CONTROL OF FETAL SIZE WITH MULTIPLE ULTRASONIC MEASUREMENTS

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It is often difficult exactly to estimate fetal weight and to diagnose intrauterine growth retardation from ultrasonic parameters such as the biparietal diameter and the thorax diameter. Therefore we measured many fetal bone and soft-tissue parameters in order to establish which parameters might improve:

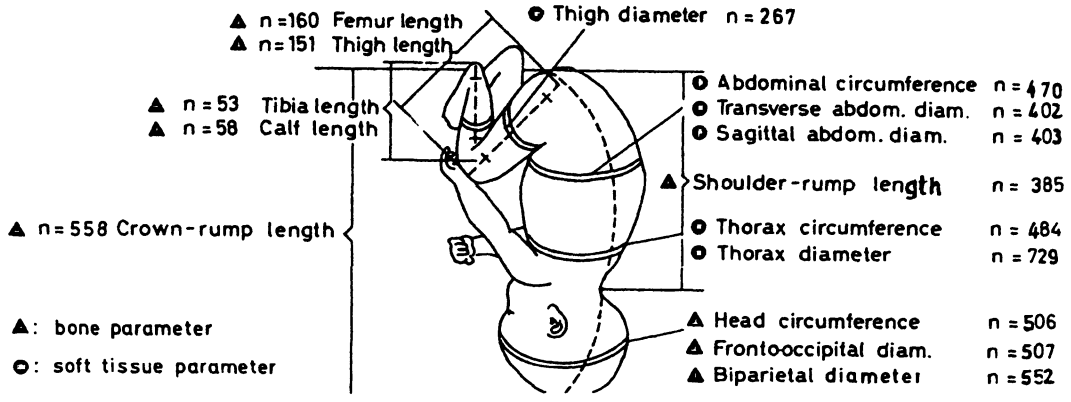
I) estimation of fetal weight
II) prediction of small-for-date babies.

MATERIAL AND METHOD

For the growth curves, data from 909 pregnancies were used. Cases with unknown gestational age, multiple pregnancy or malformation were excluded. Altogether 5685 single ultrasonic measurements of up to 15 fetal body parameters were determined, using the Siemens real-time scanner Vidoson 635 (Fig.1).

Fig.1) Ultrasonic fetal parameters measured

Jan. 1976 - Oct. 1978 : 5685 measurements of 15 parameters



All data were analysed by EDP. Where enough data are available we present the growth curves of our parameters in percentile form. Up to now, this is possible for ten parameters.
In the present study, we use only the four bone and four soft-tissue parameters shown in Tables 1 and 2.

I) In 105 eutrophic fetuses, birth weight >10th and <90th percentile according to KYANK(1), the eight ultrasonic parameters were measured 1-6 days before delivery. We evaluated the percentile values of these measurements and correlated them with the percentiles of the birth weight according to KYANK. Several combinations of the eight parameters were subjected to a factor and a regression analysis.

II) In 50 small-for-date babies, birth weight <10th percentile according to KYANK, the eight parameters were measured after the completion of the 28th week of gestation. We evaluated how frequently the ultrasonic measurements were <10th percentile. Because soft tissue parameters undergo greater changes in disproportioned growth retardation than bone parameters, quotients of soft-tissue parameters/bone parameters were likewise presented in percentile form

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RESULTS

The percentile curves of all parameters correlate very closely with the gestational age: r-values vary from 0.95-0.99.

I) The correlations of all parameters to the birth weight are also significant, but r-values vary from 0.14-0.89. Soft-tissue parameters correlate more closely than bone parameters (Tab.1).

Tab.1) Correlation between ultrasonic parameters and birth weight n=105 eutrophic babies, measurement 1-6 days before delivery

PARAMETERS	CORRELATION FACTORS
▲ Frontooccipital diameter	0.14
▲ Biparietal diameter	0.33
▲ Head circumference	0.33
▲ Crown-rump length	0.60
○ Thorax diameter	0.63
○ Thigh diameter	0.70
○ Thorax circumference	0.83
○ Abdominal circumference	0.89

The frontooccipital diameter has the lowest correlation factor: r=0.14, the abdominal circumference has the highest: r=0.89. By combining the abdominal and the thorax circumference the correlation factor is even slightly higher: r=0.91. All other combinations of ultrasonic parameters were less correlated to the weight than the abdominal circumference alone (Fig.2).

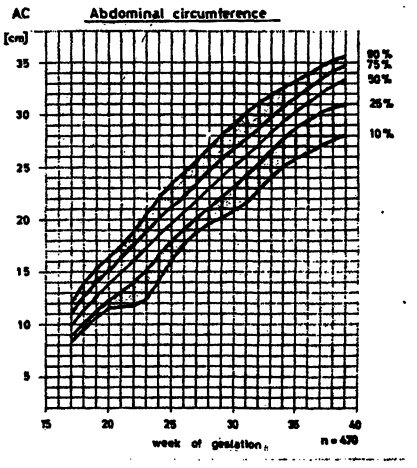

Fig.2) Percentile curves of the abdominal circumference, n=470

II) In intrautrine growth retardation, we found that the frequency of low ultrasonic values depends on which of the eight parameters is taken. Soft-tissue parameters have lower percentile values than bone parameters (Tab.2).

Tab.2) Distribution of ultrasonic parameters in percentile groups n=50 small-for-date babies, measurement after the 28th week

PARAMETERS	n<10thP.	n>10th<90thP.	n>90thP.
▲ Frontooccipital diameter	6 (12%)	43 (86%)	1 (2%)
▲ Biparietal diameter	12 (24%)	36 (72%)	2 (4%)
▲ Head circumference	14 (28%)	36 (72%)	-
▲ Crown-rump length	17 (34%)	33 (66%)	-
● Thorax diameter	20 (40%)	30 (60%)	-
● Thorax circumference	21 (42%)	29 (58%)	-
● Abdominal circumference	23 (46%)	27 (54%)	-
● Thigh diameter	32 (64%)	18 (36%)	-

The concordance between ultrasonic values<10th percentile according to our curves and small-for-date babies is poorest for the frontooccipital diameter: 12%<10th percentile, and best for the thigh diameter: 66%<10th percentile.

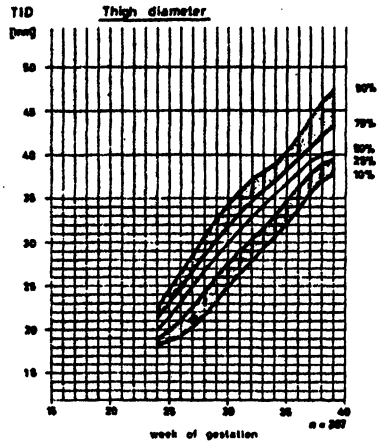

Fig.3) Percentile curves of the thigh diameter, n=267

The quotients of soft-tissue parameters/bone parameters did not give better results than the thigh diameter alone, where gestational age is known.
In uncertain gestational age however, differential diagnosis of growth retardation and time error may be difficult. Here, establishing quotients of soft tissue parameters/bone parameters may be useful, e.g. the quotient of abdominal circumference/crown-rump-length remains constant throughout pregnancy (Fig.4). Out of the 50 small-for-date babies 20% of the values were <10 th and 66%<25th percentile.

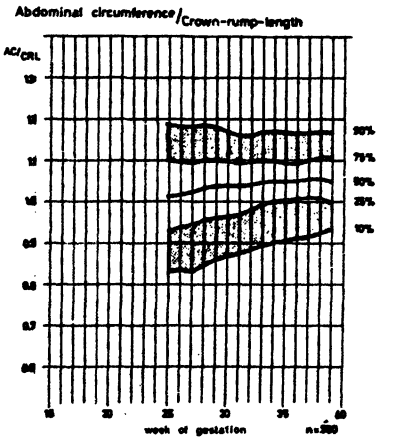

Fig.4) Percentile curves of the quotient abdominal circumference/crown rump length, n=360

SUMMARY

I) Out of eight different bone and soft-tissue parameters, the abdominal circumference correlates best with the birth weight: r=0.89. Only the combination of the abdominal and the thorax circumference has a better value: r=0.91.
However, all our parameters are linear. The employment of area or volume parameters would probably still improve fetal weight estimation.

II) For diagnosing intrauterine growth retardation measurement of thigh diameter seems to be of some value. The quotients of soft-tissue parameters/bone parameters are partly independent of gestational age. Therefore they may support the diagnosis of small-for-date babies where gestational age is uncertain.

Prospective studies with serial measurements should be carried out to verify the feasibility and practical utility of our parameters.

LITERATURE

1) KYANK, H: Zbl. Gynäk. 99, 461, 1977

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