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ORIGINAL ARTICLE

Incidence of Surgery in Developmental Dysplasia of the Hip in Taiwan

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Background/Purpose: Early detection and treatment for developmental dysplasia of the hip (DDH) by screening in nursery has been recommended for several decades. With the recent survey of high prevalence of surgery for DDH in Taiwan, it has raised issues of the effectiveness of baby hip screening.
Methods: National Health Insurance covers 97% of the 22 million population in Taiwan. From the databank, we retrieved children who were admitted from birth to 5 years of age, with the diagnosis of DDH (International Classification of Disease version 9 [ICD-9] code 754.3×) or had had one of the treatments for DDH (ICD-9 code 77.39, 79.75, 79.85, 88.32) between 1997 and 2004.
Results: There were 1229 children undergoing surgeries for DDH in this study. A total of 1097 of them were female (89%). The mean age at the first surgery was 1.7 years. Major operation, open reduction with or without osteotomy, accounted for 85% of the cases. The number of children who were born between 1997 and 1999 and who had surgery for DDH were 160, 129 and 134, respectively. Incidences of surgery for DDH among these 3 cohort years were 0.49, 0.48 and 0.47 per thousand live births, respectively.
Conclusion: The incidence of DDH in Taiwan was reported as 1.2 per thousand, so 40% of the DDH children underwent surgery. However, with 87% of surgeries occurring after walking age, it is reasonable to postulate that the screening program was not performed accurately or universally. The rate of major procedures in surgical cases of DDH is a better indicator for the effectiveness of mass screening. [*J Formos Med Assoc* 2007;106(6):462–466]

Key Words: developmental dysplasia of the hip, early detection, national health insurance, prevalence

Developmental dysplasia of the hip (DDH), also known as congenital dislocation of the hip, is a deformation arising in late fetal life.[1] DDH is a correctable deformation and early splinting results in restoration of normal anatomy of the hip in more than 90% of infants.[2–4] For early detection and treatment, screening for hip instability in the nursery has been recommended for several decades.[5,6] In Sweden, a nationwide survey revealed that late diagnosed cases of DDH were reduced from 110 per year (0.91/1000) to 30 cases per year (0.25/1000) following the implementation of a hip screening program.[7,8] In a Canadian study, it showed early detection of DDH by hip screening to be cost-effective. They proved that the total cost spent in the treatment of DDH was correlated to the rate of false-negative screening.[9]

Despite excellent results demonstrated in some studies[6,10,11] with clinical screening for DDH, cases of late diagnosed DDH still existed.[12–15] On a nationwide basis, the high prevalence of surgery for DDH raised an issue of the effectiveness of the clinical screening program in the United Kingdom.[16] Treatment under general anesthesia for DDH was estimated as 0.78 per 1000 live births from routine hospital data and orthopedic

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surveillance scheme, and the number was similar to the incidence of DDH before the start of screening.[16] Nevertheless, only 15% of the treatments for DDH were major operations such as open reduction of the hip or osteotomy. Another study in Australia using data from the Birth Defects Register and hospital inpatient records reported an incidence of surgery for DDH as 0.46 per 1000 live births.[17] Major operations were required in 33% of the cases. In these two studies, the incidence of surgery for DDH and the percentage of cases requiring major operations were used as indicators of the effectiveness of the screening programs.

National Health Insurance (NHI) covers more than 97% of the 22 million population in Taiwan and offers free vaccination as well as baby examinations four times in the first year of life. There is no universal ultrasound hip screening program in Taiwan. Patients with DDH treated surgically are recorded in the NHI databank. The aim of this study was to evaluate the DDH screening program in Taiwan by the incidence of surgery for DDH, the age at first surgery and the procedures required for treatment.

Materials and Methods

The database between January 1997 and December 2004 was retrieved from the Bureau of National Health Insurance databank at the National Health Research Institute, Taiwan. We employed two methods of data collection: (1) hospital admissions with International Classification of Disease version 9 (ICD-9) code for congenital dislocation of the hip (754.3×) and (2) treatment with one or more of the following codes: closed reduction of the hip joint (79.75), open reduction of the hip joint (79.85), pelvic osteotomy (77.39 or 81.40), femoral osteotomy (77.25 or 77.35 or 78.25), adductor tenotomy (83.12) or arthrogram examination (88.32). Cases with a diagnosis of neuromuscular disease, congenital anomaly and who had acquired hip fracture/dislocation were excluded. Cases with more than one surgery were logged by the first surgery.

We collected cases who had their first surgery in the first 5 years of life, which included most of the surgical cases in this country. We calculated the incidence of DDH that required surgical treatment by the accumulated numbers of surgical cases in those children who were born in one birth cohort year divided by the number of total live births in that birth cohort year according to the Department of Statistics, Ministry of the Interior, Taiwan. The mean age at first surgery and the surgical procedures employed to treat DDH were recorded and analyzed for use as indicators of the effectiveness of screening programs. We used χ^2 for our statistics with less than 0.05 indicating significance.

Results

Between January 1997 and December 2004, a total of 1285 children received operations under general anesthesia for DDH. Thirty-three children were excluded from the study because of teratological hip dislocation, including congenital anomaly of limbs (18), spinal dysraphism (4), chromosome disorders (3), osteochondropathy (4) and myopathy (4). Twenty children with cerebral palsy and three children with a history of septic hip were also excluded. The remaining 1229 cases were included in our study.

The mean age of the children at first surgical treatment was 1.71 ± 0.93 years (range, 0–5 years). Seventy children (5.7%) had their first surgery for DDH before the age of 6 months, the age most DDH cases can be treated successfully by Pavlic harness. Among them, 14 children had open reduction and 56 had closed reduction with or without percutaneous adductor tenotomy. Ninety-six children (7.8%) had first surgery between 6 and 12 months of age. The remaining 1063 children (86.5%) had surgery for DDH after the first year of life. Major surgical procedures, open reduction with or without osteotomy, were often required after walking age. A majority of the first procedures (60.5%) were done between 12 and 24 months of age (Table 1). Among all the surgical procedures, 84.8% were major procedures (Table 2).

Table 1. Distribution of DDH cases by age at first surgery

Age at surgery (mo)	1997	1998	1999	2000	2001	2002	2003	2004	Total
0–5.9	9 (5%)	6 (3%)	9 (6%)	8 (6%)	12 (8%)	7 (5%)	11 (7%)	8 (6%)	70 (5.7%)
6–11.9	11 (6%)	11 (6%)	8 (6%)	8 (6%)	16 (11%)	10 (7%)	17 (11%)	15 (10%)	96 (7.8%)
12–23.9	105 (59%)	112 (63%)	90 (61%)	75 (58%)	92 (60%)	100 (67%)	84 (56%)	85 (59%)	743 (60.5%)
24–35.9	32 (18%)	26 (15%)	25 (17%)	19 (15%)	15 (10%)	23 (15%)	26 (17%)	26 (18%)	192 (15.6%)
36–59.9	21 (12%)	22 (13%)	15 (10%)	20 (15%)	16 (11%)	9 (6%)	14 (9%)	11 (7%)	128 (10.4%)
Total	178 (100%)	177 (100%)	147 (100%)	130 (100%)	151 (100%)	149 (100%)	152 (100%)	145 (100%)	1229 (100%)

DDH = developmental dysplasia of the hip.

Neither the distribution of age at first surgery nor the required surgical procedures (major or minor) were significantly different among the 8-year period of survey.

In this study, we were able to complete a 5-year survey of total surgeries in children born between 1997 and 1999. The incidence of first surgery for DDH in the first 5 years of life among these 3 cohort years were 0.49, 0.48 and 0.47 per thousand live births, respectively (Table 3). There was no significant difference between each year ($p = 0.93$). The incidences were constant no matter how much the live birth number of each year fluctuated. As the incidence of true DDH in Taiwan was reported as 1.2 per thousand live births,[18] 40% of children with DDH (0.48/1.2) required surgery. The cases requiring surgery could be late diagnosed DDH or DDH that was properly screened and failed conservative treatment, so the rate of late diagnosed DDH should be less than 40%. Alternatively, in DDH screening solely by manual clinical examination performed by general pediatricians, the detection rate was more than 60%.

Discussion

The reported incidence of DDH varied greatly and in part is dependent on ethnicity, definition of diagnosis and when the diagnosis was made.[19,20] The incidence of DDH in Taiwan was 1.2 per thousand live births when only the dislocated hip at birth and late diagnosed DDH were included.[18] The incidence increased to 2.9 per thousand live births when cases with dislocatable hips at birth were included. This is close to other Asian countries, for example, in Japan and Singapore, the incidences of DDH were reported as 3.1 and 4.7 per thousand live births, respectively.[21,22] Using the incidence of true DDH of 1.2/1000 live births in Taiwan by Huang et al,[18] 40% of children in Taiwan required surgical treatment.

The rate of major surgical procedures in DDH treatment is a good indicator of the quality of DDH screening. The percentage of open reduction with or without osteotomy in all surgical

Table 2. Annual surgeries required to treat DDH

	1997	1998	1999	2000	2001	2002	2003	2004	Total	%
Minor procedures*	27	16	21	13	25	11	41	33	187	15.2
Major procedures†	151	161	126	117	126	138	111	112	1042	84.8
Total	178	177	147	130	151	149	152	145	1229	100

**Minor procedures included closed reduction, adductor tenotomy, arthrogram examination and hip spica casting; †major procedures included open reduction, pelvis osteotomy and femoral osteotomy. DDH = developmental dysplasia of the hip.*

Table 3. Case number of first surgery by year of birth and year of operation

Operation year	1997	1998	1999	2000	2001	2002	2003	2004	Total	Yearly live births in Taiwan*	Incidence of surgery for DDH†
Birth year											
1992	4										
1993	9	8									
1994	22	9	3								
1995	72	20	7	4							
1996	63	65	13	5	5					324,317	
1997	8	70	55	20	6	1			160	324,980	0.49/1000
1998		5	61	47	12	4	0		129	268,881	0.48/1000
1999			8	50	55	10	8	3	134	284,073	0.47/1000
2000				4	65	63	18	4		307,200	
2001					8	63	51	18			
2002						8	68	57			
2003							7	50			
2004								13			

**Data from the website of the Department of Statistics, Ministry of the Interior, Taiwan: http://www.ris.gov.tw/ch4/static/st20-7.xls; †incidence of surgery for DDH in the birth cohort of 1997, for example, was the number of accumulated cases who were born in 1997 and had surgery in 1997 and the following 5 years (age, 0–5 years) divided by the total number of live births in 1997. DDH = developmental dysplasia of the hip.*

cases was 15% in the United Kingdom,[16] 33% in Australia[17] and 34% in Germany.[23] In our study, 84.8% of the surgical cases were major procedures and 86.5% of first surgery cases were performed after 1 year of age in Taiwan (Tables 1 and 2).

In a 1975 study by Palmen and von Rosen[8] of Sweden, the percentage of late DDH diagnosed after the age of 1 year was 90% in the pre-screening era, which decreased to 30% after screening started. With Sweden's experience and major procedure rate of the above-mentioned countries, the effectiveness of DDH screening in Taiwan is close to the so-called pre-screening era and we need to raise awareness of DDH in physicians who are in charge of neonatal screening as well as baby examinations.

At ≥ 60% early DDH detection rate with high percentage of major procedures and a mean age of 1.7 years at the first surgery, a possible explanation is that the screening program was not performed universally in Taiwan; therefore, some areas without proper screening are responsible for most surgical cases diagnosed after the age of 1.

Since the NHI in Taiwan does not pay for treatment with a harness or splint, we have no data to estimate how many cases of DDH were treated by Pavlik harness in the early months of life. The Taiwan Pediatric Orthopaedic Society has established an automatic reporting system among the membership in the subsequent years to estimate the incidence of DDH treated by harness. With this data, in addition to the surgical rate, we can revisit our true incidence of DDH.

One drawback in this study is that we were not able to identify the situation when parents decided to search for alternative care instead of doctor's recommendations. The delay of proper treatment might result in major surgery after walking age when obvious symptoms occur. However, we believe that the number of these cases were small. Nevertheless, judging from the large number of major surgical procedures, the majority of the surgical cases are believed to be the result of late diagnosis.

In the studies of Godward and Dezateux,[16] Chan et al[17] and von Kries et al,[23] children born outside the study area were excluded. Since the yearly immigrants and emigrants make up only 0.2% of the population in Taiwan, the impact on our data of the incidence of DDH is minimal.

In conclusion, since the incidence of surgery has been stationary in 3 successive years and the number of surgeries is more than 100 per year, the DDH data on a nationwide basis is reliable. We believe that the rate of major procedures in surgical cases of DDH is a better indicator of the effectiveness of mass screening. In Taiwan, 84.8% of the surgeries required major procedures and the mean age at first procedure was 1.7 years, indicating that the current DDH screening program in Taiwan requires more attention and improvement. It is time to have a mandatory hip screening program as a policy in well baby check up in Taiwan.

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