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Roentgenologic Determination of Foetal Maturity

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ABSTRACT

Foetal length determination by roentgenologic measurement of the lumbar length is an unreliable method, with a large range of variation. It is important to be aware of this fact when the method is used for determining foetal maturity. It can be of some value, however, when no centres of ossification can be seen in the knee joint.

Foetal maturity can also be determined by non-roentgenologic methods. The biparietal diameter of the foetus can thus be measured with a relatively high degree of accuracy by the ultra sound technique which is simple and has no radiation effects on the mother or foetus. This method gives at a single examination about the same range of variation as the roentgenologic methods. It can, however, because of the lack of radiation hazards, be used in repeated examinations, whereby the rate of growth of the foetus can be estimated. We have therefore used this method during the last year, with satisfactory results.

INTRODUCTION

Determination of the degree of foetal maturity can be of value to the obstetrician, e.g. when the date of conception is uncertain or where induction of labour may come into question. The latter group includes pregnancies complicated by Rhesus incompatibility, toxicosis or diabetes mellitus.

Several roentgenologic methods are available for determining foetal maturity, one of which is the demonstration of centres of ossification (Bishop, 1965; Holmberg & Liliequist, 1969). The presence of epiphyseal ossification centres in the knee joint is often used as a sign of foetal maturity, but their absence is of no great significance (Bishop, 1965). Calculations of the foetal length based on the length of the lumbar spine (Zsebök, 1957; Fagerberg & Roonemaa, 1959; Weishaar & Port, 1964; Margolis & Woss, 1968), sitting height (Zuppinger, 1952) or biparietal diameter (Jacobs, 1953, among others) are other roentgenologic methods for determining the degree of maturity. Further, Ringertz (1971) has calculated the foetal weight from the lumbar length and abdominal diameter.

In the last 12 years in our hospital the foetal length has been calculated by the method described by Fagerberg & Roonemaa in 1959. The values obtained by this method have shown a relatively large range of variation, however, and its reliability in determining the maturity of the foetus has therefore not been quite clear. As non-roentgenologic methods for determining the foetal maturity are now available, e. g. measurement of the biparietal diameter by ultrasound (Thompson et al., 1965) and analyses of the amniotic fluid (Brosens & Gordon, 1966; Mandelbaum et al., 1967), we have investigated the reliability of the roentgenologic method of calculation of foetal length and foetal weight, on a one-year material.

MATERIAL AND METHODS

All cases examined during 1971 with a gestational time of over 32 weeks ($n=164$) and delivered within 7 days from the time of the roentgenologic examination were reviewed. The length of the lumbar spine was measured by the method of Fagerberg & Roonemaa (1959) and correlated to the length and weight of the infant post-partum (referred to hereafter as "foetal length" and "foetal weight"). The length of the lumbar spine was measured on roentgenograms taken in the prone position with a film-focus distance of 100 cm and a p.a. projection. The measurement was performed from the upper margin of L 1 to the lower margin of L 5, following the curve of the spine. The foetal length and foetal weight were measured immediately after delivery.

From the regression line for lumbar length to foetal length, correction factors for calculating the foetal length were obtained.

RESULTS

The correlation of the lumbar length, measured on the roentgenogram, to the foetal length, is shown in Fig. 1. The standard deviation is 1.98 cm, which means that the foetal length can be given with an

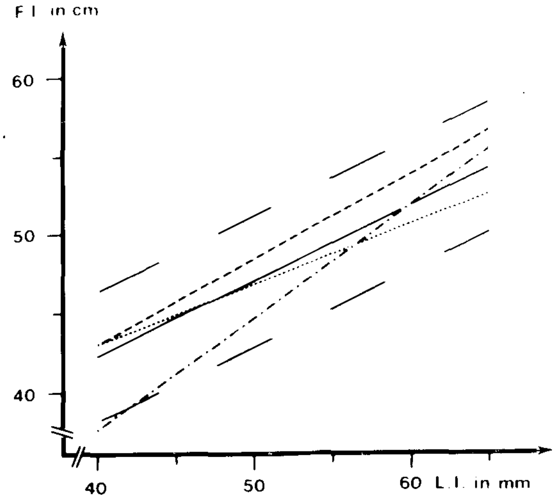

Fig. 1. Regression lines for lumbar length (L. l.) to foetal length (F. l.). —, total material (164 cases). equation: $y=23.029+0.483x$. ———, 95% confidence level for the total material; ----, diabetes mellitus (9 cases); -----, Rh incompatibility (13 cases); ---·, toxicosis (20 cases).

accuracy of ±4 cm at the 95% confidence level. The regression line for the cases with diabetes mellitus and Rh imcompatibility corresponds well with that for the whole material, while the line for the cases with toxicosis is steeper (Fig. 1). The number of cases in these sub-groups is small, however. The correlation coefficient for the whole material is 0.70.

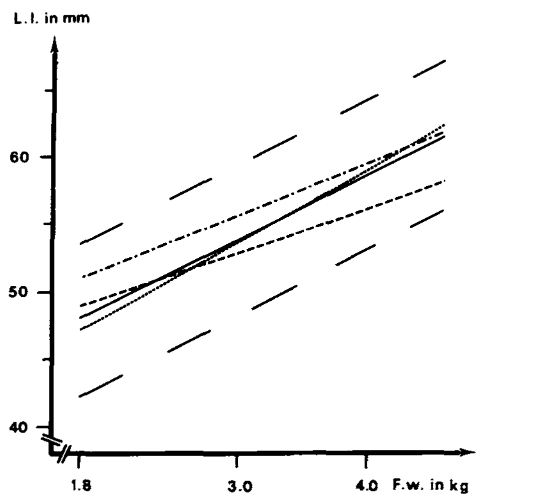

Fig. 2. Regression lines for foetal weight (F. w.) to lumbar length (L. l.). —, total material (159 cases). Equation: $y=39.19+4.9x$ ———, 95% confidence level for the total material; ---, diabetes mellitus (10 cases); -------, Rh incompatibility (13 cases); ---·, toxicosis (17 cases).

Table. *Correction factors by which some lumbar lengths are multiplied to obtain the foetal lengths*

Lumbar length (mm)	Multiplying factor	Foetal length (cm)
40	10.6	42.3±4.0
45	9.9	44.7±4.0
50	9.4	47.2±4.0
55	9.0	49.6±4.0
60	8.7	51.9±4.0

The correction factors by which the lumbar lengths are to be multiplied to obtain the foetal lengths can be seen in the table. These factors were calculated from the regression line for the whole material.

The correlation between foetal weight and lumbar length is seen in Fig. 2. For the whole material the correlation coefficient is 0.72, with a standard deviation of 0.52 kg, corresponding to ±1.02 kg at the 95% level. The regression for the different diagnostic groups falls within this range. It may be noted, however, that the foetal weight for the diabetic cases is greater than that for the total material when the lumbar length exceeds about 50 mm.

DISCUSSION

Calculation of the foetal length from the lumbar length gives an inexact result on account of the large standard deviation (±4 cm at the 95% confidence level). This deviation is of the same order of magnitude as that reported by Fagerberg & Roonemaa (1959), ±3.4 cm, and by Margolis & Woss (1968), ±5 cm. This means in gestational time about ±4 weeks (Lubchenco et al., 1966).

The regression line for lumbar length to foetal length in this investigation is somewhat less steep than that obtained by Fagerberg & Roonemaa (1959), which means that the factors for determining the foetal length will be somewhat different (see Table). Thus, for calculating the foetal length from the lumbar length the correction factors obtained here should be used.

The correlation between lumbar length and foetal weight in this material is poor. The standard deviation at the 95% confidence level is ±1.02 kg, which means that the method is not practicable for determining the foetal weight. The method used by Ringertz (1971), with measurement of the lumbar length and the abdominal diameter, gave a rather better result, with a standard deviation of ±0.5 kg at the 90% level. It is of interest, however, that the overnutrition of the foetus that takes place in diabetes mellitus (Gordon, 1962; Margolis & Woss, 1968, among others) is evident in the regression for lumbar length to foetal weight (see Fig. 2). As mentioned above, however, the number of cases in this group is small.

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