Letters to the Editor

Re: Fetal aortic arch measurements between 14 and 38 weeks' gestation: in-utero ultrasonographic study. Ultrasound Obstet Gynecol 2000; 15:226–30

The diagnosis of coarctation of the aorta during fetal lie is a challenging problem even for the most experienced fetal echocardiographer. This diagnosis is suspected prenatally by demonstration of relative hypoplasia of the aortic arch. The extent of this hypoplasia is variable and may be accompanied by asymmetry of the ventricles and great arteries. Thus, the paper of Achiron *et al.*[1] is particularly welcome because it attempts to provide reference ranges for the diameter of the transverse and distal aortic arch in fetuses across a wide gestational age range. The data points shown in Figures 3 and 4 of the paper show an increasing scatter of data points as the gestational age advances. The width of the reference range, however, remains constant across the gestational age range studied. Inspection of Figures 3 and 4 demonstrates that none of the data points obtained early in gestation come close to the limits of the 'reference range' for this gestation. This suggests that the reference range has not been modeled to take account of the gestation-specific standard deviation. Reference ranges which fail to take this into account tend to be too wide at early gestations and too narrow at later gestations. This is an important point in clinical practice because, given the current reference range, it is extremely unlikely that any fetal aortic arch measurement made early in pregnancy would fall outside the reference range. This might lead to failure to recognize abnormalities of the aortic arch early in pregnancy. Conversely, in late pregnancy some normal aortic arches may be inappropriately thought to be abnormal because the reference range is too narrow

Construction of gestation-related centiles has been addressed by statisticians who have described appropriate methodology for this situation[2]. This method has been applied in many fetal studies including the one immediately preceding the study of Achiron *et al.*[1] in the same issue of the Journal[3]. This might provide a suitably modeled reference range for measurements of the aortic arch that could be applied in clinical practice.

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References

1 Achiron R, Zimand S, Hegesh J, Lipitz S, Zalel Y, Rotstein Z. Fetal aortic arch measurements between 14 and 38 weeks' gestation: in-utero ultrasonographic study. *Ultrasound Obstet Gynecol* 2000; 15: 226–30
2 Altman DG. Construction of age-related reference centiles using absolute residuals. *Statist Med* 1993; 12: 917–24
3 Mielke G, Benda N. Reference ranges for two-dimensional echocardiographic examination of the fetal ductus arteriosus. *Ultrasound Obstet Gynecol* 2000; 15: 219–25

Authors' reply

We would like to thank Dr John Simpson for his interest in our manuscript, 'Fetal aortic arch measurements between 14 and 38 weeks' gestation: in-utero ultrasonographic study'.

Dr Simpson requested a different statistical evaluation and presentation of our data. We agree that there is another method for evaluating the data. However, we would like to comment that our aim was to give the predicted linear regression based on our observed data. This regression line was calculated using the linear regression model of the first degree, using the equation $Y = Y \pm bX^1$. The upper and lower confidence intervals were then calculated and they represent the boundaries of the predicted values. We believe that using the predicted confidence intervals is preferable to using the observed values in this case because: (a) it is a mathematical model; and (b) predicted values can be used as standard charts by a large number of examiners.

Although we are aware that there is no modeling for gestational age in such an analysis we feel that avoiding calculations from observed values, and its application as a reference chart by a large number of operators justify the approach we have taken.

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References

1 SAS/STAT. *User's Guide (Proc REG) and SAS Procedure Guide*, Version 6.12. Cary, NC: SAS Institute Inc.;