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Frequency of hospitalization in patients diagnosed with congenital talipes equinovarus (CTEV)

Abstract

Introduction. Congenital talipes equinovarus (CTEV), also called clubfoot is the second after congenital dysplasia of the hip (CDH) most frequently occurring congenital limb defect. In Europe the deformity affects 1-2 newborns in 1000 live births.

Aim. The aim of the study was to determine frequency of the deformity among other reasons for hospitalization, as well as depicting the profile of patients treated for clubfoot.

Material and methods. Study method was the analysis of medical documentation from two Orthopaedic Wards of Prof. Antoni Gębala Children's Hospital of Lublin. Medical records of patients treated for congenital talipes equinovarus (IDC 10-Q66.0) between 2008 and 2013 were the study material.

Results. Results of the study show that in the analyzed period of time 310 children were hospitalized for clubfoot in hospotal. 39.35% (n=122) of the total number of patients were girls and 60.65% (n=188) were boys. The average age of patients was 3.69 years, (Me=1.09 years). Average age of girls was 4.17 (Me=1.35 years) and boys 3.89 (Me=0.83 years). The most numerous group consisted of infants up to 1 year (n=154; 49.68%).

Conclusions. Clubfoot affects boys twice as often as girls. Moreover, in the examined hospital the average length of stay for patients with clubfoot has decreased. The research reveals that the average hospitalization length in children with congenital talipes equinovarus is systematically decreasing. The study shows that the number of patients being admitted to the Children's Orthopedics Institute of the Hospital is increasing while the number of patients with clubfoot remains on the same level.

Keywords: congenital talipes equinovarus, clubfoot, lower limb defect, foot deformity.

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INTRODUCTION

Congenital talipes equinovarus (Lat. pes equino-varus congenitus) is the second most frequent lower limb defect. Defective morphological structure of the foot includes: adduction (turning under) of the forefoot and midfoot, adduction (varus), or turning in of the heel or hindfoot and fixed plantar flexion (equinus) of the ankle characterized by the drawn up position of the heel and inability to bring to foot to a plantigrade (flat) standing position impedes walking and standing [1-3]. Clubfoot (Figure 1) is a deformity affecting foot with function impairment and preserved anatomic structures and its main elements enumerated above are visible after birth [4-5].

Congenital talipes equinovarus has several clinical types. Orthopaedic doctor at the first examination has to assess not only the severity of the deformation but most importantly to what extent it is treatable in a passive manner. To do this, doctors use Dimeglio's four-point classification developed in the 90s, which is based on the degree to which it is correctable and on the deformity described by the appropriate order and composition of two words "soft" and "stiff".

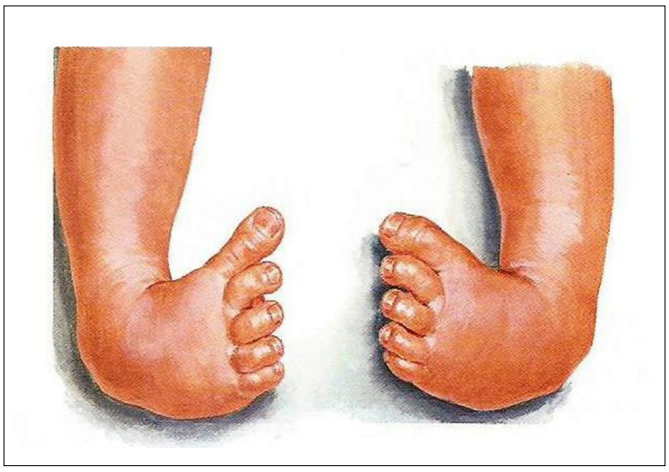

FIGURE 1. Bilateral congenital talipes equinovarus.

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Alan Dimeglio's foot deformity classification:

1. Type I soft-soft – soft foot, it is a positional deformity, easy to correct and position properly. It is benign foot deformity. It corresponds with habitual foot type and comprises 20% of all deformities.
2. Type II soft-stiff – soft-stiff foot undergoes positioning in the sagittal and horizontal plane to over 50 degrees, with tarsus varus below 20 degrees. Type II makes 33% of all deformities.
3. Type III stiff-soft – harder foot with deformity correction below 50 degrees in sagittal and horizontal plane, comprises 35% of all deformities.
4. Type IV stiff-stiff – hard foot, stiff, teratogenic with possible correction of equinus and adduction below 20 degrees with tarsus varus of above 45 degrees, makes 12% of all deformities [6-8].

AIM

The authors investigated the frequency to discover frequency of the deformity and elicited profiles of patients treated for clubfoot.

MATERIAL AND METHODS

The authors looked at an analysis of medical documentation of 310 patients treated for congenital talipes equinovarus (IDC 10-Q66.0), hospitalized in two Orthopedic Wards of Prof. Antoni Gębala Children's Hospital of Lublin between years 2008 and 2013. Patients were hospitalized in one of the two wards: Ward I- Children's Orthopedic and Rehabilitation Clinique of Medical University of Lublin's Orthopedic Department and Ward II- Children's Orthopedic Clinique of Medical University of Lublin. Children's Hospital in Lublin is the only place in the East macro region of Poland where patients with clubfoot are treated.

Data gathered in the study were analyzed with statistical methods. Values of the analyzed measurable parameters were represented by mean, median and standard deviation and non-measurable parameters were represented with the numerousness and percentage. In order to assess the normality of measureable parameters Saphiro-Wilk test W was employed.

Kruskal-Wallis analysis of multiple comparisons was used to compare many independent groups. Chi square distribution test was used to determine differences between frequencies in compared groups with qualitative values.

Significance level of $p<0.05$ was employed to indicate the existence of statistically significant differences. Data base was created and statistical analysis was conducted with STATISTICA 10.0 software (StatSoft, Poland).

RESULTS

A statistical analysis of the documentation gathered at Medical University of Lublin Children's Orthopedic Department between years 2008-2013 showed that 310 children were hospitalized for congenital talipes equinovarus, 39.35% of which were girls (n=122) and 60.65% were boys (n=188). Average age of the group was 3.69 years (Me=1.09 years). Average age of girls was 4.17 (Me=1.35 years) and boys 3.89 (Me=0.83 years). The most numerous age group were infants up to one year (n=154; 49.68%), while 21.29% (n=66) of patients were aged 1 to 3, 16.13% (n=50) aged 4 to 10 and 12.90% (n=40) were more than 10 years old. 62.23% (n=196) of the analyzed group was hospitalized between years 2008 and 2013 in I Children's Orthopedic Ward and 36.77% (n=114) in II Children's Orthopedic Ward. Among patients treated for congenital talipes equinovarus 89.35% (n=277) were treated for the deformity as a main illness, clubfoot in 0.97% (n=3) patients was an additional illness while 9.68% (n=30) had clubfoot as an concurrent illness. Admission frequency analysis shows that clubfoot patients were more frequently admitted in 2010 (n=72) and 2011 (n=62), than in 2008 (n=44), when the least numerous group of patients diagnosed with CTEV was admitted (Table 1).

TABLE 1. Frequency of clubfoot between 2008-2013 in relation to the total number of patients admitted in Children's Orthopedic Department of Medical University of Lublin.

Year	All admissions				Total	
	Clubfoot diagnosis		Other reason			
	n	%	n	%	n	%
2008	44	2.51%	1710	97.49%	1754	100.00%
2009	45	2.32%	1894	97.68%	1939	100.00%
2010	72	3.42%	2032	96.58%	2104	100.00%
2011	62	2.20%	2756	97.80%	2818	100.00%
2012	51	1.75%	2870	98.25%	2921	100.00%
2013	49	1.51%	3203	98.49%	3252	100.00%

Source: Netter F. Netter's Orthopaedic Anatomy Atlas. 2007, p. 259

Medical University's Children's Orthopedic Department material was analyzed in the study. The examined department consists of two clinics: Children's Orthopedic and Rehabilitation Clinic of Children's Orthopedic Department referred to as "Ward I" and Children's Orthopedic Clinic referred to as "Ward II" in the organizational structure of Children's Hospital of Lublin. Study reveals that the majority of patients with congenital talipes equinovarus (63.23%) were hospitalized in Ward I and 36.77% of patients were hospitalized in Ward II within the examined period. In Ward I the total number of patients with clubfoot equaled 209 while the general number of all patients summed up to 7243. In the examined years the percentage of patients with CTEV in relation to total number of admissions equaled 2.88%. Over the examined years the percentage changed as follows: in 2008 – 2.9%, 2009 – 3.05%, 2010 – 4.62%, 2011 – 3.13%, 2012 – 2.08% while in year 2013 the percentage dropped to 1.90%. The number of patients treated for clubfoot in later years was similar to the number form first years of the examined period and systematic decline in the percentage is caused by the increase in the total number of patients treated in the hospital. In the Ward II during the examined period 114 patients with clubfoot were hospitalized while the total number of patients amounted to 7336. Some 1.55% of the total number of patients hospitalized in the Ward II, were patients diagnosed with congenital talipes equinovarus. Over the years, the percentage of clubfoot patients was dropping systematically: 2008 – 2.02%, 2009 – 1.57%, 2010 –2.25%, 2011 – 1.46%, 2012 – 1.35% to reach 1.11% in 2013. Results of the analysis indicate that among children treated for clubfoot in 2013, boys (63.27%) were significantly more frequently hospitalized than girls (36.73%).

A similar discrepancy was observed is observed in year 2008 (74.19% of boys compared to 25.81% of girls) and in

year 2009 (71.11% and 28.89%). In the remaining years the frequency of admission was equal – similar number of boys and girls was admitted. Differences are not statistically significant (p=0.14).

TABLE 2. Number of patients treated for congenital talipes equinovarus in Children's Orthopedic Department of Medical University of Lublin in years 2008-2013 according to gender.

Year	Gender				Total	
	Girls		Boys			
	n	%	n	%	n	%
2008	11	25.00%	33	75.00%	44	100.00%
2009	13	28.89%	32	71.11%	45	100.00%
2010	36	50.00%	36	50.00%	72	100.00%
2011	26	41.94%	36	58.06%	62	100.00%
2012	21	41.18%	30	58.82%	51	100.00%
2013	18	36.73%	31	63.27%	49	100.00%
Statistical analysis Chi^2=8.25; p=0.14						

n=323, 11 children were hospitalized several times

Taking into consideration patients' age on the day of admission, statistical analysis did not show any significant differences among examined years (p=0.60). Each age group has the same frequency of admission in the analyzed years. However, the most numerous group of patients treated for congenital talipes equinovarus comprised of infants up to one year old.

TABLE 3. Frequency of congenital talipes equinovarus in Children's Orthopaedic Department of Medical University of Lublin in years 2008-2013 according to the age on the day of admission.

Year	Age								Total	
	Up to 1 year		1-3 years		4-10 years		More than 10 years			
	n	%	n	%	n	%	n	%	n	%
2008	20	45.46%	13	29.55%	5	11.36%	6	13.63%	44	100.00%
2009	22	48.89%	10	22.22%	7	15.56%	6	13.33%	45	100.00%
2010	42	58.33%	11	15.28%	9	12.50%	10	13.89%	72	100.00%
2011	29	46.77%	15	24.19%	10	16.14%	8	12.90%	62	100.00%
2012	27	52.94%	12	23.53%	6	11.77%	6	11.76%	51	100.00%
2013	22	44.90%	9	18.37%	14	28.57%	4	8.16%	49	100.00%
Statistical analisys: Chi^2=13.03; p=0.60										

n=323, 11 children were hospitalized several times

Table 4 presents the hospitalization time of clubfoot patients in years 2008-2013 in Children's Orthopedic Department of Medical University of Lublin. Conducted analysis revealed that among particular years the hospitalization time was significantly different (p=0.0002). Multiple comparison analysis showed that hospitalization time in years 2008, 2009 significantly differed in comparison to years 2010, 2011, 2012 and 2013, while among the remaining years the differences were not statistically significant (p>0.05).

DISCUSSION

Congenital talipes equinovarus is the second most frequent limb defect and affects around 135 000 newborns worldwide. In Europe clubfoot affects 1-2 newborns per 1000 live births. In China cases of the deformity are the least frequent where in 1000 births only 0.3 children are affected with CTAV [9-19]. In Hawaii and Tonga in turn, 6-7 infants in 1000 births are reported to be born with clubfoot [20]. Maori Islands' medical records also show high percentage of clubfoot patients (6-7 cases in 1000 births) [21]. High number of children with CTAV is also observed in New Zealand where 6.8 infants in 1000 births are born with the deformity [22].

Boys suffer from clubfoot twice as often as girls, although in girls the deformity is more severe and less likely to be cured. Reason for this sexual dimorphism where men are two times more frequently affected by the deformity are still unknown [6,23,24]. Presented research confirms the thesis about higher probability of diagnosing clubfoot in male infants than in females. In the researched group 39.35% (n=122) of patients were girls while 60.65% (n=188) were boys.

Ostrowski's analysis of clubfoot hospitalization in years 1970-1999 showed that 68% of the total number of 1041 children hospitalized were boys while 32% were girls [25]. Etiology of clubfoot is researched by many scholars, yet main reasons of the deformity are still unknown [26-29].

Researchers of congenital talipes equinovarus give few factors as causes of the deformity. Probable causes include: environmental exposure to tobacco, genetic disorders, tobacco exposure combined with hereditary factors or even seasonal virus infections [30-34]. Other premises suggest that primary causes of clubfoot are osseous system modifications or soft tissue alteration. Differences in the clinical picture of clubfoot may indicate differences in its etiology. Benign clinical types can be connected with mechanical causes of external origin, like incorrect position of a child's foot in uterus or small amount of amniotic fluids. Some authors claim that clubfoot is not an embryonic deformity as the affected foot at first develops correctly to become equinovarus in the second trimester. CTAV is a developmental deformity [35]. It can exist as one of the components in one syndrome or as an isolated defect. Considering the deformity as a syndrome, clubfoot origins as well as its inheritance correspond with its etiology. When the defect is isolated the etiology is not known. Inheritance of CTAV can be estimated on the level of 24%. In multifactor etiology the risk of clubfoot inheritance decreases to only 3% [9,36,37]. In case of the multifactor inheritance when only one boy in a family has clubfoot the risk of its occurrence in the next

TABLE 4. Hospitalization time in years between 2008 and 2013 in Children's Orthopedic Department of Medical University of Lublin .

Year	Mean	Standar dev.	Lower quartile	Median	Upper quartile
2008	5.56	3.29	2.21	5.06	7.12
2009	5.61	5.00	1.98	4.02	6.98
2010	3.89	2.77	1.93	2.85	5.10
2011	4.09	3.29	1.86	2.99	4.96
2012	3.73	2.80	1.81	2.83	4.92
2013	2.91	1.92	1.91	2.00	3.95
Statistical analysis: H=23.72; p=0.0002*					

child is 2%, while when it affects girl the risk rises to 5%. In case where one of the parents have the deformity the risk is as high as 25%. Among the Polynesian population, the frequency of clubfoot inheritance stays on high levels of 54% [38-40]. Average hospitalization time of patients with CTAV in Children's Orthopedic Department of Medical University of Lublin in 2008 lasted around 5.56 days, in 2009 – 5.61 days, from 2010 the average dropped to 3.89 days, in year 2011 – 4.09 days, 2012 – 3.73 days while in 2013 the average hospitalization time decreased to 2.91 days. Conducted study shows that hospitalization time differences in the examined years were statistically significant (p=0.0002). V. Pavone [4] analyzed 82 clubfoot patients in the Orthopedic Clinic of Catania University, 68.29% of which were boys, while 31.71% were girls. In the researched group almost half of the patients (49.68%) were less than one year old, while 21.29% were 1-3 years old.

RESULTS

1. Congenital talipes equinovarus affects males more frequently than females.
2. Study shows that the average hospitalization time of clubfoot patients is systematically decreasing.
3. The authors' analysis shows that more patients are being admitted to Children's Orthopedic Department of Medical University of Lublin while the number of patients with clubfoot remains on the same level.

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