Following exclusions, a total of 27 patients were included in the study (Fig. 2). For all patients, the mean age at presentation was 25 ± 19 months. All patients had unilateral DDH, with the site of involvement being on the left side for 21 (77.8%) patients. Patients were mostly girls (\( n = 22; 81.5\% \)). 9 (33.3%) patients had received prior treatment. Mean age at surgery was 40 ± 31 months. The most commonly performed procedure for open reduction was soft tissue release with acetabuloplasty (\( n = 20; 74.1\% \)). The other procedures performed are presented in Table I.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft tissue release, proximal femur osteotomy, acetabuloplasty</td>
<td>5 (18.5)</td>
</tr>
<tr>
<td>Soft tissue release, acetabuloplasty</td>
<td>20 (74.1)</td>
</tr>
<tr>
<td>Soft tissue release only</td>
<td>2 (7.4)</td>
</tr>
</tbody>
</table>

*Open reduction of the hip was performed in all procedures. DDH: developmental dysplasia of the hip*
The most common presenting complaints causing patients to be referred to our institution were limping (n = 10; 37.0%) and recent diagnosis of DDH (n = 10; 37.0%), followed by limb length discrepancy (n = 5; 18.5%), delayed walking (n = 1; 3.7%) and hip pain (n = 1; 3.7%).

Group 1 had five patients while Group 2 had 22 patients (Table II). Of the 22 patients in Group 2, 11 patients were born outside the country of study. Both groups had similar age at presentation, gender distribution, site of involvement, number of risk factors and prior treatment. Both groups had a large proportion of late presenters (Group 1: n = 4, 80.0%; Group 2: n = 21, 95.5%; p = 0.34), defined as those presenting after three months of age. Patients in Group 1 had a significantly higher rate of documented newborn clinical screening (Group 1: n = 4, 80.0% vs. Group 2: n = 1, 4.5%; p < 0.01).

**Table II. Patient characteristics according to place of birth.**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
<th>Group 1 (born at our institution) (n = 5)</th>
<th>Group 2 (born outside our institution) (n = 22)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at presentation (mth)*</td>
<td>16 (0–48)</td>
<td>18 (1–80)</td>
<td></td>
<td>0.68</td>
</tr>
<tr>
<td>Late presentation</td>
<td>4 (80.0)</td>
<td>21 (95.5)</td>
<td></td>
<td>0.34</td>
</tr>
<tr>
<td>Screened at birth</td>
<td>4 (80.0)</td>
<td>1 (4.5)</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Female gender</td>
<td>3 (60.0)</td>
<td>19 (86.4)</td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>Age at surgery (mth)*</td>
<td>24 (19–52)</td>
<td>28 (11–159)</td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>Left hip</td>
<td>5 (100.0)</td>
<td>16 (72.7)</td>
<td></td>
<td>0.56</td>
</tr>
<tr>
<td>Previous treatment</td>
<td>1 (20.0)</td>
<td>8 (36.4)</td>
<td></td>
<td>0.64</td>
</tr>
<tr>
<td>One or more risk factors</td>
<td>4 (80.0)</td>
<td>20 (90.9)</td>
<td></td>
<td>0.47</td>
</tr>
</tbody>
</table>

*Data presented as median (range).*

In Group 1, one patient was screened to have DDH at birth and was commenced on Pavlik harness. The treatment failed, and the patient underwent adductor release and closed reduction at age three months, which also failed and required open reduction. A second patient was screened to be normal at birth and later presented at age 16 months with a limp. A third patient was screened to be normal at birth but no proper documentation could be found. Later, this patient presented at age 48 months, with limb length discrepancy. The last two
patients had required immediate stay in the neonatal intensive care unit after birth due to respiratory distress and sepsis, respectively. It was therefore not possible to perform the immediate newborn examination for these two patients. They were only examined at the 5th and 31st days of life, respectively, during which both patients were found to be normal by the concerned junior physicians.

**DISCUSSION**

This study showed that the main reason for performing open reductions for DDH is late presentation. This is consistent with Sanghrajka et al’s study, in which the authors found that open reductions of the hip were performed mainly for late presentation rather than failure of early non-operative treatment. Limping and limb length discrepancy were the most common presenting complaints, which was similar to our study.

We postulate that one of the reasons for late presentation in DDH is the absence of institutionalised newborn clinical screening programmes. As shown in this study, only one out of 22 patients born outside of our institution was screened as a newborn. The prevalence of late diagnosis can be as low as 2.4% in the presence of a screening programme, based on clinical examination alone. Therefore, we advocate institutionalised newborn clinical screening programmes at all maternity centres.

Even so, the success of such screening programmes would depend almost entirely on its quality. For instance, after the first newborn screening was introduced in the UK, 70% of DDH patients were still diagnosed late (defined as after age three months). Similarly, 70% of DDH patients were diagnosed only after the age of three months in Northern Ireland. The initial newborn examination is thus paramount to preventing the late diagnosis of DDH. It is known that the experience of the examiner for clinical examination is important for picking up early signs of DDH. This was evident in our study, where there were four
patients with missed diagnosis from our institution, all of whom were not examined by a senior specialist physician during the newborn clinical screening. We recommend that all newborn clinical screening be cross-examined by a physician of at least a senior specialist level.

There were a few limitations to our study. Firstly, it was retrospective in nature. Secondly, the ‘developmental’ nature of DDH means that some newborns may have inevitably been correctly screened to be normal, but this would not preclude the child from developing DDH later in life.\(^{(12)}\) A safety net structure should be in place to detect these patients (e.g. an active review by a general practitioner or health visitor at specified intervals after birth, such as that in place in Northern Ireland).\(^{(10)}\) Thirdly, this was a single-institution study, so the true rate of open reduction for late DDH diagnosis in Singapore was not known. However, the findings here may still be representative of the local patient population, as our institution is the largest of only two public paediatric hospitals in the country, with a suggestion elsewhere that the rate of late DDH diagnosis is similar between private and public sector hospitals.\(^{(13)}\)

In conclusion, the lack of an institutionalised newborn clinical screening appears to be the root cause for late presentation of DDH leading to open surgeries. We recommend that all maternity units put in place an institutionalised newborn clinical screening programme for DDH. The examining physician should be experienced and of at least a senior specialist level.

**REFERENCES**


**FIGURES**

**Fig. 1** Flow chart shows the institutional neonatal clinical screening for DDH. DDH: developmental dysplasia of the hip
Fig. 2 Flow chart shows the patient selection for the present study. DDH: developmental dysplasia of the hip