301. Rentgenological classified characteristics of pes plano-valgus

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Abstract. The author proposes a new method of evaluation of the degree of severity of pes-plano valgus taking into consideration the data of clinical and rentgenological examination in 2 reciprocally perpendicular projections with the definition of angles A and B.

Keywords: pes plano – valgus, rentgenological classification.

Introduction

Static skeletal deformities are known to be the most common pathology of the musculoskeletal system [1,3,4]. In this group of diseases the core position is given to pes plano – valgus (in the Russian-language literature the preferred term is flat-foot). This pathology is encountered in 6.9% to 70% of the population [1,3,4,8].

Among children static deformities of the locomotorium make up over 77% out of all orthopedic diseases. In this group various foot deformities account for 58.3% of all cases [1].

The author, in the course of examining 5259 children of school-going age, has revealed various deviations in the forming of the foot in 1615 patients (30,7%). 87% of the examined children have been diagnosed with pes-plano valgus.

In infancy and juvenile age in case of untimely diagnostics and delayed treatment foot deformities progress. In separate cases the pathology becomes irreversible, cannot be eliminated by means of orthopedic devices and is subject to surgical treatment [11].

With the purpose of controlling the anatomical deviations the forming of the foot within the preoperative period and analysis of the results of conservative and operative treatment a variety of instrumental methods of investigation: plantoscopy, photoplantoscopy, plantar computer barography [6,10]. However, the indicated instrumental investigations are not available to practical public health services.

At the same time the rentgenological method of investigation, which allows to study the bony skeleton of the foot, is available to all and allows to objectively evaluate the peculiarities of structure and compile a plan of treatment.

Contemporary biomechanical research has shown that 63% of the stability of the foot is ensured by the configuration of the bones and their short ligaments [7,9,12].

For objective evaluation of the anatomy of the foot skeleton, which is the basis of the foot's stability, there exists a series of rentgenological classifications [2,5]. As a rule, they take into account the alterations in only one plane – sagittal or frontal. This does not allow a composite evaluation of the anatomico-functional condition of the entire foot.

The aim of the given study is to improve the classification of pes-plano valgus on the basis of objective rentgenometrical and clinical showings.

Materials and methods

The author supervised the observation of 40 operated children with pes-plano valgus (55 feet). The age of the patients ranged between 2.5 and 15 years. The 40 children were comprised of 27 boys (67.5%) and 13 girls (32.5%). All the patients had bilateral deformities. 18 children (36 feet—65.45%) had surgery on both feet. All the patients showed clearly defined clinical symptoms.

Upon objective investigation 34 children showed non-fixed pes-plano valgus, 6 children had a partially fixed deformity.

Rentgenological investigation, as the basic diagnostic objective method, was applied to all patients. It was carried out in 2 projections with the patients in a standing position with physiological pressure. The lateral projection was carried out with centering on the head of the astragaloid bone.

During the analysis of the radiograms of operated patients the author noted that only in 9.09% of all cases the

angle of the longitudinal arch ranged from 150° to 155°, which corresponds to the 3rd degree of severity of flat-foot according to the conventional classification used in our country [5]. In the rest of the cases (90,9%) the showing varied between 156° and 176°, but they were also belonged to the group of patients with the 3rd degree of severity of the deformity. Thus, according to the conventional classification, patients with the most severe forms of the illness are not divided into groups.

The absence of classified characteristics of clearly defined foot deformities do not allow one to objectively divide patients into clinical groups according to the degree of severity and analyze the results of treatment. Therefore the creation of characteristics which objectively divide patients with severe forms of pes-plano valgus into homogeneous groups is an urgent issue.

Classification is a process of collateral subordination of ideas with the purpose of establishing connections between them and orientation in the variety of them. A classification system must present a totality of rules of attribution of these ideas to a certain group. Every system of classification must meet the needs of unambiguity, clearness and serviceability. Stable and objective features must be used as criteria for attributing objects to certain groups.

In connection with this, the author proposes a clinical-and-rentgenological classification of pes-plano valgus which is new, unambiguous in its treatment of the achieved results, clear and easy to use practically.

Two main rentgenological angle indices are defined – angle A in the sagittal plane and angle B in the horizontal plane.

The definition of the angle of the longitudinal arch A is done on the lateral radiogram (Fig.1)

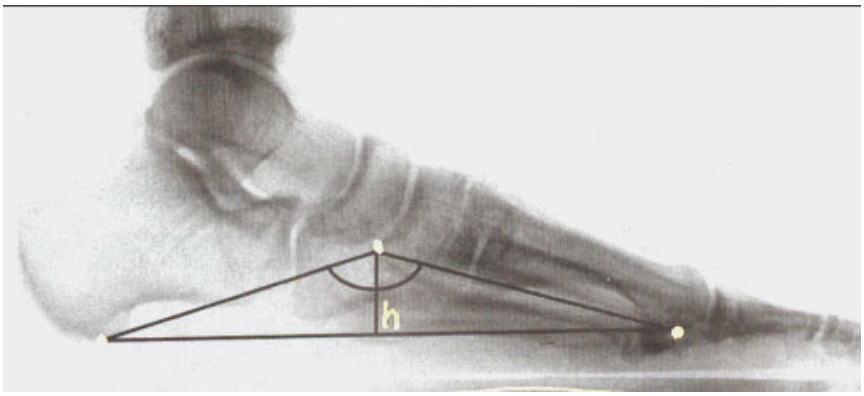

Fig. 1. Method for defining the angle of the longitudinal arch A

For this process three points are used: the first – the tuber calcanei lower bearing point, the second – the caput ossis metatarsalis 1 lower bearing point, the third – the lower joint point between os cuneiforme mediale and os naviculare. The norm for angle A is below 135°.

Angle B – the intertarsal angle – characterizes the interrelation between the rear and middle sections of the foot in the horizontal plane. The definition of angle B requires locating the transverse axis of the middle section of the foot. The key points: along the inner surface – tuberositas ossis navicularis and a point at the level of the 1 sphenoid-metatarsal joint – the said points are joined with a straight line, which is divided in half. This produces the first required point on the medial surface of the foot.

The second point for locating the transverse axis of the middle section of the foot is found on the outer surface of the foot by means of joining of the two points with a straight line along the surface of the cubiform bone and dividing the acquired line in half. Both points, located on the outer and inner sides of the foot are joined with a straight line, which is the transverse axis of the middle section of the foot. Next, a perpendicular is dropped on this line. A longitudinal line is drawn along the axis of the astragaloid bone. The intertarsal angle B is formed by the longitudinal axis of the astragaloid bone and the perpendicular dropped on the transverse axis of the middle section of the foot (Fig.2). According to the author's data, the norm fro this angle ranges from 0° to 10°.

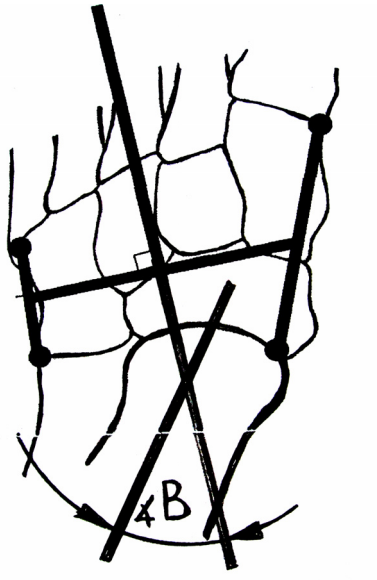

Fig. 2. Method for defining the intertarsal angle

Taking into account the value of angles A and B 5 stages of severity of pes-plano valgus are determined.

Degree of severity	A	B
I	136° - 145°	11° – 20°
II	146° - 155°	21° – 30°
III	156° - 165°	31° - 40°
IV	166° - 175°	41° - 50°
V	>176°	>51°

Depending on the evidence of clinical signsm the compensated, subcompensated and decompensated forms of trhe disease are distinguished.

The compensated is characterized by a significantly lowered longitudinal arch, the foot is broadened in the middle section and elongated, the rear section of the foot is pronated. Subjectively – without evident clinical signs at a moderate load. Pain syndrome and hypostasis of the feet occur after significant physical activity by the end of the working day. Foot deformities are not fixed.

The subcompensated form – the longitudinal arch of the foot cannot be traced, the foot is evidently broadened in the middle section, and the rear section is pronated. The patients walk loses flexibility and resilience. Upon examination occurrences of tenosynovitis and aseptic arthritis are noted. Subjectively – high fatigability during prolonged walking and pain syndrome after moderate physical activity, foot deformities are partially fixed, trophic alterations of the skin on the sole surface of the foot are noted.

The decompensated form – the longitudinal arch is absent, the foot is broad, the rear section is pronated, the front section is supinated. The bulging shape of the rear surface is lost. The patient's walk becomes heavy, clumsy, hobbling. Pain syndrome is pronounced, a venous figure is noted on the rear surface of the foot, пастозность and hypostases of the foot and lower third of the shin, occurrences of tenosynovitis and aseptic osteoarthritis. Trophic manifestations on the skin of the foot in the form of abrasions, X-disease. Deformities in a significant degree are fixed.

In order to define the degree of fixation of a foot deformity an attempt of a single-stage manual correction of all given pathological deviations was carried out. During early stages of illness the deformity, without significant effort, the deformity was corrected manually by the physician. The deformity was considered fixed in case the manual correction did not eliminate all components of the deformity and give the foot the correct shape.

Example of formulating a diagnosis: bilateral pes-plano valgus A111 B111, sudcompensated, unfixed form.

In children of ages from 5 to 7 the standard method of defining the angle of the longitudinal arch A cannot be applied. It is due to the fact that in the given ages the lateral radiogram allows to trace only the cores of calcification of the navicular bone and the sphenoid abd locating the lower joint point between cuneiforme mediale and os naviculare is impossible. In such cases one determines the angle of inclination of the astragaloid bone to the area of bearing (the bearing-astragaloid angle). It is formed by two transversal straight lines: one is drawn along the longitudinal axis of the well-defined core of calcification of the astragaloid bone, the second – drawn across the lower bearing point tuber calcanei and bearing point caput ossis metatarsalis 1. The study of the correlation between the value of the bearing-astragaloid angle and the degree of evidence of pes-plano valgus will be continued in the author's future works.

Results and discussion

The application of the proposed classification allows dividing patients with pes-plano valgus into 5 groups. Patients with deformities below the third degree of severity according to the mentioned classification are subject to conservative treatment: supplying with efficient footwear, corrective orthopedic insoles, carrying out physical therapy, remedial gymnastics and massage therapy. The third degree of severity is the borderline between conservative and surgical treatment. Surgical treatment is possible for patients since the age of 5 to 7 years with third-degree deformities and pronounced clinical presentations. Observations have shown that upon revelation of the third degree of severity of foot deformity at the aforementioned age, verified by rentgenological means, throughout the process of growth, in spite of regular conservative treatment, normalization of basic rentgenometric figures does not occur. At the same time, delay of operative correction leads at the age of 12-13 to the appearance of signs of arthrosis of the talonavicular joint in the form of spinous accretions on the rear surface of the head of the astragaloid bone and the forming of irregular wedge-shaped form of the navicular bone.

Conclusions

The proposed clinical-and-rentgenological classify-cation of pes-plano valgus is rational, monosemantic in its interpretation, vivid and convenient for practical application. It can be recommended for application in podiatric practice while selecting the method of treatment.

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