Acta Genet Med Gemellol 39:395:399 (1990)

Sixth International Congress
on Twin Studies

Estimated Fetal Weight in Twin Pregnancy: How Good Are We?

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Abstract. Ultrasonic assessment of fetal weight derived from multiple measurements of the fetus has become accepted in clinical practice as being useful in singleton pregnancies. Several different formulae for estimating fetal weight have been derived from differing measurements of the fetus, such as biparietal diameter, trunk circumference, and femur length. To date, there has been no attempt to evaluate such a technique in multiple pregnancy. This study aims to see whether the formulae derived for singleton pregnancy are applicable to twin pregnancies. Estimated fetal weight will be derived by mathematical modelling from ultrasonic measurements made within a week of delivery and the results compared with the actual birthweight to give an indication of how good such estimated fetal weights are. Factors to be considered in the analysis include whether there are differences between Twin I and Twin II, differences of presentation with twins and differences by gestation at delivery.

Key words: Fetal growth, Ultrasounds, Twin pregnancy

INTRODUCTION

Ultrasonic assessment of fetal weight has been used for some time now in singleton pregnancy. Various different groups of workers have used mathematical modelling techiques to predict birthweight, using mainly measurements of fetal head and abdomen. Table 1 shows four of the commonly used equations. The first two use only abdominal circumference measurements, and the second two use both abdominal circumference (AC) and biparietal diameter (BPD).

There are theoretical reasons why one might question their usefulness in twin pregnancies. Firstly, overcrowding of the uterus might lead to distortion of shape, and there-

Table 1 - Predicting fetal weight: Existing equations for singleton pregnancy

1. $\log_e$ B.Wt. =	$-4.564 + 0.282(AC) - 0.00331(AC)^2$ (Campbell and Wilkin, 1975)
2. $\log_{10}$ B.Wt. =	$-1.8367 + 0.092\ (AC) - 0.000019(AC)^3$ (Warsof et al, 1977)
3. $\log_{10}$ B.Wt. =	$-1.599 + 0.144\ (BPD7 + 0.032(AC) - 0.000111(BPD^2AC)$ (Warsof et al, 1977)
4. $\log_{10}$ B.Wt. =	$-1.7492 + 0.166(BPD) + .046(AC) - 0.002646(BPD \times AC)$ (Shepard et al, 1982).

B.Wt.: Birthweight in kg; AC: Abdominal circumference in cm; BPD: Biparietal diameter in cm.

fore inaccuracies in measurement. Secondly, there may be difficulty in measuring either the biparietal diameter or the abdominal circumference because of awkward fetal positions within the uterus. Third, there is a differing rate of growth in twin fetuses compared with singletons [3]. This paper examines the value of the existing models in twin pregnancy and then presents some results from our own ultrasonic assessment of twin fetuses.

METHODS

Sixty women expecting twins had an ultrasonic scan performed within ten days of the actual date of delivery, giving 120 fetuses for use in assessment. It was impossible to measure abdominal circumference in 2 Twin Is and 3 Twin IIs, respectively (3% and 5%). It was not possible to measure biparietal diameter in 48 Twin Is (40%) and 30 Twin IIs (35%). Estimated fetal weight was then calculated for each of the four equations listed in Table 1 and then compared with the actual fetal weight. A scatter plot of the estimated fetal weight derived by Campbell and Wilkin [1] formula against the actual weight is shown in the Figure.

RESULTS

Differences between actual and estimated fetal weight for each of the four models tested and their goodness of fit are given in Table 2. Although the mean difference is small for all four models tested, the range of underestimation and overestimation was considerable. Table 3 shows the difference between estimated and actual fetal weight as a percentage of the actual weight. Less than half fall within 7.5% of the actual weight, a difference of approximately 150-200 g in averaged sized twins. The four models were then ranked according to their closeness of fit to actual weight. The results of this statistical testing are shown in Table 4. The conclusion with respect to this part of the

https://doi.org/10.1017/S000156600000533X Published online by Cambridge University Press

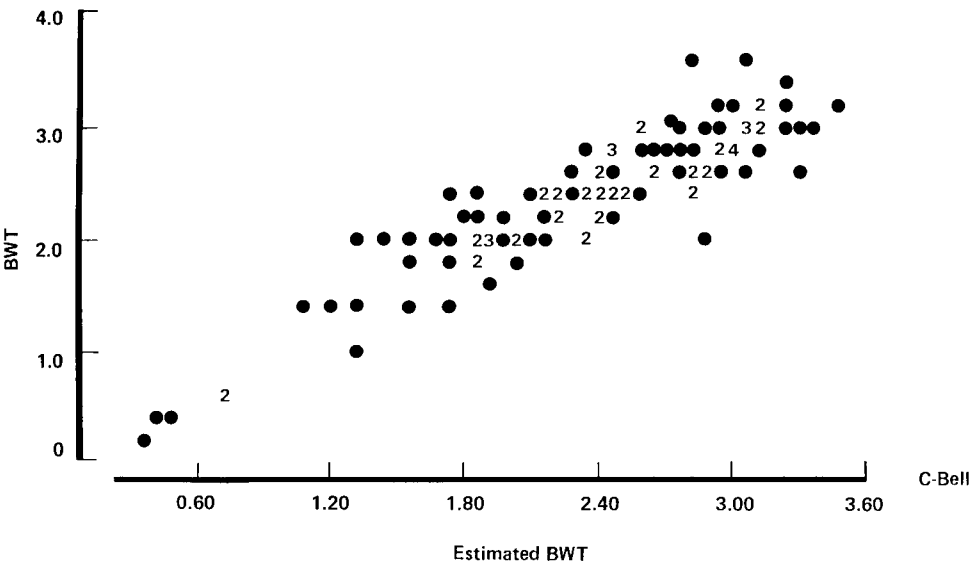

Figure. Actual birthweight vs estimated birthweight using the formula of Campbell and Wilkin [1] in twins.

Table 2 - Difference (g) between actual and estimated fetal weight

Model	Mean	Median	SD	Minimum	Maximum	No.
1	6.0	–17.8	276.5	–786.0	785.2	115
2	–54.9	–35.5	312.8	–943.7	705.8	115
3	126.4	118.0	247.3	–643.4	666.1	81
4	10.7	4.1	249.5	–784.1	550.0	81

Table 3 - Differences in percentage of fetal weight estimates (%)

Model	Within ± 25g/kg of actual weight	Within ± 75g/kg of actual weight	Within ± 125g/kg of actual weight	More than ± 125g/kg
1	18.3	47.8	74.8	25.2
2	15.7	36.5	64.3	35.7
3	16.0	46.9	66.7	33.3
4	17.3	48.1	76.5	23.5

work is that there is not a great deal of difference between the four models tested, although the model of Campbell and Wilkin [1] when abdominal circumference only is used, and that of Shephard et al [2] using both biparietal parameter and abdominal circumference, appear to be marginally better than the other two.

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Table 4 - Models ranked according to closeness of fit: Mean rank and percentage with best and poorest rankings

Model	Mean rank	Best	Poorest
1	2.22	26.1	6.1
2	2.52	27.0	33.9
3	2.78	32.1	34.6
4	2.48	34.6	8.6

Table 5 - Overestimate (%) from actual fetal weight

Model	Twin I	Twin II	All
1	44.8	59.7	52.2
2	48.3	66.7	57.4
3	33.3	31.1	32.1
4	47.2	48.9	48.2

In deriving regression equations it was considered that certain factors might influence the estimation of fetal weight, namely, fetal sex, twin number, and gestation at delivery.

There was no effect of fetal sex on the predictive value of ultrasonic estimation of fetal weight. With respect to twin number, however, interesting differences arose (Table 5). A significantly greater proportion of fetal weight of Twin II was overestimated when compared with those of Twin I. This applied when the models using abdominal circumference only are considered (Model 1, $\chi^2 = 2.53$; Model 2, $\chi^2 = 3.98$), whereas there was no difference in the proportion of baby weights overestimated when both biparietal diameter and abdominal circumference were included. There was in addition more fetal weights of Twin II overestimated by over 10% of actual weight when abdominal circumference only was used.

Initially, regression equations similar to the four originally tested using the same fetal parameters were derived giving new constants and new coefficients. R^2 was slightly improved to values between 92% and 94.9%. A stepwise regression of analysis using

Table 6 - Stepwise regression of twin data using 7 predictors

For $\log_{10}$ B.Wt.	For B.Wt.
1st BPD	1st BPD × AC
2nd AC	2nd AC^3
3rd $BPD^2 \times AC$	3rd Gestation
4th Gestation	

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eight predictors of birthweight, BPD, AC, AC^2, $BPD^2 \times AC$, AC^3, $BPD \times AC$, was performed. Actual birthweight and the logarithm 10 birthweight were considered in two separate stepwise regression analyses. The results are given in Table 6. Only variables entering significantly into the model are listed. Gestation is considered statistically significant in terms of its additional contribution in predicting birthweight even in the presence of parameters reflecting fetal size.

CONCLUSION

This work suggests that estimating fetal weight in twin pregnancy is as expected liable to larger errors than singleton pregnancy. It is nonetheless accurate in about 50% of these cases. If biparietal diameter is to be used in estimation of fetal weight, however, it must be noted that there were an unacceptably large number of measurements in twins unobtainable, 40% of Twin I and 25% of Twin II.

There are differences in the rate of over- and underestimation of fetal weight between Twin I and Twin II: namely, an overestimation of Twin II and underestimation of Twin I if abdominal circumference only is used. This may be due to the relative position of the twins in the uterus, in particular a greater degree of flexion of Twin II may lead to difficulty in assessing abdominal circumference.

Finally, it is perhaps surprising that gestation at delivery has still a significant effect on birthweight even after the effect of fetal size has been allowed for, namely, biparietal diameter and abdominal circumference, which are, of course, themselves highly correlated to gestational age.

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