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Serum Calcium, Vitamin D Levels in Pediatric Flatfoot Patients That were Brought to Clinic with or without in-Toeing Complaint

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ABSTRACT

Objectives: This study aims to evaluate the serum levels of calcium and Vitamin D in pediatric patients with flatfoot, who were brought to clinic with or without in-toeing compliants.

Methods: Flatfoot patients who were followed up between November 2017 and December 2019 were divided into four groups. Group A included patients who had flatfoot with in-toeing. Group B included patients who had flatfoot without in-toeing. Group C included patients who had in-toeing without flatfoot. Group D was the control group and it included patients who had neither flatfoot nor in-toeing. Group D had no other acquired or congenital diseases via to the pediatric age. Serum levels of calcium and Vitamin D were detected by biochemical assays on study and control groups.

Results: In this study, four study groups included 204 children who were divided in to four groups as Group A, B, C and D. All groups included 51 (%25.0) patients. According to test results, in the serum calcium levels, there was a significant difference between Group A and Group D in favor of the control group (p=0.040). There was no significant difference between serum vitamin D levels and foot deformities (p=0.457). The relationship between calcium values and foot deformities was significant (p=0.004). The relationship between vitamin D values and foot deformities was not significant (p=0.457).

Conclusion: The coexistence of flatfoot and in-toeing may be related to lower serum calcium levels. Flatfoot with or without in-toeing has no relationship with serum Vitamin D levels.

Keywords: Flatfoot, in-toeing, calcium, vitamin D

INTRODUCTION

Flatfoot is a common cause of hospital visits for families.[1] At the young children, age pediatric flatfoot is usually asymptomatic. Krul et al. found the incidence rate as 4.9 in 1000 individuals and 3.4 in 1000 individuals from 1987 to 2001.[2] They linked this condition that patients and their parents had been chosen orthopedic specialists for flatfoot. At the choice of treatment for flatfoot, it must be to determine whether flatfoot is rigid or not on the first step. Jack test is used for differing two clinical conditions. Jack Test is defined as the disappearance of the internal longitudinal arch when hyperextending the first toe. Jack test is positive in patients with flexible planus foot and negative in patients with rigid planus foot.[3] On the other hand, rotational problems are divided into main two groups as in-toeing and out-toeing. In-toeing is commonly seen in infants. The in-toeing clinic makes many parents more concerned about their child's gait profile. Parents brought their children with the in-toeing complaint to orthopedic and family medicine clinics in several times. This pathology has a relationship with in-toeing as femoral anteversion tibial torsion and metatarsus adductus. The foot had been turned inward in metatarsus adductus, the shinbone in tibial torsion and the thighbone in femoral anteversion.[4]

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Lower extremity problems in childhood make parents concerned commonly. At the evaluation of the patient with lower extremity abnormality, a satisfying anamnesis and careful physical examination must be executed. The physical examination must include angular measurements and torsional profile tests.[5] However, there was no study about the relationship between flatfoot, in-toeing, and serum levels of calcium (Ca), vitamin D (Vit D) in pediatric-aged patients. In this study, the mentioned relationship was searched. This study aims to search the relationship between flatfoot and clinical, metabolic aspects such as insufficiency of Vit D and Ca levels on the patient with or without in-toeing gait using clinical, physical examination methods and biochemical assays, too.

METHOD

In this cross-sectional study groups were divided into four groups as Group A, B, C and D. All study groups were randomized chosen to differ adult patients as under 16 age. Clinical, biochemical and radiological findings of study groups were recorded between November 2017 and December 2019. All patients with flatfoot findings were examined radiologically. Group A included pediatric flatfoot patients who have in-toeing, too. Group B included pediatric flatfoot patients without in-toeing. Group C included pediatric patients who had been brought to the clinic with in-toeing without flatfoot. Group D was the control group which had neither flatfoot nor in-toeing. Group D had no other acquired or congenital diseases due to the pediatric age.

Serum Ca and Vit D levels were detected by blood biochemical analyses in all groups. The serum Ca levels were measured by turbidimetry method (Roche/Hitachi Cobas© c systems, 501 analyzers © 2018, Roche Diagnostics, Mannheim/Germany). Serum Vit D assay is intended for the quantitative determination of a total of 25 hydroxyvitamin D in serum. The electrochemiluminescence binding assay is intended for use on the immunoassay analyzer (Elecsys Vitamin D assay Cobas© 2019, Roche Diagnostics, Mannheim/Germany). The measurement unit of serum Ca is mg/dL and serum Vit D levels are ng/mL.

As the exclusion criteria, patients who were treated with Ca or Vit D were excluded from study groups. Also, patients who had flatfoot with neuromuscular disorders, vertical talus, or tarsal coalition were not included. The gait analysis for study and normal control groups were compared clinically.

Statistical analysis was carried out using the software SPSS 20.0 (Windows, USA). Descriptive statistics for numerical variables were expressed values as frequency, percentage, mean, standard deviation, median, minimum and maximum values. One-Way ANOVA test was used for variables with normal distribution, and the Kruskal Wallis test was used for variables with the abnormal distribution. Tukey Test was used to examine between which parameters this meaningful relationship was. Categorical variables were analysed using Chi-Square test. The results were evaluated within the 95% confidence interval. A p-value less than 0.05 was considered significant.

RESULTS

There were 204 patients under 16 years-old in the chosen study groups. All groups included 51 (25.0%) patients. The age and gender of all groups are shown in Table 1.

The mean in serum Ca levels was 9.5±0.5 mg/dL, 9.9±0.6 mg/dL, 9.7±0.4 mg/dL, and 9.8±0.4 mg/dL in Group A, Group B, Group C and Group D, respectively (p=0.004). Serum Ca and Vit D levels of all groups are shown in Table 2 and, the comparison of all study groups for serum Ca levels is shown in Table 3.

DISCUSSION

The results of our study suggest that flatfoot patients with in-toeing may be examined for serum Ca levels. Our results imply that a compound bone deformity as the coexistence of flatfoot with rotational problems of the lower extremity may be related to serum Ca and Vit D levels via metabolic changes. Serum Ca and Vit D levels may be examined for

Table 1. The age and gender of all groups

	Group A (n=51)	Group B (n=51)	Group C (n=51)	Group D (n=51)	p
Age (years)	7.1 (4.0-16.0)	9.0 (4.0-16.0)	8.3 (4.0-16.0)	8.2 (4.0-16.0)	0.509*
Gender, n (%)					
Female	21 (41.2)	23 (45.1)	22 (43.1)	24 (47.1)	0.760†
Male	30 (58.8)	27 (54.9)	29 (56.9)	27 (52.9)	

Grup A: flatfoot+in-toeing; Grup B: flatfoot; Group C: in-toeing; Group D: control.
Data is presented as median (minimum-maximum) and n (%).
*Kruskal Wallis test, †Chi-Square test used.

Table 2. Serum calcium and vitamin D levels of all groups

	Group A (n=51)	Group B (n=51)	Group C (n=51)	Group D (n=51)	p
Serum calcium (mg/dL)	9.5±0.5	9.9±0.6	9.7±0.4	9.8±0.4	0.004*
Serum vitamin D (ng/mL)	16.8 (6.5-37.9)	16.9 (3.4-94.8)	18.7 (5.1-42.4)	16.3 (9.1-89.3)	0.457†

Grup A: flatfoot+in-toeing; Grup B: flatfoot; Group C: in-toeing; Group D: control.
Data is presented as mean±SD and median (minimum-maximum).
*One-Way ANOVA test, †Kruskal Wallis test.

Table 3. The comparison of all study groups for serum calcium levels

	Mean Difference	Std. Error	p
Group A			
Group D	-0.254	0.095	0.040
Group B	-0.333	0.095	0.003
Group C	-0.162	0.095	0.323
Group B			
Group D	0.078	0.095	0.844
Group A	0.333	0.095	0.003
Group C	0.170	0.095	0.282
Group C			
Group D	-0.092	0.095	0.769
Group B	-0.170	0.095	0.282
Group A	0.162	0.095	0.323
Group D			
Group B	-0.078	0.095	0.844
Group A	0.254	0.095	0.040
Group C	0.092	0.095	0.769

Grup A: flatfoot+in-toeing; Grup B: flatfoot; Group C: in-toeing; Group D: control.
Tukey Test.

flatfoot patients with in-toeing.

Flexible flatfoot has a normal arch during non-weight activity. However, rigid flatfoot has stiffness and collapsed posture. As the flexible flatfoot is accepted as a physiologic situation during four years, in-toeing and flatfoot are often the coexisting part of this deformity. Generally, radiologic studies are not needed in the first step of physical examination. Referral to orthopedic clinics is often not necessary. If severe deformities cause dysfunction to appear, surgery may be required older than eight-years-old.[5] If the congenital vertical talus, tarsal coalition, and skew-foot are concerned with inpatient with flatfoot, the patient must be evaluated for surgical management.[6] As focused in the literature, foot posture and measurement must be made carefully to avoid the unnecessary worry of parents.[7] At a study, dynamic footprints with the Foot Scan system were determined in both feet of 1059 children (6-13 years old). The relationship between the flexible flat foot (FFF) and age, gender, side, body mass index (BMI) was searched. There was no correlation between the prevalence of FFF and gender side. The prevalence of FFF decreases by age. It makes a plateau on 12 or 13 years old. It is positively correlated with increased BMI and height.[8] If conservative treatment were failed, joint-preserving surgery, deformity-corrective techniques is might be used for pediatric flexible flat feet in conjunction with deformity-specific soft tissue procedures.[9] The relationship between flatfoot and in-toeing is not clear. However, the coexistence of these two deformities is not rare. All patients with flatfoot must be evaluated for torsional profile tests and angular measurements.

Many anxious parents get to bring their children to orthopedics with in-toeing problems, also rarely the out-toeing problem. Blackmur et al. did not recommend radiographs, ultrasounds or computed tomography for the diagnosis of in-toeing.[10] They found that the median age for in-toeing was four years. In their study, any patient underwent surgery. Eighty-six percent of the children were evaluated as normal. There was no significant pathology on 14% of their case series. They emphasized that to referral patients with in-toeing to the orthopedic clinic is not necessary.[10-12] In the surgical treatment of in-toeing, there is an osteotomy that is effective for rotational deformities. However, it has high complication rates. It should not be considered until the patient is eight years.[13] In patients with cerebral palsy, in-toeing is not rare, and it has multiple etiological factors. Because of the necessity of surgical correction, these patients must be considered to refer to orthopedic clinics by family medicine physicians.[14] Patients with neuromuscular dysfunctions with flatfoot, in-toeing at the same time must be a referral to surgical audit by orthopedists.[15] According to another study, the treatment of in-toeing must be individualized because of various etiological factors in each patient.[16]

When looking at the serum Ca and Vit D levels of patients in various orthopedic deformities, there is a situation that needs to be explained. Qamar et al. found that hypovitaminosis D may be related to the pathogenesis of growing pains.[17] The study of Tague et al. suggest that Vit D deficiency may lead to muscular hypersensitivity and pain.[18] According to Smith et al., supplementation with Vit D (±Ca) may reduce the risk of fragility fractures and improve fracture healing.[19] To our knowledge, in the literature, no study searched the relationship between flatfoot with the in-toeing clinic and serum Vit D levels. Eslamian et al. found that joint deformities and severe knee pain were correlated with low levels of Vit D.[20] Among the other mechanical factors, flatfoot is enounced as an etiological factor for Patellofemoral Pain Syndrome risk factors.[21] Severe Vit D deficiency in children causes in developmental delays, nutritional rickets, and impaired growth.[22, 23] Low levels of 1,25-Dihydroxyvit D in children play the role of a factor of negative Ca balance and it inhibits bone formation.[24, 25] Barazaet al. detected a low serum Ca levels (corrected 2.28 mmol/L) in a patient who was diagnosed as bilateral pes plano-valgus deformity with multiple bone cysts.[26] Serum Ca and Vit D levels are affected by multiple factors. Vit D helps to absorb serum Ca in-take. Recently, Lips declared that age and residence are crucial etiological factors as baseline Ca intake, baseline Vit D status. Also, the author emphasized that there is an interaction between Ca and Vit D.[27]

This study has some limitations. The small sample size and non involvement of patients with out-toeing was made difficult to generalize the results. Moreover the grading of in-toeing requires new measurement scores.

CONCLUSION

We conclude that there was a statistical difference in Ca levels of between flatfoot patients with in-toeing and control groups, but not for serum Vit D levels. Flatfoot with or without in-toeing clinic was found as unbound with serum Vit D levels. However, the coexistence of flatfoot and in-toeing may be related to serum Ca levels. More comprehensive and more qualified studies are needed to investigate the relationship between the in-toeing clinic and serum Vit D and Ca levels in pediatric patients with flatfoot.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Ethics Committee Approval: The ethical approval for this study was obtained from Kafkas University School of Medicine Ethical Committee (Approval date: 28/11/2018, Approval number: 805766354-050-99/95).

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