Original paper

Screening of vitamin D deficiency in children with chronic functional constipation

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Abstract

Introduction: Vitamin D deficiency is one of the most common nutritional deficiencies worldwide. Chronic functional constipation is one of the most common gastrointestinal disorders in childhood in developing and developed countries. Vitamin D has been linked to different systemic diseases. The medical domain has recently been interested in the role of vitamin D.

Aim: To screen for vitamin D deficiency and insufficiency among children with chronic functional constipation.

Material and methods: It was a cross-sectional study. Two groups of children were collected at the outpatient clinic at Alexandria University. Children who fulfilled Rome IV criteria of chronic functional constipation were assigned to the first group (Constipation group). Children who did not have chronic functional constipation were considered as the second group (Healthy control group). Vitamin D level was measured in both groups. Statistical analysis used: Data were fed to the computer and analysed using IBM SPSS software package version 20.0. Quantitative data were described using range (minimum and maximum), mean, standard deviation, and median.

Results: Vitamin D levels were significantly deficient or at least insufficient in the group of children with chronic functional constipation.

Conclusions: Chronic functional constipation is associated with vitamin D deficiency and insufficiency in children.

Introduction

Functional constipation is often described as difficult or infrequent bowel movements/deviation from normal frequency, painful defecation, the passage of hard stools, and/or sensation of incomplete evacuation of stool. Constipation is defined as functional constipation if there is no underlying organic cause, which is the case in up to 95% of children [1].

Constipation is one of the commonest digestive complaints in children. Constipation in children is a common health problem affecting 0.7% to 29.6% of children across the world [2, 3].

Vitamin D deficiency is a worldwide public health problem. Low vitamin D and its consequences among children and adolescents could be considered as one of the most important health-related problems. Vitamin D deficiency and insufficiency are highly prevalent. In sunny countries, the special pattern of conservative clothing and the lack of outdoor physical activity might be the underlying factor for the high prevalence of vitamin D deficiency [4].

Vitamin D has recently been a point of discussion in the medical domain and has been found to be strongly associated with many systemic disorders. There has been augmented interest within the medical community in vitamin D, especially its deficiency, in various systemic disorders. The association of vitamin D in skeletal and extra-skeletal health is an established medical fact [5].

It has anti-inflammatory effects, immune modulatory effects, and it has been linked to gastro-intestinal motility [6, 7].

There are insufficient studies in the literature discussing the level of vitamin D in children with constipation.

Aim

To screen for vitamin D deficiency or insufficiency in children with chronic functional constipation.

Material and methods

This study is a cross-sectional study. Two groups were collected at the paediatric outpatient clinic. The first group (Constipation group) comprised 55 patients newly diagnosed with chronic functional constipation according to ROME IV criteria [8] who had not received treatment yet. The second group (Healthy group) comprised 55 healthy children coming to the clinic for follow-up who did not have chronic constipation.

Exclusion criteria from both groups were as follows: patients taking any medications causing constipation, such as iron, or any drug affecting vitamin D level, such as corticosteroids. Patients with organic causes of constipation were excluded. Patients with chronic constipation who started laxatives were excluded. Moreover, patients and healthy children supplemented with vitamin D were excluded.

Demographic data were collected: name, age, and sex. Weight and height were recorded. The Constipation and Control groups were classified according to age into 2 groups: < 4 years old and ≥ 4 years old.

History was taken including symptoms of constipation like infrequent evacuation, faecal incontinence, hard stool, painful stool, and large diameter of stool and symptoms of vitamin D deficiency such as bone pain, muscle weakness, fatigue, bone deformities, delay in motor development, tetany, and convulsions.

The Constipation and Control group were asked about vitamin supplementation and drug intake. Clinical examination including abdominal and rectal examination was done. 25 hydroxy vitamin D level was measured in both groups. Vitamin D level was considered sufficient if equal to or above 30 ng/ml. Vitamin D level was considered insufficient if 20–29.9 ng/ml. Vitamin D level was considered deficient if below 20 ng/ml [9].

The group of patients with newly diagnosed constipation were screened for vitamin D level first before giving treatment with laxatives according to ESPHGAN guidelines [3].

Statistical analysis

Data were fed to the computer and analysed using IBM SPSS software package version 20.0 (Armonk, NY: IBM Corp). Qualitative data were described using number and percentage. Continuous data were tested for normality by the Kolmogorov-Smirnov test was used to verify the normality of distribution χ^2 test for categorical variables, to compare between different groups. Fisher's exact or Monte Carlo correction for chi-square was used when more than 20% of the cells had an expected count of less than 5. Quantitative data were described using range (minimum and maximum), mean, standard deviation, and median. Student's *t*-test was used to compare 2 groups for normally distributed quantitative variables. The Mann-Whitney test was used to compare 2 groups for non-normally distributed quantitative variables. The significance of the obtained results was judged at the 5% level.

Results

The study involved 55 patients with chronic functional constipation and 55 healthy children without constipation.

Table I shows that 78.2% of the constipated group were 4 years old or above. Table I shows that the mean ages of the Constipation group and the Control group were comparable (6.95 ±3.59 and 5.67 ±3.91, respectively; $p = 0.078$). Vitamin D levels were below the reference values in 55 patients with constipation (100%). Vitamin D levels were not normal in any patient with chronic constipation. Vitamin D levels were significantly lower in the patients with constipation. There was no statistical difference between the 2 groups regarding weight and height.

Table II shows that vitamin D was either deficient or insufficient in the constipated group whether the age was < 4 years or ≥ 4 years.

Discussion

It is known that vitamin D toxicity causes constipation [10].

In our study we screened patients with chronic functional constipation for vitamin D levels. Vitamin D levels were significantly lower in the patients with chronic functional constipation. This can be explained by the fact that vitamin D may aid in gastric motility or movement of the muscles in the gastrointestinal tract. Thus, deficiencies may lead to the slowing of the movement in the gastrointestinal tract, causing constipation. Although laxatives were identified to affect vitamin D status, we excluded patients with chronic functional constipation taking laxatives before measuring vitamin D levels [11].

Roma *et al.* reported that constipated children had a lower caloric and nutrient intake and a higher prevalence of anorexia. He reported that in the constipated group, the percentage of anorexic children was 5 times higher than in control subjects. Anorexia, low intake of energy, and nutritious food rich in vitamins could be caused by early satiety secondary to a loaded colon [12].

Sherief *et al.* reported in a study that a lack of vitamin D was present in almost all the studied Egyptian healthy adolescents (99%) – 94.8% had vitamin D deficiency, and 4.2% had vitamin D insufficiency. Girls had a higher prevalence of vitamin D deficiency than boys. There was a significant association between lack of physical activity, sun exposure, and vitamin D deficiency [4].

Table I. Comparison between the 2 studied groups according to age and vitamin D level

Parameter	Constipation (n = 55)	Healthy control (n = 55)	Test of sig.	P-value
Age [years]				
Less than 4 years	12 (21.8%)	20 (36.4%)	χ^2 = 2.821	0.093
4 years or more	43 (78.2%)	35 (63.6%)		
Median (min.–max.)	7.0 (1.0–14.0)	5.0 (1.0–13.0)	t = 1.777	0.078
Mean ± SD	6.95 ±3.59	5.67 ±3.91		
Vitamin D level [ng/ml]				
Deficient (< 20)	43 (78.2%)	18 (32.7%)	χ^2 = 32.579*	0.001*
Insufficient (20–29.9)	12 (21.8%)	15 (27.3%)		
Normal (≥ 30)	0 (0%)	22 (40%)		
Median (min.–max.)	13.60 (5.0–25.0)	26.60 (7.90–73.0)	U = 549.00	> 0.001*
Mean ± SD	14.63 ±4.85	28.99 ±15.50		
Weight [kg]				
Underweight	1 (1.8%)	2 (3.6%)	χ^2 = 3.173	^{MC}p = 0.237
Normal weight	54 (98.2%)	50 (90.9%)		
Obese	0 (0%)	3 (5.5%)		
Median (min.–max.)	25.0 (9.0–50.0)	20.0 (7.0–100.0)	U = 1270.5	0.147
Mean ± SD	23.89 ±9.48	22.99 ±15.64		
Height [cm]				
Short	1 (1.8%)	0 (0%)	χ^2 = 1.009	^{FE}p = 1.000
Normal height	54 (98.2%)	55 (100%)		
Median (min.–max.)	115.0 (82.0–158.0)	105.0 (80.0–165.0)	U = 1208.50	0.069
Mean ± SD	117.53 ±21.21	109.80 ±24.50		

*χ^2 – Chi-square test, t – Student t-test, U – Mann-Whitney test, MC – Monte Carlo, FE – Fisher exact, p – p-value for comparing between the Constipation group and the Healthy control group, *statistically significant at p ≤ 0.05, SD – standard deviation.*

Table II. Comparison between the 2 studied groups according to vitamin D level

Vitamin D level [ng/ml]	Constipation	Healthy control group	χ^2	^{MC}p
Less than 4 years	12 (21.8%)	20 (36.4%)		
Deficient (< 20)	8 (66.7%)	5 (25%)	14.504*	0.001*
Insufficient (20–29.9)	4 (33.3%)	2 (10%)		
Normal (≥ 30)	0 (0%)	13 (65%)		
4 years or more	43 (78.2%)	35 (63.6%)		
Deficient (< 20)	35 (81.4%)	13 (37.1%)	20.449*	< 0.001*
Insufficient (20–29.9)	8 (18.6%)	13 (37.1%)		
Normal (≥ 30)	0 (0%)	9 (25.7%)		

*χ^2 – chi-square test, MC – Monte Carlo, p – p-value for comparing between the Constipation group and the Healthy control group, *statistically significant at p ≤ 0.05.*

Panarese *et al.* reported that serum vitamin D deficiency could be associated with functional chronic constipation induced by intestinal motility disorders [13].

Several studies showed that hypovitaminosis D may be a risk factor for many chronic diseases [14, 15]. Notably, vitamin D deficiency has been involved in the pathophysiology of inflammatory bowel disease and irritable bowel disease [16, 17].

Irritable bowel syndrome (IBS) is one of the most common gastrointestinal conditions, characterised by chronic abdominal pain, bloating, and alteration of

bowel habits (constipation or diarrhoea, alternating or mixed) without any organic cause [18].

Ali *et al.* reported that vitamin D deficiency was found to be higher in the IBS group (76.6%) compared to control group (46.7%). When different subtypes were analysed IBS-constipation subtype (62.2%) was more common than IBS-diarrhoea subtype (20%) and IBS-mixed subtype (17.8%) [19]. Jalili *et al.* reported that 6-week supplementation with vitamin D improves the symptoms and quality of life in patients with IBS [20].

Conclusions

Constipation is associated with vitamin D deficiency or insufficiency. Further studies are needed to evaluate the effect of vitamin D supplementation on the symptoms of constipation in children.

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Ethical approval

The study protocol was approved by the ethical committee of the Alexandria University Faculty of Medicine, Alexandria, Egypt (ZU-IRB#: 00012098). Informed consent was obtained from the parents or the caregivers of all children before inclusion in the study

Conflict of interest

The author declares no conflict of interest.

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