Pediatric rheumatology

Joint hypermobility in Indian children

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Abstract

Objectives

To study the prevalence of joint hypermobility in children from Mumbai, India and to study its association with malnutrition.

Methods

In a cross-sectional field study from September '02 to February '03 in Mumbai, 829 children of the lower urban socio-economic strata, between 3 and 19 years of age were evaluated independently by two observers for hypermobility using the Beighton 9-point scoring system. A score of ≥ 4/9 was considered positive. Their nutritional status was stratified using standard Indian growth charts and hypermobility was quantified in various nutritional groups. Musculoskeletal symptoms were assessed by a questionnaire given to parents. Standard tests of significance (Chi square test, $p < 0.05$ - significant) were applied.

Results

58.7% of the population studied, had a Beighton score ≥ 4/9. There was a declining prevalence of joint hypermobility noted with increasing age. Near equal sex incidence was noted. A higher incidence of finger signs was noted in comparison to elbow hyperextension, knee hyperextension and hands-to-floor. 26% of the hypermobile population had musculoskeletal symptoms as compared with 17.2% of the non-hypermobile population ($p < 0.05$). A positive Beighton score was found in 452/734 (61.5%) children with Grade 3 and 4 malnutrition in comparison to 35/95 (36.8%) children with normal nutrition or mild grades (Grade 1 and 2) of malnutrition ($p < 0.05$). In the group with Grade 3 and 4 malnutrition, 26.1% of those hypermobile had musculoskeletal symptoms in comparison to 17.7% of their non-hypermobile counterparts ($p < 0.05$).

Conclusions

In our study population: 1. A high prevalence of hypermobility using Beighton's score was noted; 2. Finger signs of the Beighton score were more common than the other signs; 3. Moderate and severe malnutrition were associated with hypermobility; 4. Musculoskeletal symptoms were linked to joint hypermobility; 5. Moderate and severely malnourished hypermobile children were more likely to have musculoskeletal symptoms as compared to their non-hypermobile counterparts.

Key words

India, hypermobility, Beighton, musculoskeletal symptoms, malnutrition.

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Introduction

Joint hypermobility is joint laxity in an excess range of normal, beyond the limits of physiological movement. It was put on the medical map in 1967 by Kirk, Ansell and Bywaters (1). Though there are several studies on prevalence, data from the Asian continent is scant. Only one Indian study has been conducted to date (2). This study proposed to quantify the prevalence of hypermobility in a lower socioeconomic pediatric population in Mumbai, India and study its association with malnutrition.

Materials and methods:

A cross-sectional study was conducted from September '02 to February '03 in Mumbai. Eight hundred and twenty-nine urban children between 3 and 19 years of age, belonging to the lower economic strata, receiving non-formal after school education from a voluntary organization were enrolled in the study. Due parental and child consent in accordance with the guidelines of the ethics committee of our institution was taken before the examination.

A separately designed proforma was used for this study. This involved the subject's demographic data, weight and a detailed musculoskeletal history that recorded the presence or absence of the following symptoms: arthralgia, joint swellings, dislocation, growing pains, soft tissue rheumatism, backache and their relation to rest, exercise, daily activity and posture.

The nutritional status using weight as a parameter was stratified using standard Indian growth charts (3) and was graded according to the IAP (Indian Academy of Pediatrics) classification viz normal nutrition - > 80^{th} percentile, malnutrition grades: Grade 1 = 80^{th}-70^{th} percentile, Grade 2 = 70^{th}-60^{th} percentile, Grade 3 = 60^{th}-50^{th} percentile, Grade 4 = < 50^{th} percentile. For the purpose of our analysis, Grades 1 and 2 were considered mild and grades 3 and 4 were considered as moderate to severe grade malnutrition.

The children were evaluated by two pediatricians for hypermobility by using the nine-point Beighton scoring system. Both had to agree that a joint was hypermobile in order to grade it as such. A score of ≥ 4/9 was considered positive. Standard tests of significance (chi-square test, $p < 0.05$ - significant) were applied.

Results

Fifty-eight point seven percent (58.7%) of the population studied had a Beighton score ≥ 4/9. The incidence of hypermobility in the various age-groups was: 3-7 years 145/182, (79.7%), 7-13 years 290/474, (61.2%), 13-19 years 51/173, (29.5%) and a break up of the sexes is depicted in Figure 1. The overall sex incidence was: males - 257/436 (58.9%), females - 230/393 (58.5%).

The profile of Beighton signs seen alone or in combination is shown in Figure 2. There was a higher incidence of finger signs noted in comparison to elbow hyperextension, knee hyperextension and hands-to-floor.

On analyzing the nutritional status of the population studied, a positive Beighton score was found in 452/734 (61.5%) children with moderate to severe (Grades 3 and 4) malnutrition in

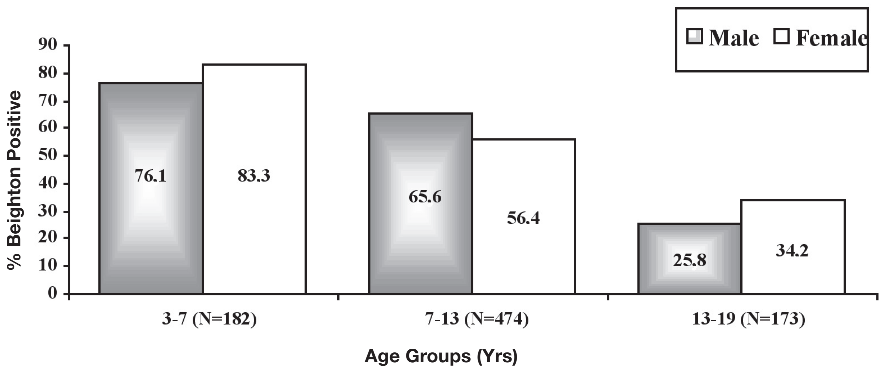

Fig. 1. Age and sex distribution.

Competing interests: none declared.

comparison to 35/95 (36.8%) children with normal nutrition or mild grades (Grade 1 and 2) of malnutrition ($p < 0.05$, significant).

Furthermore, musculoskeletal symptoms (MSK) were more significantly found in hypermobile as compared to the non-hypermobile population ($p < 0.05$) (Table I). Within the hypermobile group, MSK was not significantly increased in the malnourished group (28.5%) as compared with the well-nourished group (26.1%) (Table III).

In the population of moderate to severe malnourished children, those who were hypermobile, were more likely to manifest MSK (118/452; 26.1%) as compared with the non-hypermobile group (50/ 282; 17.7%) ($p \leq 1$) as depicted in Tables II and III.

Discussion

We report a prevalence of 58.7% in our population ranging from 3-19 years, using a Beighton cut-off of ≥ 4/ 9. These figures are comparable with studies conducted at certain centers [Brazil (4), Barcelona (5), Hong Kong (6), in Indian populations abroad (7) and a subsequent (unpublished) study by our team in a different pediatric population in our own city]. There is, however, a striking contrast with earlier surveys from some other countries [Israel (8), USA (9), Iceland (10), Egypt (11), Greece (12) and our own country, in Southern India (Chennai) (2)]. If we were to use a Beighton cut-off of ≥ 5/ 9, as used by studies conducted in countries depicted in Table IV, 41% of our population would be hypermobile.

In the Chennai study, the Carter Wilkinson's scoring system was used to survey 1000 children between 6-15 years and they reported a prevalence of 17.2% (Table V). At least two factors can help explain the difference. Firstly, the South Indian study looked at children between 6-15 years, while we studied a wider age interval. A higher prevalence in our 3-7 year cluster can partly explain the disparity. The second reason is that the South Indian study used malnutrition as an exclusion criterion for their study and thus their population comprised of only the well-nourished pediatric population.

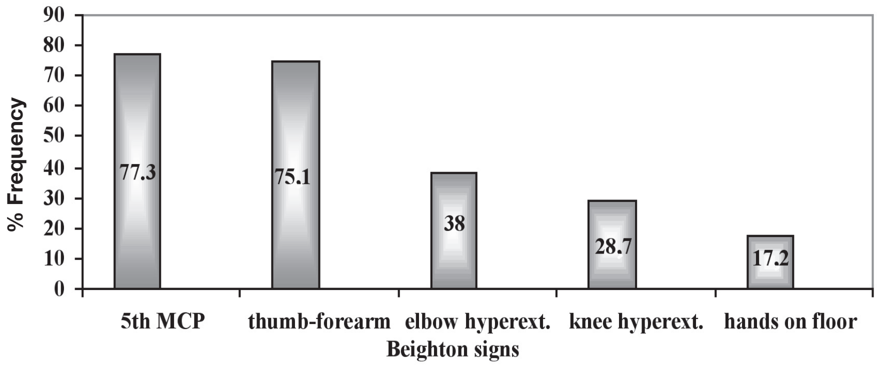

Fig. 2. Profile of Beighton signs.

Table I. Total population.

	Hypermobile	Non-hypermobile
No.	487	342
MSK	128	59
%	26	17.2

Chi square test, $p < 0.05$, significant.

Table II. Moderate and severe malnutrition.

	Hypermobile	Non-hypermobile
No.	452	282
MSK	118	50
%	26.1	17.7

Chi square test, $p < 0.05$, significant.

Table III.

	Hypermobile		Non-hypermobile	
Nutrition	Normal to mild	Moderate to severe	Normal to mild	Moderate to severe
	35	452	60	282
MSK	10 (28.5%)	118 (26.1%)	9 (15%)	50 (17.7%)

While some studies have reported a striking female preponderance [Barcelona (5), Palma (13), USA (9), Iceland (10)], we were unable to document a sex difference. Workers from Houston (14), Egypt (11), Brazil (4) and Hong Kong (6) have reported similar trends (Tables IV and V).

A criticism for Beighton's scoring system is that it has a tendency to be 'top heavy' *i.e.,* having a skew towards upper extremity signs. This is substantiated by the high prevalence of hand and elbow signs in our population (similar to observed studies from Iceland (10) and Egypt (11). A paradox is created, as the symptoms are often in the lower extremities while the signs are in the upper (15). This was also the observation by Kirk, Ansell and Bywaters in their landmark study (1).

Conditions hitherto known to influence joint hypermobility are physiological factors such as age, sex, ethnicity, dominant side, training and pathological entities such as acromegaly, hyperparathyroidism, rheumatic/rheumatoid arthritis (16). Our study shows that in addition to the above factors, moderate or severe malnutrition can influence joint hypermobility *i.e.,* malnourished children are more likely to have hypermobility than their better nourished counterparts. While animal studies

Table IV. Population studies on Hypermobility using the Beighton scoring system.

Country/Year of publication	Numbers (n)	Age (years)	M (n); %HM	F (n); %HM	Scoring used	% HM
India (Delhi) 2006 (21)	2050	Adult	NS	NS	≥ 5/ 9	20%
U.K (London) 2005 (15)	225 (116 normals)	Mean age 7	NS	NS	≥ 5/ 9	34%
Italy 2004 (20)	311	6.3-19.3	F > M, not statistically significant		≥ 5/ 9	34%
Manchester 1997 (9)	264	Mean age 15.5	150; 6%	114; 22%	≥ 5/ 9	12.9%
Our Study	829	3-19	- 58.5%	- 58.9%	≥ 5/ 9 ≥ 4/ 9	41% 58.7%
Barcelona 2000 (5)	112	4-7	50; 42%	62; 61.2%	≥ 4/ 9	52.6%
Iceland 1999 (10)	267	Mean age 12	143; 40.5%	124; 12.9%	≥ 4/ 9	27.7%
Singapore 1999 (7)	306	15-39	NS	NS	≥ 4/ 9	17%
Texas 1998 (14)	192	5-19	83; 30.1%	109; 37.6%	NS	34%
Egypt 1998 (11)	997	6-15	499; 14.4%	498; 18%	≥ 4/ 9	16.1%
Canada 1995 (19)	378	Mean age 16	49; NS	329; NS	≥ 4/ 9	13.2%

Table V. Population surveys on HM using other scoring systems.

Country/Year of publication	Numbers (n)	Age (years)	M (n); %HM	F (n); %HM	Scoring used	% HM
Dutch 1997 (22)	252(group1) 658 (group2)	4-13 (group1) 12-17 (group2)	Group1- F > M; not significant Group2- F > M; significant		Beighton score & Biro Score	Group1- 15% Group2-13.4%
Southern India 1996 (2)	1000	6-15	F > M HM		Carter & Wilkinson	17.2%
Brazil 1993 (4)	1005	5-17	445; 33.7%	560; 38.3%	Carter & Wilkinson	36.3%
Israel 1993 (8)	338	9-15	179; 11%	159; 14%	Carter & Bird	13%
Palma 1991 (13)	1136	11-14	13%	21%	NS	NS
Hong Kong 1991 (6)	2360 Chinese (C) and Non-Chinese (NC)	3-13	M = F HM		Carter & Wilkinson	Age 3- 100% (C) 50% (NC) Age 6- 67%(C) 9% (NC) Age12- 28%(C) 1%(NC)

M: male; F: female; NS: not specified; HM: Hypermobile; C: Chinese; NC: non-Chinese

have shown that malnutrition affects collagen synthesis (23, 24), the relationship of malnutrition to hypermobility in humans has not been studied to date. This is probably because most studies on prevalence of hypermobility have been reported from centres where malnutrition is not a problem.

Our study reiterates the belief of other workers that 'It is time to take hypermobility seriously' (17). There is a strong association with musculoskeletal symptoms (18, 19). Children complaining of these musculoskeletal symptoms do not get the attention they deserve, largely because of scant physician awareness.

In summary, we report a prevalence of 58.7% joint hypermobility in our study population belonging to the urban lower socio-economic strata and additionally, the association of hypermobility with moderate to severe malnutrition.

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