**Objectives** To clarify the use of ultrasonography by determining the frequency of developmental dysplasia of the hip among breech-presented Chinese neonates in Hong Kong.

**Design** Prospective case series.

**Setting** Regional hospital, Hong Kong.

**Patients** All breech-presented Chinese neonates born during January 2008 to June 2009 were included (except premature neonates). They were examined clinically from birth until the age of 1 year. Ultrasound of the hips was performed at the age of 2 weeks, and X-ray of the pelvis at the age of 1 year.

**Results** A total of 209 breech-presented neonates were born during the study period; 110 neonates completed all necessary investigations and follow-up. Among the latter, there were three neonates with developmental dysplasia of the hip warranting treatment, which amounted to a frequency of 2.7%.

**Conclusion** Developmental dysplasia of the hip among breech-presented Chinese babies is only slightly less common than in corresponding populations in other regions in the world. Since early diagnosis is important, ultrasonography screening in high-risk cases such as those with breech presentation may be useful.

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### Key words

Breech presentation; Hip dislocation, congenital; Hong Kong; Incidence

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**Introduction**

Developmental dysplasia of the hip (DDH) has long been recognised but still gives rise to much confusion and controversy. Its severity is very variable, ranging from instability to dislocation with no gold standard for the diagnosis.\(^1\) Besides being an important cause of childhood disability, it is believed to be a common reason for subsequent adult joint replacement surgery.\(^2\)

Early recognition with prompt treatment has been shown to be effective,\(^3\) so it is crucial to achieve an early diagnosis. Different screening programmes are in place across the globe ranging from clinical examination, to selective ultrasonography (USG) of at-risk subjects, to universal USG screening.

The point prevalence of DDH was historically quoted to be about 1 to 1.5 per 1000 live births,\(^4\) but there is substantial geographical variation due to genetic and/or environmental factors; figures range from 3.5/1000 live births in Saudi Arabia\(^5\) to 10.5/1000 in Australia.\(^6\) Moreover, the quoted frequency is reported to be increasing since the introduction of routine USG screening for DDH,\(^7\) which has caused concerns about the possibility of overtreatment.

Hoaglund et al\(^8\) reported an overall DDH frequency in Hong Kong ranging from 0.005 to 0.009\% of live births over a 7-year period. Although their study was limited by its methodology, it became accepted that DDH was uncommon among the Chinese. Accordingly, DDH is screened for in Hong Kong by serial clinical examinations only.

As clinical examinations are specific but not sensitive,\(^9\) they may only detect neonates with dislocatable or dislocated hips and not those with stable acetabular dysplasia.\(^10\)
Moreover, clinical signs are thought to become less obvious within a few weeks of birth. Various risks factors for DDH have been identified, including being first-born, female, maternal oligohydramnios, and having a family history of DDH. Among these, breech presentation was found to be one of the most important. Among the Chinese moreover, the role of USG for DDH detection has yet to be defined. We aimed to help clarify this issue by determining the frequency of DDH among breech-presented Chinese neonates in Hong Kong.

**Methods**

This was a 30-month prospective study conducted at Tuen Mun Hospital, a large district hospital in Hong Kong. The recruitment period was from 1 January 2008 to 30 June 2009 (18 months). Prior approval was obtained from the New Territories West Cluster Clinical Research and Ethics Committee. All breech-presented Chinese neonates born at our hospital during the recruitment period were potential subjects, with the exception of premature neonates (<36 weeks gestation). Consent was obtained from the parents.

The study protocol is illustrated in Figure 1. At birth, the newborn was examined clinically by a paediatrician. Ultrasonography of the hips was then performed by either one of the two consultant radiologists at Tuen Mun Hospital, at around the age of 2 weeks using static and dynamic methods suggested by Graf and Harcke and Grissom, respectively. If the results were normal, the neonate was reassessed by a paediatric orthopaedic surgeon in the following week. If the results were suspicious, then a follow-up USG was performed at the age of 3 months. Further clinical assessments were repeated when the neonate was 4 and 8 months old. Standard anteroposterior radiographs of the pelvis were taken at the age of 12 months, for both qualitative and quantitative assessment of hip reduction and development (absence of hip dysplasia) using the Acetabular Index (AI). The hips were considered congruently reduced if the Shenton’s and reverse Shenton’s lines were not broken (Fig 2). We considered acetabular development as normal if the AI was less than 29 degrees, which corresponded to 2 standard deviations from the mean at the age of 1 year.14

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**FIG 1. Study protocol**

USG denotes ultrasonography

**FIG 2. Radiographic assessment of a 1-year-old patient**

A denotes Acetabular Index, B Shenton’s line, and C reverse Shenton’s line
Results
There were 209 neonates that fitted our inclusion criteria during the recruitment period (Fig 3). Consent was obtained and USG performed at the age of 2 weeks in 172 of them. At the end of 1 year, there were 110 neonates who completed the clinical assessments and follow-up X-ray of the pelvis, giving an overall loss to follow-up rate of 47%.

The demographics of the studied neonates are shown in Table 1, there being a slightly larger proportion of female babies among neonates born by Caesarean section. Figure 4 shows the progress for the 110 neonates (220 hips) who completed follow-up. There were 3 hips that showed gross instability (dislocatable) at the first USG at 2 weeks old, and underwent treatment with Pavlik harnesses. An additional 59 (27%) of the hips showed immaturity (Graf type IIa) or laxity, but the majority of these (90%) became normal at the subsequent USG at the age of 3 months. Only one hip remained dysplastic and was treated with an abduction splint. All of the 158 hips which were normal at the initial USG at 2 weeks remained so when the pelvis was X-rayed at the age of 1 year. Regarding the four hips that were treated, they all appeared normal at the 1-year follow-up without any complications.

The results of the initial USGs performed at the age of 2 weeks are shown in Table 2. Using the static method, there were 180 (82%) type I hips and 40 (18%) type IIa hips. The three dislocatable hips were type IIa. There were 22 type I hips that showed laxity during dynamic assessment.

Overall, there were four hips which were dysplastic and deemed to need treatment. Since one of them was a neonate with bilateral involvement, the frequency of DDH in this group was 3/110, or 2.7%, which could be regarded as the frequency among breech-presented Chinese neonates.

Discussion
With the knowledge that early diagnosis and treatment for DDH reduces sequelae, it may be tempting to advocate universal USG screening for all neonates. In our pre-study review of DDH cases in 2007, we identified at least one patient born in our centre whose presentation was delayed and who underwent open reduction that was complicated by avascular necrosis of the femoral head. By contrast, at the other end of the spectrum, clinical examination alone may not be sensitive enough to avoid a catastrophically delayed diagnosis. Knowing the frequency of DDH in Hong Kong may help us determine which screening method might be most appropriate.

From our study, the frequency of DDH among breech-presented Chinese neonates was 2.7%. Whilst according to the 2004 audit by the Hong Kong College of Obstetricians and Gynaecologists, 4% of all local deliveries were breech-presented. Assuming that breech presentation confers a relative risk for DDH of 11.1, among non–breech-presented Chinese neonates the expected frequency was 0.25%. Overall, this yields a DDH frequency of 0.35% among Chinese neonates in Hong Kong. This may only be a gross estimate, given the limitations of the calculation, but appears to show that it is not as rare as previously believed.

Notably, even early non-operative treatment like the Pavlik harness is not without complications, such as femoral nerve palsy and avascular necrosis of the femoral head. By contrast, at the other end of the spectrum, clinical examination alone may not be sensitive enough to avoid a catastrophically delayed diagnosis. Knowing the frequency of DDH in Hong Kong may help us determine which screening method might be most appropriate.


TABLE 2. Ultrasonography results according to Graf’s methodology of classification of hip dysplasia

<table>
<thead>
<tr>
<th>Graf’s type*</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
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<tbody>
<tr>
<td>I</td>
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<tr>
<td>a</td>
<td>43</td>
<td>49</td>
<td>92</td>
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<td>b</td>
<td>38</td>
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<td>II</td>
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</tr>
<tr>
<td>a</td>
<td>11</td>
<td>29</td>
<td>40</td>
</tr>
<tr>
<td>b-d</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>III a-b</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>IV</td>
<td>0</td>
<td>0</td>
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* Type 1 denotes mature hip, type IIa immature hip (indicating retarded development of the bony edge of the acetabulum), type II b-d retarded/delayed ossification and decentring hip, and type III-IV eccentric hip

Even among breech-presented neonates, our overall figure of 2.7% (for both males and females) was not as high as that quoted by the American Academy of Pediatrics (2.6% for males, 12% for females).20 Given the recent findings that selective USG screening may be of benefit in neonates with risk factors,21 we believe such a programme may also be justified among high-risk neonates in the Chinese.

Although the present investigation provides an estimate of the frequency of DDH, it was nevertheless a small-scale, single-centred study that recruited only breech-presented neonates. The high rate of loss to follow-up was probably due to the lack of symptoms among the neonates and because some parents lived elsewhere (Mainland China). The small sample size also meant that it was not feasible to confidently derive separate frequencies for males and females.

Despite its popularity, USG assessment for this purpose is still controversial. Graf’s static delineates the anatomy of the hip but demands technical expertise. In our study, some morphologically mature hips showed laxity on Harcke’s dynamic assessment. However, only a small minority of these later develops DDH.22 In this study, there may also have been a degree of underestimation, as all term breech neonates born by Caesarean section had previously been shown to be associated with a reduced frequency of DDH.23

This study is one of the few that assessed DDH frequency among Chinese neonates prospectively and systematically. It showed that USG screening in high-risk neonates appears useful. Further studies are needed to determine who should be included as a high-risk patient and the cost-effectiveness of any corresponding screening programme.

Acknowledgements

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