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Foetal growth velocities in twin pregnancies

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A retrospective longitudinal study was performed to quantify foetal growth velocities in twin pregnancies and to determine the effect of variables specific to twin pregnancies on growth velocity. Foetal growth velocity standard deviation (Z) scores were calculated from serial ultrasound data using published singleton reference data for 131 consecutive sets of twins from 30 to 37 weeks' gestation. Compared with low-risk pregnancies, the twin foetal abdominal area growth velocity Z scores were significantly reduced from 30 to 37 weeks and biparietal diameter growth velocity Z scores were also significantly lower, from 30 to 33 weeks. Amongst the twin pairs there were no significant differences in Z scores with respect to chorionicity, foetal sex, birth order to whether delivery was premature or term. This retrospective study has demonstrated that twin foetal growth velocity is reduced when compared to singletons from at least as early as 30 weeks' gestation. Twin specific variables such as chorionicity, sex, birth order and subsequent premature birth do not need to be accounted for in the interpretation of growth velocities in twins. The clinical importance of determining foetal growth velocity in twin pregnancies awaits further prospective study.

Keywords: foetal growth velocity, twins, chorionicity, foetal sex, birth order, preterm and term delivery

Introduction

Prematurity remains the principal cause of perinatal mortality in twins, but intrauterine growth retardation is a major contributor to poor perinatal and possibly long term outcome.[1] The identification of abnormal foetal growth may allow better obstetric intervention in twin pregnancies, and thus improve perinatal outcome. Current clinical practice frequently involves serial ultrasound foetal biometry making reference to standards derived from cross-sectional data sets. These data sets are inappropriate for the quantification of serial changes in biometry which should be compared to reference ranges derived from a longitudinally collected and appropriately analysed population.[2] Previous work in this department has allowed the construction of reference ranges for foetal growth velocity based upon serial measurements from 274 low-risk singleton pregnancies.[3]

This study aims to describe the pattern of twin growth using biparietal diameter (BPD) and foetal abdominal area (FAA) growth velocities. These are derived from and compared with singleton standards using standard deviation scores (Z scores) enabling us to assess the influence of specific features of twin pregnancies on growth velocity such as chorionicity, foetal sex, birth order and gestational age at delivery.

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Materials and methods

All sets of twins delivered at Ninewells Hospital, Dundee in the three-year period between 1 January 1994 and 31 December 1996 were identified from the hospital birth register. The original ultrasound data for each pregnancy was reviewed. All ultrasound measurements within the department were made by one of two experienced observers dedicated to obstetric ultrasound, using either a Diasonics Prisma or an Acuson 128 XP/10 real time machine with a 3.5 Mhz or 5 Mhz curvilinear probe. Initial dating ultrasound scans were performed measuring either the crown–rump length (CRL) or bi-parietal diameter (BPD) in the first or early second trimester using standard techniques.[4] A routine anomaly scan was performed at 19 weeks' gestation and scans performed every two to three weeks to assess both BPD and foetal abdominal area (FAA) from 24 weeks' gestation. The FAA is used in preference to abdominal circumference in our department and is measured at the level of the umbilical vein by tracing the abdominal outline on the screen.

From the original ultrasound data mean daily growth velocities for both BPD (mm/day) and FAA

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(cm²/day) were calculated for each twin. These calculations were performed where the interval between measurements was not less than 14 or greater than 35 days and are reported at the gestational age of the second measurement using the equation:

Growth velocity = (Yt – Yt – n) / n

where n is the number of days and (YT – YT – n) is the difference between the two measurements. Gestation specific velocity Z scores were derived from singleton reference data[3] for both BPD and FAA using the equation:

$$Z = \frac{\text{Measured mean growth velocity} - \text{Reference mean growth velocity}}{\text{Reference velocity standard deviation}}$$

Birth weight specific Z scores were calculated from established nonograms.[5] Statistical comparisons of BPD and FAA velocity Z scores with singleton reference data were made at each week of gestational age using the statistical software package SPSS for MS Windows Release 6.1. Analysis was also performed to determine any association between chorionicity, foetal sex, twin order, gestation at delivery and foetal growth using Student's t test and the Mann-Whitney test as appropriate.

Results

A total of 131 sets of twins booked for delivery at Ninewells Hospital, Dundee between January 1994 and December 1996 were born alive and still living at the end of the first week.

Seventy-one (54.2%) sets of twins were delivered after 37 weeks, 56 sets (42.7%) between 30 and 36 weeks, whereas only 4 sets (3.1%) were delivered before 30 weeks' gestation. Thirty of the 131 sets of twins (22.9%) were monochorionic as established on the basis of being same sex and upon examination of the placenta and membranes. Eighty-nine sets (67.9%) were dichorionic, whilst there were 12 sets of same sex twins (9.2%) in which there was insufficient information to determine chorionicity. Birth weight Z scores adjusted for foetal sex and parity[5] are plotted from 33 weeks in Figure 1 (the calculation of birth weight Z scores before 33 weeks was not possible due to the lack of published reference data). The twins were significantly smaller than control singleton pregnancies but the mean birth weights remained above the 3rd centile at all gestations.[6]

Ultrasound data was available for 130 of the 131 pregnancies, but there were insufficient measurements for the calculation of growth velocities and velocity Z scores in 14 cases (10.7%). The total number of velocity Z scores calculated was 1104 (mean 4.74 per foetus).

Figure 2a shows the BPD growth velocities in twins along with singleton reference data.[3] The BPD velocity Z scores are significantly less from 30 to 33 weeks and at 37 weeks' gestation ($P < 0.05$) (Figure 2b). Similar graphs for FAA growth velocity are presented in Figure 3a and Figure 3b. There is a significant reduction in twin FAA growth from 30 to 37 weeks ($P < 0.05$). At the extremes of gestation (26

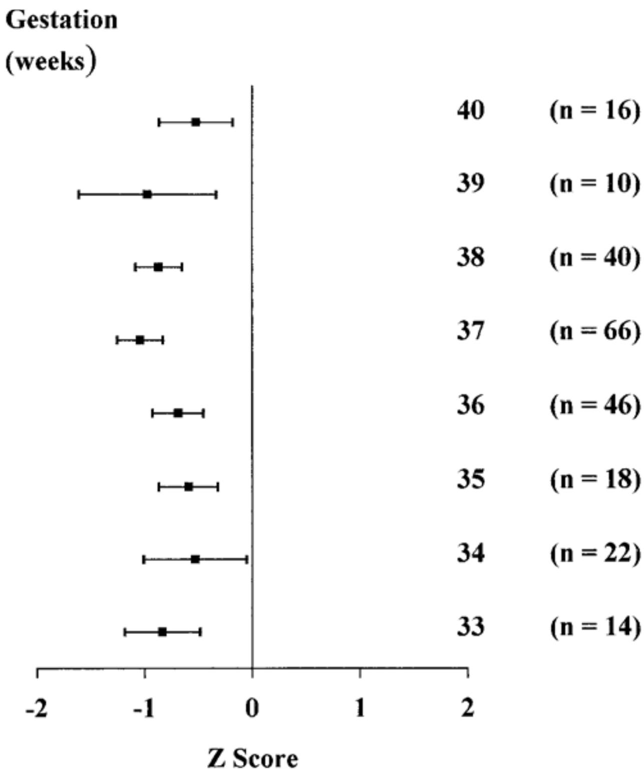

Figure 1 Mean twin birth weight Z scores compared with singleton data, with 95% confidence intervals (n = number of cases at each gestation).

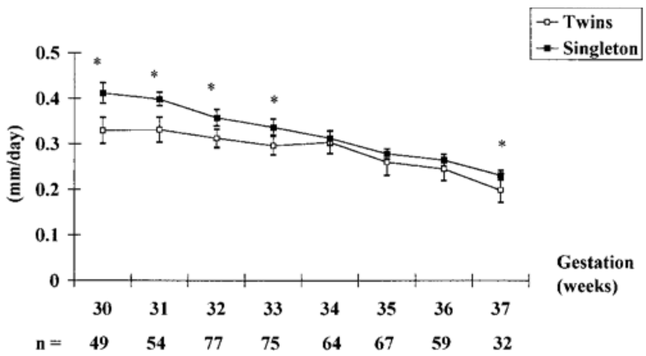

Figure 2a Mean BPD growth velocities in twins, plotted with 95% confidence intervals against singleton reference data (n = number of cases, * $P < 0.05$).

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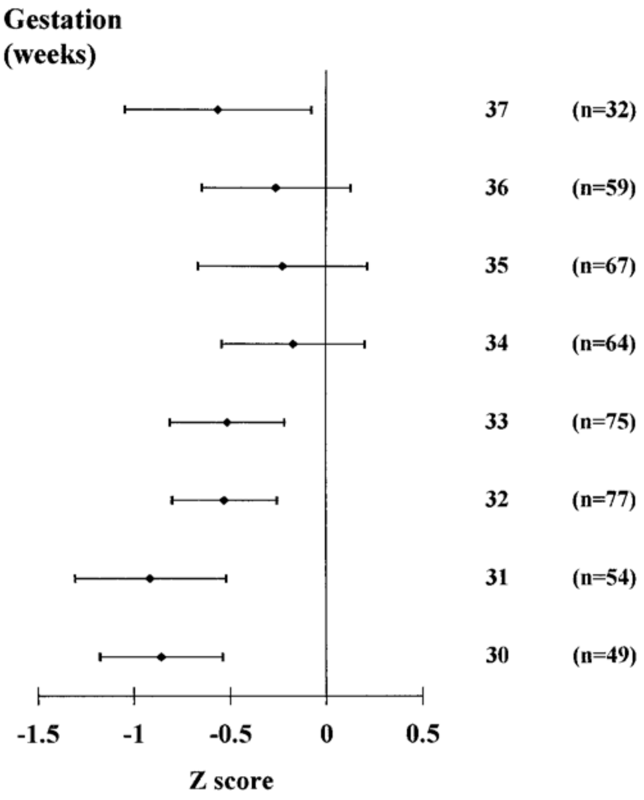

Figure 2b Mean BPD velocity Z scores compared with singleton data, plotted with 95% confidence intervals (n = number of cases).

to 29 and 38 to 40 weeks) the numbers studied were too small for analysis.

Statistical analysis of foetal growth velocity Z scores found no significant difference in twin BPD or FAA between mono-chorionic and di-chorionic twins between 30 and 37 weeks velocity (Figure 4a and Figure 4b). There were no significant differences in growth velocity Z scores at all gestations between male and female twins or between the first and second born twin (data not shown). Growth velocities of twins delivered prematurely (< 37 weeks)

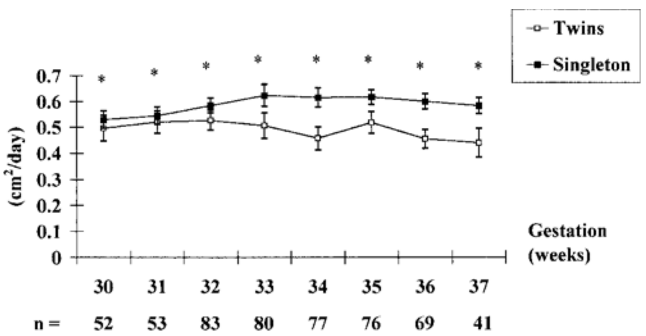

Figure 3a Mean FAA growth velocities in twins, plotted with 95% confidence intervals against singleton reference data (n = number of cases, * $P < 0.05$).

were not significantly different to those delivered at term (Figure 5a and Figure 5b).

Discussion

Cross-sectional foetal biometric data allows the interpretation of foetal size, but it is inappropriate for the assessment of foetal growth and hence the diagnosis of intrauterine growth retardation (IUGR) in both singletons and twins.[7,8] Reece et al[9,10] have published longitudinal data relating to head and limb growth in twins, but reported no clinically significant difference from growth patterns seen in singleton pregnancies. The use of individualised growth curves has shown that twins have the ability to achieve a normal growth potential and these techniques also allow the identification of IUGR.[8,11] To our knowledge this is the first study to apply appropriately derived growth velocity standards[3] to a twin population.

Z scores form the basis of the statistical analysis within this paper and they have previously been used to represent foetal growth velocity in the

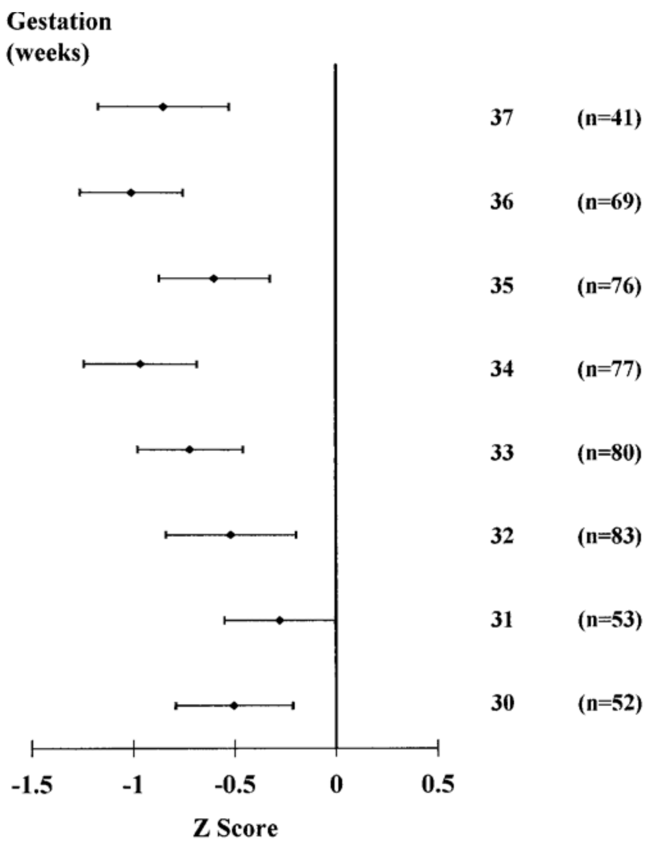

Figure 3b Mean FAA velocity Z scores compared with singleton data, plotted with 95% confidence intervals (n = number of cases).

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assessment of foetal outcome.[12] A Z score of zero lies on the 50th centile, whilst Z scores of –1.3 and 1.3 represent the 10th and 90th centiles, respectively. Hence they provide greater information about growth velocity than the simple comparison of twin growth velocity rates with the singleton reference data shown in Figure 2a and Figure 3a.

Our twin population is representative as it includes all twins booked at our unit in a three-year period. Ninewells Hospital, Dundee, is the major maternity hospital caring for women in the Tayside region. The mean infant birth weight in our twin population is lower than that of singleton infants at similar gestations, which is in agreement with a number of previously published reports.[13,14]

After 30 weeks' gestation there is a significant reduction in FAA growth velocity, a finding which has not been previously reported using serial ultrasound assessment. A number of studies have presented cross-sectional data comparing abdominal circumference (AC) in twins and singletons. Socol et al[15] reported that the AC in twins started to lag from 34 weeks towards term, and Grumbach et al[16] found twin AC was significantly smaller compared with that of singletons from 32 weeks. Both of these findings are explained by the reduction in FAA growth velocity noted in this study.

The significant reduction in BPD growth velocity from 30–34 weeks is interesting and may explain the 'flattening' of the BPD 'growth curves' constructed from cross-sectional data.[15,16] The small number of cases below 30 weeks does not allow conclusions to be drawn about earlier twin BPD growth velocity. In their longitudinal assessment of BPD growth in 35 twin pregnancies Reece et al[9] showed no significant difference from singletons, a finding supported by cross-sectional studies.[16,17]

Chorionicity does not appear to have an influence on either BPD or FAA growth velocities in twins. These findings have not been previously reported but are consistent with Nielson[18] who found no difference between twin abdominal circumference (AC) based on foetal zygosity in a cross-sectional study of 65 sets of twins. There have been few

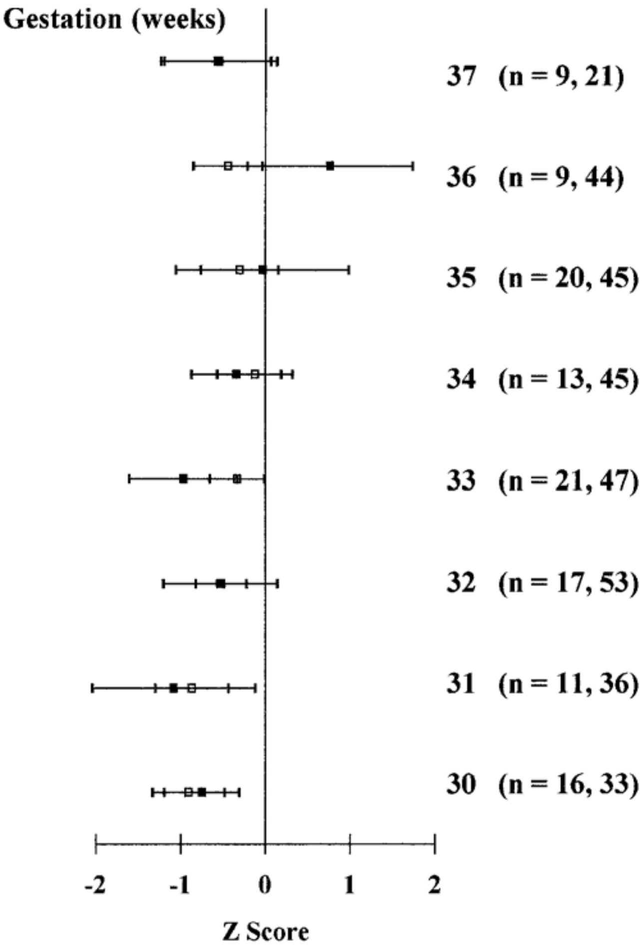

Figure 4a Chorionicity – mean BPD velocity Z scores. Monochorionic (black) vs Dichorionic (white), plotted with 95% confidence intervals, n = number of cases (MC, DC).

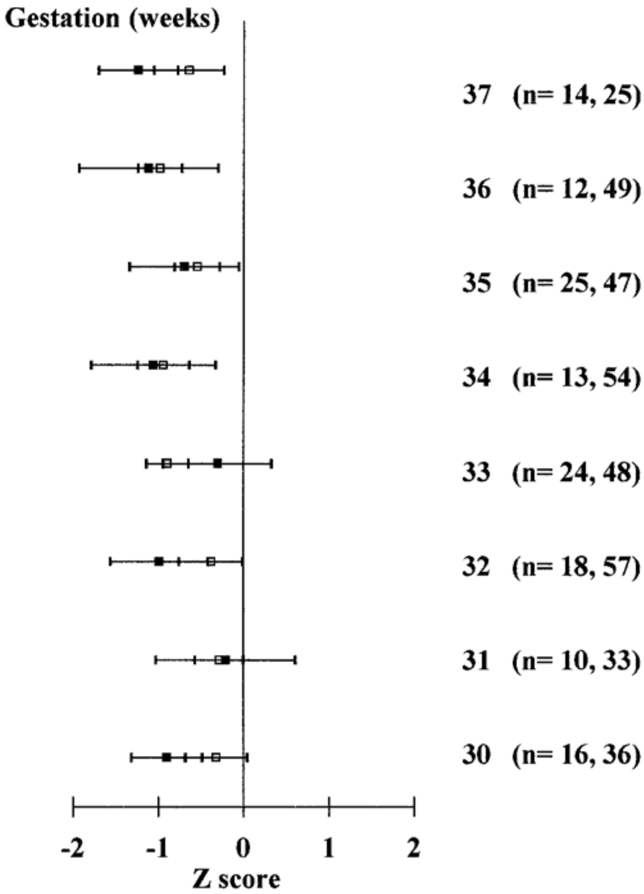

Figure 4b Chorionicity – mean FAA velocity Z scores. Monochorionic (black) vs Dichorionic (white), plotted with 95% confidence intervals, n = number of cases (MC, DC).

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reports of biometric differences between the sexes assessed by antenatal ultrasound. This study demonstrates that ultrasound twin growth velocities are not significantly influenced by foetal sex.

Based on cross-sectional studies, a number of workers have suggested that singleton foetuses born prematurely experience impaired intrauterine growth.[19,20] Nielson[27] found no difference in the AC of preterm twins compared to those delivered after 37 weeks, a finding substantiated by Smith et al[21] who also reported no significant difference in their cross-sectional assessment of AC and BPD in 113 twin pregnancies. Our study demonstrates no significant difference in BPD or FAA foetal growth velocities amongst prematurely delivered twins compared to those delivered at term. In addition, no significant difference in growth velocities was found in relation to birth order between 30 and 37 weeks. These findings agree with the cross-sectional study of Blickstein et al[22] who reported no difference in a number of biometric parameters relating to birth order after 30 weeks.

As the present study was retrospective, no specific scanning schedule was employed, although clinical practice within the unit dictated that the majority of twin pregnancies were scanned at 2–3 week intervals from around 24 weeks' gestation. The number of cases at early and late gestations were small and there may be an over-representation of some twin pairs within the analysis growth velocity. Chorionicity was determined in the majority (90.8%) of cases, but information was insufficient in the other pregnancies. These methodological problems could be overcome by a more definitive prospective study with a large sample size entered into a standardised scanning schedule.

Conclusion

Amongst singleton pregnancies foetal growth velocity and serial biometry predicts neonatal IUGR and morbidity amongst SGA and low risk pregnancies.[12] This study has demonstrated significant differences between the growth velocity of singleton and twin pregnancies, but no significant difference in growth velocity with respect to chorionicity, foetal sex and birth order. It remains to be seen whether ultrasound

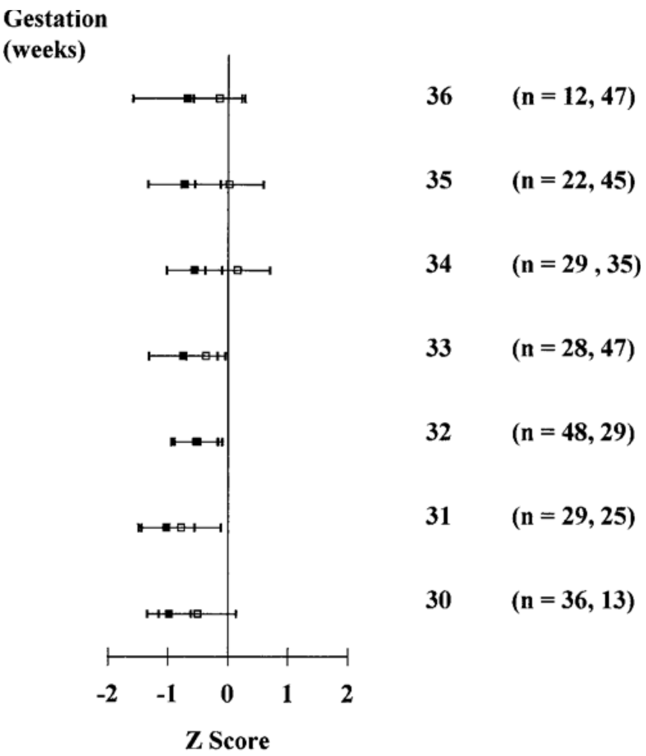

Figure 5a Prematurity – mean BPD velocity Z scores, born before 37 weeks (black) vs born after 37 weeks (white), plotted with 95% confidence intervals, n = number of cases (< 37 weeks, > 37 weeks).

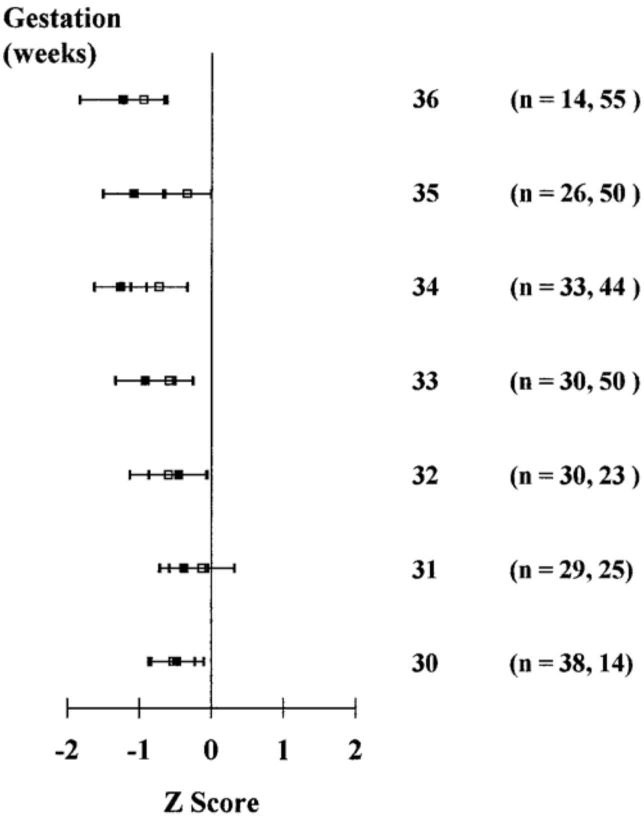

Figure 5b Prematurity – mean FAA velocity Z scores, born before 37 weeks (black) vs born after 37 weeks (white), plotted with 95% confidence intervals, n = number of cases (< 37 weeks, > 37 weeks).

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foetal growth velocity can improve the antenatal identification of twin foetuses experiencing impaired intrauterine growth, their subsequent management and perinatal outcome.

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