ORIGINAL ARTICLE

Frequency of developmental dysplasia of the hip in breech-presented Chinese neonates in Hong Kong

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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 till 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.

New knowledge added by this study

- Frequency of developmental dysplasia of the hip among breech-presented Chinese is comparable to neonates in other areas.

Implications for clinical practice or policy

- Thus in the Chinese, ultrasonography screening may be useful only in high-risk neonates.

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]

香港臀位產新生兒的發育性髖關節脫位發病率

目的 找出香港臀位產華籍新生兒的發育性髖關節脫位發病率，從而探討超聲檢在這方面的用途。

設計 前瞻性病例系列。

安排 香港一所分區醫院。

患者 研究對象為所有於2008年1月至2009年6月期間臀位產的華籍新生兒（早產兒除外）。他們從出生至一歲間均接受臨床檢查；分別在他們出生後兩個星期接受臀部的超聲檢，而出生一年後則會接受骨盆的X射線。

結果 研究期間共有209名臀位產新生兒，其中110名完成整個檢查及跟進的過程。最終發現三名新生兒因出現發育性髖關節脫位而需接受治療；發病率為2.7%。

結論 本港華籍新生兒的發育性髖關節脫位發病率稍低於其他地方。由於早期診斷發育性髖關節脫位相當重要，為高危病例如臀位產新生兒進行超聲檢會有幫助。

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.[11] 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[12] and Harcke and Grissom,[13] 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]

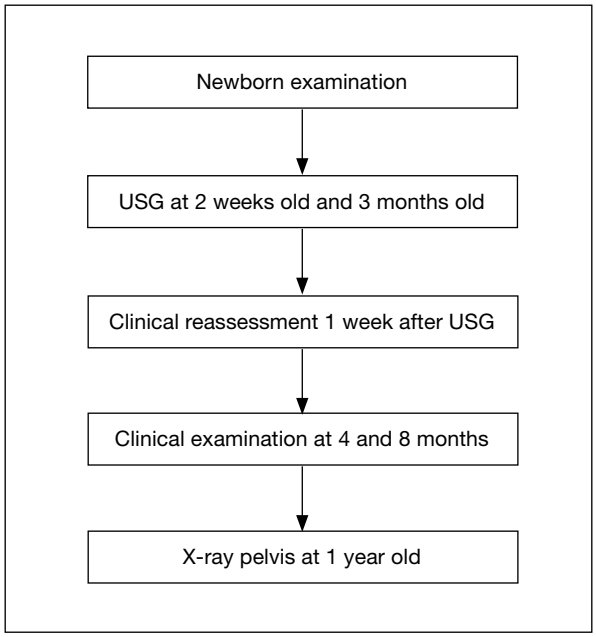

FIG 1. Study protocol
USG denotes ultrasonography

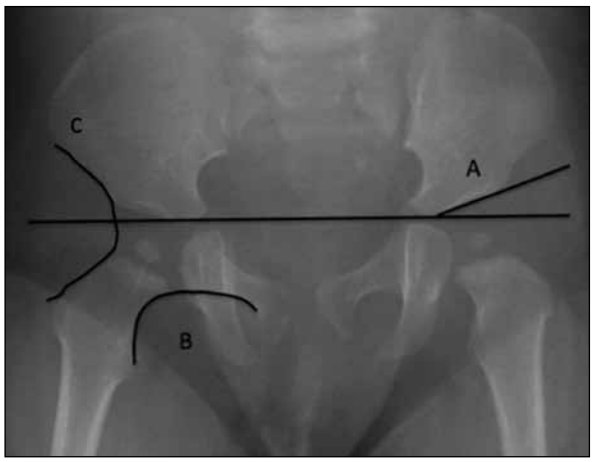

FIG 2. Radiographic assessment of a 1-year-old patient
A denotes Acetabular Index, B Shenton's line, and C reverse Shenton's line

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.

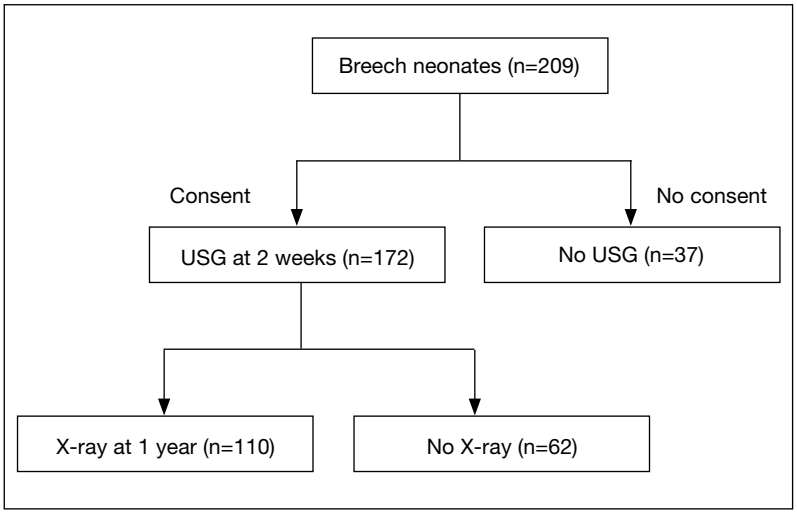

FIG 3. Subject workflow
USG denotes ultrasonography

TABLE 1. Subject demographics

Demographics	Data
Gender	
Male	46 (42%)
Female	64 (58%)
Mean gestation (weeks)	38.05
Mean birth weight (kg)	3.07
Mode of delivery	
Elective Caesarean section	69 (63%)
Emergency Caesarean section	41 (37%)
Vaginal delivery	0

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. On the other hand, although treatment of early cases of DDH is relatively simple and non-invasive, there are concerns about over-diagnosis and over-treatment. In our series, most of the patients with mild degrees of USG abnormality without gross instability had reverted to normal by the time they were 1 year old. This was similar to the findings reported by Peled et al[15] looking into USG of the neonatal hip.

Notably, even early non-operative treatment like the Pavlik harness is not without complications, such as femoral nerve palsy[16] and avascular necrosis of the femoral head.[17] By contrast, at the other end of the spectrum, clinical examination alone may not be sensitive enough to avoid a catastrophically delayed diagnoses. 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,[18] 4% of all local deliveries were breech-presented. Assuming that breech presentation confers a relative risk for DDH of 11.1,[19] 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.

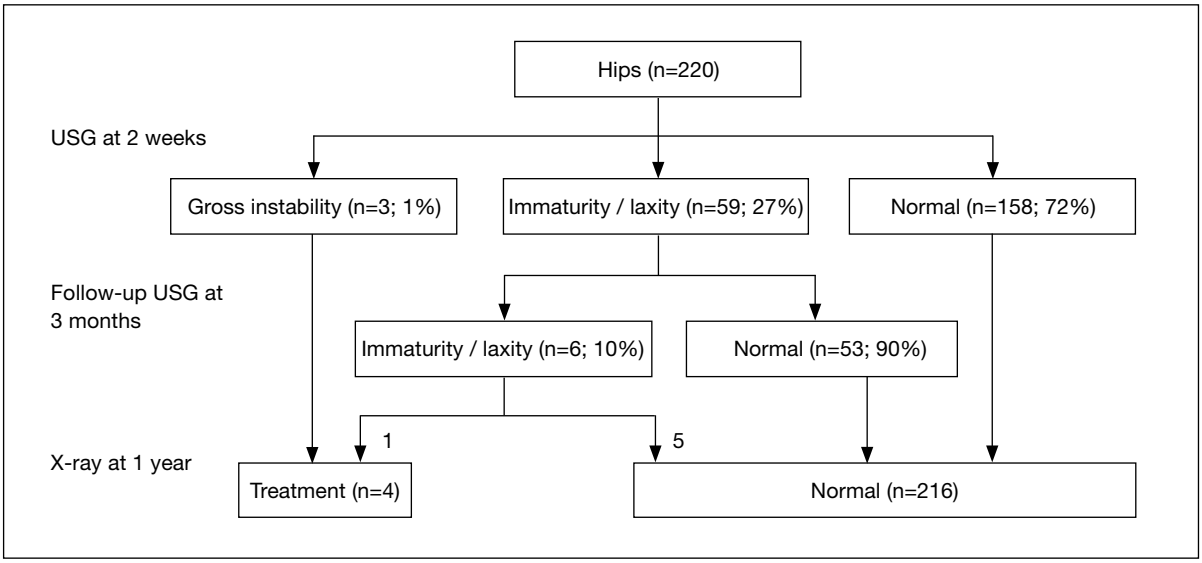

FIG 4. Results of 110 breech-presented neonates
USG denotes ultrasonography

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

Graf's type*	Male	Female	Total
I			
a	43	49	92
b	38	50	88
II			
a	11	29	40
b-d	0	0	0
III a-b	0	0	0
IV	0	0	0

* 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.

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References

1. Klistic PJ. Congenital dislocation of the hip—a misleading term: brief report. J Bone Joint Surg Br 1989;71:136.
2. Engeseter LB, Furnes O, Espehaug B, Lie SA, Vollset SE, Havelin LI. Survival of total hip arthroplasty after previous paediatric hip disease. J Bone Joint Surg Br 2003;85 Suppl 3:258.

3. Kalamchi A, MacFarlane R 3rd. The Pavlik harness: results in patients over three months of age. J Pediatr Orthop 1982;2:3-8.
4. Morcuende JA, Weinstein SL. New developments in developmental dysplasia of the hip. Curr Probl Pediatr 1994;24:335-43.
5. Mirdad T. Incidence and pattern of congenital dislocation of the hip in Aseer region of Saudi Arabia. West Afr J Med 2002;21:218-22.
6. Yiv BC, Saidin R, Cundy PJ, et al. Developmental dysplasia of the hip in South Australia in 1991: prevalence and risk factors. J Paediatr Child Health 1997;33:151-6.
7. Rosendahl K, Markestad T, Lie RT. Ultrasound screening for developmental dysplasia of the hip in the neonate: the effect on treatment rate and prevalence of late cases. Pediatrics 1994;94:47-52.
8. Hoaglund FT, Kalamchi A, Poon R, Chow SP, Yau AC. Congenital hip dislocation and dysplasia in Southern Chinese. Int Orthop 1981;4:243-6.
9. Jones D. Neonatal detection of developmental dysplasia of the hip (DDH). J Bone Joint Surg Br 1998;80:943-5.
10. Murray KA, Crim JR. Radiographic imaging for treatment and follow-up of developmental dysplasia of the hip. Semin Ultrasound CT MR 2001;22:306-40.
11. Stein-Zamir C, Volovik I, Rishpon S, Sabi R. Developmental dysplasia of the hip: risk markers, clinical screening and outcome. Pediatr Int 2008;50:341-5.
12. Graf R. The diagnosis of congenital hip-joint dislocation by the ultrasonic compound treatment. Arch Orthop Trauma Surg 1980;97:117-33.
13. Harcke HT, Grissom LE. Performing dynamic ultrasound of the infant hip. AJR Am J Roentgenol 1990;155:837-44.
14. Tönnis D. Normal values of the hip joint for the evaluation of X-rays in children and adults. Clin Orthop Relat Res 1976;(119):39-47.
15. Peled E, Eidelman M, Katzman A, Bialik V. Neonatal incidence of hip dysplasia: ten years of experience. Clin Orthop Relat Res 2008;466:771-5.
16. Murnaghan ML, Browne RH, Sucato DJ, Birch J. Femoral nerve palsy in Pavlik harness treatment for developmental dysplasia of the hip. J Bone Joint Surg Am 2011;93:493-9.
17. Pap K, Kiss S, Shisha T, Marton-Szücs G, Szöke G. The incidence of avascular necrosis of the healthy, contralateral femoral head at the end of the use of Pavlik harness in unilateral hip dysplasia. Int Orthop 2006;30:348-51.
18. HKCOG Territory-side O&G audit report. Hong Kong: Hong Kong College of Obstetricians and Gynaecologists. HKCOG website: http://hkcog.obg.cuhk.edu.hk/public/docs/audit/audit_og_report_2004.pdf. Accessed Nov 2011.
19. Shipman SA, Helfand M, Moyer VA, Yawn BP. Screening for developmental dysplasia of the hip: a systematic literature review for the US Preventive Services Task Force. Pediatrics 2006;117:e557-76.
20. Clinical practice guideline: early detection of developmental dysplasia of the hip. Committee on Quality Improvement, Subcommittee on Developmental Dysplasia of the Hip. American Academy of Pediatrics. Pediatrics 2000;105:896-905.
21. Paton RW, Hinduja K, Thomas CD. The significance of at-risk factors in ultrasound surveillance of developmental dysplasia of the hip. A ten-year prospective study. J Bone Joint Surg Br 2005;87:1264-6.
22. Koşar P, Ergun E, Unlübay D, Koşar U. Comparison of morphologic and dynamic US methods in examination of the newborn hip. Diagn Interv Radiol 2009;15:284-9.
23. Lowry CA, Donoghue VB, O'Herlihy C, Murphy JF. Elective Caesarean section is associated with a reduction in developmental dysplasia of the hip in term breech infants. J Bone Joint Surg Br 2005;87:984-5.