The Diagnosis of the Bone Age and Prediction of Adult Height by the Ebrí Methods

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Bone maturation is the best overall indicator of biological development we have in the human species. Bone age expresses this maturation process, requiring simple radiological studies for determining, with the left hand radiograph in the opinion of most authors, the preferred anatomical region [1].

The evaluation of the individual's growth and determining periods of intense growth occurring during ripening, provide important clinical information for interdisciplinary diagnosis, especially for pediatric endocrinologist, in order to control a child's normal growth. It is of interest to calculate bone age not only for the pediatrician and endocrinologist, but in sports medicine, in order to avoid negative influences of intensive training on the growth and maturity of young athletes. It is also of interest in Forensic Medicine, when they analyse human remains badly damaged, presumably belonging to children or young individuals [2-4].

Bone age also provides a basis for predicting namely height and to follow the evolution of the child after a treatment in this regard. It is also of interest to the parents themselves, who want to know the future height of their children [5-6].

To calculate bone age, morphological and numerical methods may be used. We have spent more than 40 years researching in different anatomical regions: Basically we make a historical review of bone age calculation methods and adult height prediction based on regions of the hand and the tarsus, including our own studies [7]. The importance of knowing bone maturation in pediatrics and endocrinology are highlighted in this paper.

Our original method of studying bone age in the carpus and the tarsus in a large cross number of children has been referenced extensively in the literature. A Spanish population of 5225 healthy children was studied by the method IVO carpal and 540 by the method IVO tarsal. 96 fetuses of both sexes in tarsal region were also studied research was published over several years [8-14]. Recently we have studied a longitudinal series of Spanish children to calculate bone age of these children and predict adult height [15-17].

The casuistry of this study comes from the General Survey Anthropometric Aragonés Andrea Prader Somatometric and Radiological Study [18] promoted by the Endocrinology Unit of Miguel Servet Hospital of Zaragoza (Spain).

Let us recall to the readers of his Review that in this longitudinal study we use three ossific indexes: The index obtained for calculating bone age in these areas are: IC (Carpal index), IMF (metacarpal phalanx index), ICMF (carpal metacarpal phalanx index). This carpo-metacarpophalangeal index (ICMF) is a joint index of the two anatomical regions of the carpal and metacarpal phalanges. These index are the result of the sum of the maximum diameters of the bones of each region studied, measured in millimeters. This methodology can be applied by the pediatrician in their daily. They can be used manually or using a software program.
ossification diagnostic of children of short ages of 0 to 2 and 2 to 4 years, we have decided to create this program. In the child, with specific equations for calculation for these short ages, the diagnosis is more adjusted by avoiding the statistical “weight” of the remaining sample until the age of 20 years. From the personal experience of the method and from suggestions received from other colleagues, we find that in the tarsal region too, our method overestimates bone age in very young children. This fact is due to the influence that the total of the casuistry of the older children also exerts on these short ages. To correct this problem, specific equations for these ages were created in their day for manual resolution [10]. Now, to simplify this question, we have also decided to create another software program for the Tarsian region for these ages, and in addition, the program may also perform the ossific diagnosis by tarsal IVO in ages up to 17 years, using the general equations. This program will be “hung” also soon in the mentioned web of the College of physicians of Zaragoza (Spain).

The casuistry that allows this diagnosis of bone age by the tarsus also comes from a cross-sectional Hispanic case, which allows only the diagnosis of bone age but not the prediction of adult height of the longitudinal casuistry Andrea Prader.

Acting jointly on these two anatomical regions: Hand and Tarsus, we can study and improve the ossification diagnosis by acting separately. Using the hand program, not only a correct ossification is achieved but also a predictive estimate of reliable adult height.

Conflict of interest

No authors have a conflict of interest or any financial tie to disclose.

References