The Relationship Between Beighton Score and Walking Age in Children

Lavenia Kurniawati,* Indrayuni Lukitra Wardhani, Nur Rochmah,*** Sulistiawati******

**Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia*
***Department of Physical Medicine and Rehabilitation, Soetomo General Hospital, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia*
****Department of Pediatric, Soetomo General Hospital, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia*
***** Department of Public Health – Preventive Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia*

Abstract

Introduction*: Studies showed that the condition of joint hypermobility is quite common in children. In general, joint hypermobility asses through the Beighton score method. The objective of this research was to investigate the relationship between beighton score and walking age in children.*
Method*: This research was conducted at a kindergarten in Surabaya using an observational analytic research type and a cross-sectional design. Data collected through interviews and physical examinations. A joint hypermobility examination performed using the Beighton score criteria. Meanwhile data was analyzed using the crosstabulation and Spearman test.*
Result*: It was found that 84% of children had ≥4/9 score on the Beighton score and there were 92% with positive Beighton score in the knee joint. In this study, as many as 20 children experienced the first independent walks over 18 months when 18 of them who has Beighton score ≥4 points. However, there is no correlation found on the Beighton score and the walking age [sig. (2-tailed) = 0.053].*
Conclusion*: Children who have ≥4 points of Beighton score are mostly found in this study. The relationship between the Beighton score and walking age was not statistically significant.*

Keywords*: Beighton score, child development, delay motor development, joint hypermobility*

Korespondensi: Lavenia Kurniawati
E-mail: lavenia.kurniawati-2017@fk.unair.ac.id

Hubungan antara Skor Beighton dan Usia Berjalan pada Anak

Lavenia Kurniawati, Indrayuni Lukitra Wardhani,** Nur Rochmah,*** Sulistiawati*****

**Fakultas Kedokteran, Universitas Airlangga, Surabaya, Indonesia*
***Departemen Kedokteran Fisik dan Rehabilitasi Medik, RSUD Dr. Soetomo, Fakultas Kedokteran, Universitas Airlangga, Surabaya, Indonesia*
****Departemen Anak, RSUD Dr. Soetomo, Fakultas Kedokteran, Universitas Airlangga, Surabaya, Indonesia*
*****Departemen Ilmu Kesehatan Masyarakat-Kedokteran Pencegahan, Fakultas Kedokteran, Universitas Airlangga, Surabaya, Indonesia.*

Abstrak

***Pendahuluan**: Sejumlah penelitian menyatakan bahwa kondisi hipermobilitas sendi cukup sering ditemukan pada usia anak-anak. Secara umum, kondisi hipermobilitas sendi dinilai dengan metode skor Beighton. Penelitian ini bertujuan untuk melihat hubungan antara skor beighton dan usia berjalan pada anak.*
***Metode**: Penelitian ini dilaksanakan pada sebuah taman kanak-kanak di Surabaya menggunakan jenis penelitian analitik observasional dan desain cross-sectional. Pengambilan data melalui wawancara dan pemeriksaan fisik. Pemeriksaan hipermobilitas sendi dilakukan dengan kriteria skor Beighton. Data dianalisis menggunakan metode cross tabulation dan tes korelasi Spearman.*
***Hasil**: Seratus anak mengikuti penelitian ini. Ditemukan 84% anak memiliki skor ≥4 pada skor Beighton dan terdapat 92% dengan skor Beighton positif pada sendi lutut. Dalam penelitian ini didapatkan sebanyak 20 anak memiliki usia jalan pertama >18 bulan dan 18 orang memiliki skor ≥4 pada skor Beighton. Namun tidak ditemukan hubungan antara skor Beighton dan usia berjalan [sig. (2-tailed) = 0.053].*
***Kesimpulan**: Anak-anak dengan skor Beighton ≥4 banyak dijumpai pada penelitian ini. Hubungan antara skor Beighton dan usia berjalan tidak bermakna secara statistik.*

***Kata Kunci**: Skor Beighton, pola pertumbuhan anak, keterlambatan motorik, hipermobilitas sendi*

Introduction

Joint hypermobility is an increase joint motion due to the excessive weakness of the limiting soft tissue.[1] This situation is commonly seen in children than in adolescence and adulthood. In general populations, joint hypermobility has been reported to range from 2% to almost 65%.[2-4] Adib et al.[5] shows the prevalence of hypermobility in children reached 94% with a score of ≥4/9 on the Beighton scale. In some groups, increasing range of motion becomes an advantage as in the gymnasts' group.[6] Clinical manifestations of joint hypermobility are often related to the musculoskeletal system include joint instability, joint pain, joint dislocation, muscle weakness or even recurring injuries.[1,3,6-7]

Joint hypermobility is caused by an autosomal dominant abnormality that causes defects in collagen tissue (Tenascin-X).[8] Therefore, the complaints that often arise are flexibility in several joints, especially joints in the limbs. Deficiency in tenascin-x causes reduced density of collagen fibrils and can result in congenital hypotonia or muscle weakness.[5,9] By the decrease in muscle strength, there can be a delay in motor development which makes children will experience limitations in daily physical activity.[6,10] Joint hypermobility may affect motor development in children. In general, children can walk without stumbling at the age of 12–18 months. However, if a child cannot walk when he is >18 months old, then a more thorough evaluation of medical development is needed.[11]

Joint hypermobility can be measured by several diagnostic criteria, where the Beighton scoring system is the method most often used. The Beighton score contains 5 question components that have the highest total score of 9 points. This assessment has included joint motion in the upper and lower extremity.[12]

In this research, the Beighton score and its relationship with the age of walking in children were calculated.

Methods

This research was an observational study conducted in kindergarten X, Surabaya using a cross-sectional design. This research was held from October 2019 until January 2020. The research protocol has been approved by the Ethics Commission of the Faculty of Medicine, Universitas Airlangga (No. 35/EC/KEPK/FKUA/2020). As many as 100 children from Kindergarten X in Surabaya were involved in this study. Those who were participated were those who fulfilled the inclusion criteria which are as follows: (1) able to communicate well, (2) no paralysis, (3) has no deformities in the body, (4) agrees to participate in the study, follows an examination and signs the informed consent. Determination of inclusion criteria is based on the deformities in the body and carried out through a simple non-invasive physical examination. The deformity assessed is an abnormality in the musculoskeletal system and will manifest in the form of abnormalities of the extremities or the spine. Parents, in this case, sign a consent form that contains the objectives and research procedures. Their consent will then be used for the data in this study. The presence of joint hypermobility was assessed using the Beighton score (Table 1). Joint hypermobility occurs when the score is ≥4. Assessment using the Beighton score has a sensitivity of 87% and a specificity of 99%.[13]

To measure the wide-angle of joint motion of the joints, the goniometer was used. Data related to age (months) for the first independent walking was obtained based on direct interviews with the subject's parents/caregivers.

Frequency is calculated for all variables. Statistical analysis was performed using the IBM SPSS Statistic 25 application with a significance level of $p < 0.05$ using crosstabulation and the Spearman test.

Results

There were one hundred children that met the inclusion criteria. All of them have included in this study. Subjects underwent a physical examination in the form of height, weight, and continued with the Beighton score examination using a goniometer. Parents/caregivers who agreed to participate in this study attended the interview session. The subjects of this study consisted of 54 boys (54%) and 46 girls (46%) aged 3–6 years (Table 2). The majority of respondents were Javanese (38%) and Chinese (35%). Other respondents identified as ethnic/racial in addition to those listed above (27%). In this study, 60 children (60%) were included in the normal BMI category.

Table 2. Descriptive Characteristics of Participants

	Beighton score ≥ 4		
	No, n (%)	Yes,n (%)	p value
	Beighton score ≥ 4, n = 84 (84%)		
Gender			.457
Male	10 (10)	44 (44)	
Female	6 (6)	40 (40)	
Age (yr)			.615
3	0 (0)	5 (5)	
4	4 (4)	25 (25)	
5	7 (7)	37 (37)	
6	5 (5)	17 (17)	
Ethnicity			.470
Javanese	3 (3)	32 (32)	
Chinese	7 (7)	31 (31)	
Other	6 (6)	21 (21)	
BMI*			.092
Underweight	4 (4)	26 (26)	
Normal	8 (8)	52 (52)	
Obese	4 (4)	6 (6)	

A significance level of $p < 0.05$ has been used.
*BMI grouping follows CDC (BMI for age percentiles) curves based on gender

Table 1. The Beighton Score for Joint Hypermobility

1	Passive dorsiflexion on the little fingers beyond 90° (one point for each hand)
2	Passive apposition of the thumbs to the flexor aspects of the forearm (one point for each thumb)
3	Hyperextension of the elbows beyond 10° (one point for each thumb)
4	Hyperextension of the knee beyond 10° (one point for each thumb)
5	Ability to forward flexion of the trunk with knees fully extended so that the palms of the hands rest flat on the floor

Table 3. Percentage of Positive Beighton Score Tests for Each Tested Joint for All Participants

Joint	All participants	Male participants	*.p value*	Female participants	*p value*
	n = 100	n = 54		n = 46	
	%	%		%	
Right little finger	77	83.3	.050	69.6	.007*
Left little finger	86	88.9	.008*	82.6	.056
Right thumb	26	20.4	.101	32.6	.157
Left thumb	31	31.5	.144	30.4	.651
Right elbow	41	38.9	.004*	43.5	.029*
Left elbow	48	38.9	.004*	58.7	.003*
Right knee	71	77.8	.000*	63	.174
Left knee	72	70.4	.000*	73.9	.003*
Spine	71	64.2	.055	80.4	.000*

A significance level of $p < 0.05$ has been used.

Nearly all participants in this study (84%) were identified as having a Beighton score ≥4 and received a positive score on the pinky finger hyperextension test. There was no significant difference in the incidence of positive scores on Beighton scores in boys and girls for each joint examination item performed (Table 3). Data related to walking age were obtained from interviews with parents/ caregivers. Based on these results, as many as 20 children were identified as having experienced their first independent walk at the age of more than 18 months. The age range of these children is 19–42 months. There was no significant correlation found between Beighton score and walking age [p>0.05].

Discussions

This study found no relationship between Beighton score and walking age in children based on the Spearman statistical test (p = .053).

In addition, the study found that 84% of children had Beighton scores ≥4 points. In line with the Adib,[5] it was stated that 94% of participants experienced joint hypermobility in children aged <18 years. However, in other literature studies, there are still inconsistencies in data of the relationship between age and the incidence of joint hypermobility.[2,5,14-15] Previous studies have stated that the number of women who experience joint hypermobility is more than men because they have differences in activities, especially activities that practice the level of flexibility such as dancing/ ballet that many women do.[16] Even though the number of women experiencing more joint hypermobility, but there is still no statistically significant correlation as in this study.[17]

There has been no research on the relationship between ethnic groups in Indonesia and the Beighton score. However, several studies stated that the Asian race has a higher hypermobility value than the Caucasian race.[18] In this research, it was found that the highest prevalence found in Javanese (34.81%) and Chinese (33.62%). The relationship with BMI also did not have a significant value in this study which is in line with Arkadiusz's research.[19] BMI can affect the health of children because in children with obesity, joints must withstand excessive loads, whereas in the cases of malnutrition, the conditions in muscle and ligament strength may decreased.[20]

In other studies with similar age participants, it reported that there was no relationship found between Beighton score results and MABC (Movement Assessment Battery for Children). It means that there is no statistically significant correlation was found between joint hypermobility and delayed motor development in children. However, somehow it found that the score of motor development in children with joint hypermobility is lower when compared to the general population.[21] Besides the possible implications of joint mobility in children with poor motor control still need to be considered because suboptimal muscle strength can lead to poorly joint motion control and instability.[21-22]

It was also found in this study that out of a

total of 20 children who experienced first independent walks at the age of more than 18 months, there were 18 children (90%) who have Beighton score ≥4 points. In previous studies, it was mentioned that hypermobility could affect motor development in children, even without being characterized by neurological deficits.[22] Hypermobility that occurs in the lower extremities can affect standing balance and show results in postponement of crawling, standing, and walking.[23]

Hypermobility that occurs in the lower extremities could evaluate with a knee hyperextension value >10° on the Beighton Score. In this study, it was found that as many as 77 children (91.67%) of a total of 84 participants who has Beighton score ≥4 points also received a positive score on a knee hyperextension test >10°. In addition, as many as 17 children (94.44%) of a total of 18 participants who has Beighton score ≥4 points and experienced first independent walks at the age more than 18 months, received a positive score on a knee hyperextension test >10°. Despite all of the findings, this result needs to be considered in children with delayed walks because excessive knee hyperextension can affect the child's balance function. In an evaluation of gait in children with joint hypermobility, it was found that children with hypermobility used less knee flexion when walking than most children and had an extended hyperextension phase during the standing phase.[24] There is also a shortening of knee flexion during loading response and lengthening of knee extension during mid-stance.[25]

Conclusion

From this study it was known that almost all children who participated in the research has Beighton score ≥4 points (84%) without a significant correlation between the Beighton score and the walking age. Further research with a cohort or prospective research design is needed to minimize recall bias when collecting data is performed.

Conflicts of Interest

The authors confirmed no conflict of interest.

Acknowledgments

All authors have seen and approved the final manuscript. LK designed the outline concept of the research and wrote the initial draft. ILW, NR, and S revised and expanded the manuscript.

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