What`s the best head circumference reference range in antenatal screening for microcephaly?

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Objective

Antenatal detection of microcephaly relies on identifying head circumference measurements that depart from the gestational age specific reference ranges. However, there are several published references and there is currently no agreement in the literature as to which would be the more appropriate in screening. The present study aims to test the fit of the distribution of measurements using three different reference ranges in a dataset of normal fetuses.

Methods

916 head circumference measurements from 240 normal fetuses ranging from 24 to 40 weeks were plotted against Hadlock, Chevernak and Intergrowth reference ranges. The proportion of cases with measurements below the median, -2SD and -3 SD were compared to the expected proportions assuming a normal distribution, using a Fisher / Chi-square test. Measurements of the dataset were then converted to Z-scores for each reference and plotted in histograms in order to evaluate the frequency distribution centrality and dispersion.

Results

The proportion of cases below the median was higher than expected (p<0. 0001) when using Hadlock: 72. 4% (663/916) vs expected 50%. It was lower than expected (p<0. 0001) when using Chevernak: 31. 3% (287/916). And the same was true for Intergrowth: 40. 6% (372/916) vs 50% (p<0. 0001). The proportion of cases below -2 SD was markedly (p<0. 0001) overestimated when using Hadlock reference: 7. 8% (71/916) versus expected 2. 3%. Inversely, it was underestimated (p=0. 0003) when using Chevernak reference range: 0. 3% (3/916) versus expected 2. 3%. In the case of Intergrowth reference range, the proportion of cases below 2SD was similar (p=0. 29) to the expected: 1. 6% (15/859) versus expected 2. 3%. The proportion of cases below -3 SD was significantly (p=0. 0033) overestimated when using Hadlock reference: 1. 64% (12/916) versus expected 0. 13%. The proportion of cases below -3SD did not depart significantly (p=0. 62) from the expected for Chevernak: 0. 33% (3/916). The same was true (p=1. 00) for Intergrowth reference: 0. 22% (2/916) versus expected 0. 13%. Histograms of the Z-converted measurements showed that Hadlock distribution of measurements was consistently shifted to the left while Chevernak dispersion of measurements was reduced, due to a larger standard deviation, when compared to the other references. Intergrowth distribution of measurements showed the best fit to our dataset.

Conclusion

Intergrowth reference range showed the best fit to our dataset and should be the reference of choice. Use of Hadlock could result in overdiagnosing microcephaly while Chevernak could result in underdiagnosis.