

Perspective

Accuracy of Height Prediction by Bayley Pinneau Method

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Height Prediction (HP) is an important tool in pediatric endocrinology clinics to help the clinician make crucial decisions. The parents are informed about future growth potential of the patient based on these predictions. However, it is common to experience disappointment when final height is achieved. Our predictions may misguide us despite careful assessment of height and Bone Age (BA).

Bayley and Pinneau (BP) method is the most commonly used method for HP. It was developed in 1950 and revised in 1959. This method is based on BA assessment according to the standards of Greulich and Pyle [1]. However, normal adult height has considerably increased over the past decades and population growth charts have been updated accordingly [2,3]. Furthermore, differences in timing and progression of normal puberty have also been observed [4]. In contrast, the standards we use to assess BA and HP have not changed.

A normal child grows with normal velocity on the same percentile which is appropriate for the target height of the family. The current methods of HP consider neither target height nor height velocity. They only give us what percent of adult height is already achieved according to whether the BA is average, retarded, or accelerated. Interestingly, the HP according to the tables of Bayley and Pinneau is higher for individuals with accelerated BA compared to those with average or retarded BA. In contrast, the HP for retarded BA is lower than for average or accelerated BA. However, in reality, advanced BA causes early fusion of epiphyseal plates which prevents further growth. On the other hand, retarded BA such as observed in constitutional growth delay is an advantage providing additional time for growth.

Bayley and Pinneau state that these predictions may be erroneous especially in younger ages. The Berkeley Growth Study has shown that the standard deviation of percent of mature height achieved by the children may be as high as 3.96 for boys at 14 and 3.27 for girls at 12 years of age [5].

Previous studies on various methods of HP have raised questions about their accuracy [6,7]. We have recently demonstrated that advanced bone age leads to overestimation and retarded bone age leads to underestimation of final height [8].

One assumption of Bayley and Pinneau is that children who are accelerated in physical maturity tend to grow with 'exceptional vigor' [1]. However, this argument disregards the loss of time

caused by accelerated bone age. In addition, the pathogenesis of BA advancement which is usually precocious puberty may continue despite treatment and further shorten the time for future growth. We may assume that the body behaves according to the level of maturity rather than the time in the calendar as proposed by Bayley and Pinneau [1]. However, although accelerated BA may increase the vigor with which the child grows, at the same time, it decreases the duration of growth. An alternative method may be plotting the height of the patient on the growth chart according to the BA rather than the chronological age and projecting to final height on that percentile. This may still lead to overestimation since BA may continue to advance due to the primary pathology such as precocious puberty further impairing the final height. In case of retarded BA, plotting the present height according to BA will place the child at a higher percentile and then the projected height will be better taking into account the longer duration of growth provided by delayed BA.

In conclusion, HP by BP method must be revised taking into account the future duration of growth which is decreased when BA is accelerated and increased when BA is retarded. Meanwhile, plotting the current height according to BA rather than the CA and projecting growth on this percentile to adulthood may provide a more realistic HP. However, this method may also lead to overestimation in advanced BA and underestimation in retarded BA. This proposed method needs to be tested in large cohorts prospectively.

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