

Correlation of sonographic cephalometry with clinical assessment of fetal age following early midtrimester D & E abortion*

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Abstract

A chronic problem in early midtrimester D & E abortion is the accurate preoperative assessment of gestational length. In the present study, 104 patients ranging from 13 to 21 menstrual weeks of gestation were studied sonographically prior to abortion. After the abortion, sonographic biparietal diameter was compared with clinical biparietal diameter and other parameters of fetal age. Sonographic biparietal diameter was shown to have a much higher correlation with clinical biparietal diameter than other preoperative evaluations. Correlations between biparietal diameter and other fetal measurements are shown, along with formulas for deriving the unknown dimension. Sonographic study also proved to be useful in assessing or diagnosing such problems as uterine abnormalities, placental location, and pelvic tumors.

Uno de los problemas crónicos de los abortos de principios del segundo trimestre es el diagnóstico correcto de la edad gestacional. Se estudiaron mediante sonografía 104 pacientes entre las 13 y 21 semanas de gestación. El diámetro biparietal sonográfico fue comparado con el diámetro biparietal clínico así como con otros parámetros para determinar la edad fetal postaborto. La determinación del diámetro biparietal sonográfico mostró tener una correlación mayor con el diámetro biparietal determinado clínicamente que otras determinaciones preoperatorias. Las correlaciones biparietales fueron bastante correctas. Las correlaciones entre el diámetro biparietal y otras medidas fetales se muestran conjuntamente con fórmulas a fin de deducir la dimensión desconocida. El estudio sonográfico fue útil además para diagnosticar problemas como anomalías uterinas, localización de placenta y tumores pélvicos.

Introduction

One of the difficulties in performing abortion after the 14th menstrual week of gestation is the problem of accurately determining the length of gestation prior to the abortion. However experienced the operator, an estimate based on manual examination has a high prob-

ability of error due to variations in amniotic fluid volume, uterine abnormalities, the patient's abdominal musculature, and degree of obesity. These problems are accentuated in dilatation and evacuation abortions, since small differences in biparietal diameter are important factors in operative technique and results.

The use of sonography has produced data

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regarding fetal growth that can now be applied to the problems of D & E abortion.¹⁻¹⁰ Reports vary concerning fetal measurements—and, in particular, concerning biparietal diameter—but major studies have produced results comparable enough for Wiener *et al* to have produced a composite biparietal growth curve for 14–40 menstrual weeks of gestation.⁵ Bartolucci compared sonographic biparietal diameters with fetal weight in 101 pregnancies terminated by hysterotomy, Caesarean section, or amnioinfusion technique, but reported on the accuracy of the sonographic reading in only 15 patients.³

The present study was begun after ultrasonographic equipment had been installed in the Boulder Community Hospital in Boulder, Colorado. The new equipment permitted the assessment of patients being readied for D & E abortion procedures in an outpatient office nearby. The primary diagnostic intent was to determine biparietal diameter and, as a consequence, the need and/or eligibility for the D & E procedure. Additional information sought included the location of the placenta and the presence of hydatidiform moles, uterine abnormalities, multiple pregnancies, and pelvic tumors.

Materials and Methods

Up to the time of this report, 209 D & E procedures using a multiple laminaria treatment had been performed. Of these, 104 pa-

tients were studied sonographically prior to the abortion after first having been screened by physical examination and review of menstrual dates. Commercially available gray scale ultrasound equipment was used. Biparietal measurements were taken from a leading edge B-mode display, measuring from the outside of the calvarial echo on one side of the fetal head image to the outside of the calvarial echo on the other side. Care was taken to obtain a complete, round, cross-sectional image through the fetal skull to display the falx cerebri.

Following a standard protocol reported earlier, each patient received a multiple laminaria treatment over a period of approximately 42 hours.⁶ The D & E procedure was performed under paracervical block anesthesia and the tissue examined carefully for completeness. The fetus was weighed and various parameters measured. The degree of cervical dilatation obtained due to the multiple laminaria treatment usually allowed delivery of the fetal skull in a collapsed but relatively intact condition. This permitted measurement of the actual biparietal diameter by filling the cranium with water or air and then measuring by sight with a plastic ruler. Results were then compared to the figures derived earlier from sonographic study. Final estimate of gestation was made utilizing data from Streeter,⁷ Gottesfeld,⁸ Campbell,¹ and Sabbagha.⁴ The patient's menstrual dates and history of isolated intercourse were used if they seemed reasonably

TABLE 1
Median fetal measurements and weight of products of conception, 13-21 menstrual weeks gestation

N	Weeks gestation	Tissue Weight (g)	Fetal weight (g)	Foot length (mm)	Biparietal diameter (mm)
44	13	82	18 (22.5) ⁹	11 (11.4) ⁷	22 (22.5) ¹
39	14	125	36 (34.5)	14 (14.0)	26 (28.4)
57	15	150	59 (51.0)	17 (16.8)	30 (33.2)
33	16	212	101 (79.8)	22 (19.9)	36 (36.9)
7	17	266	146 (125)	25 (23.0)	39 (40.1)
	18	278	160 (172)	27 (26.8)	42 (43.9)
5	19	340	210 (217)	31 (30.7)	44 (47.2)
2	20	417	280 (255)	35 (33.0)	48 (50.2)
1	21	486	325 (330)	39 (35.0)	48 (53.5)

Note 1a

Numbers of observations, by week, of fetal weight: 13, 27; 14, 30; 15, 48; 16, 31. Number of observations, by week, of foot length: 13, 33; 14, 31; 15, 48; 16, 30. Number of observations, by week, of biparietal diameter: 13, 10; 14, 23; 15, 39; 16, 30; 17, 11.

consistent with clinical findings; however, an inaccurate menstrual history was a major characteristic of many of the patients presenting at this stage of pregnancy.

Results

Table 1 shows measurements taken on 209 specimens following D & E abortion performed at 13 menstrual weeks of gestation or later as a comparison with previous observations of correlations between gestational length and fetal parameters. Numbers in parenthesis under the *fetal weight* column are observations by Brenner, *et al.*⁹ Brenner's 25th percentile was used since it most closely approximates observed values in this series. The difference in altitude between North Carolina and Colorado may account for the differences in fetal weights in the North Carolina series. In addition, the abortion technique used was quite different. Numbers in parenthesis in the *foot length* column are Streeter's observations, and numbers in parenthesis in the *biparietal diameter* column are from Campbell.¹ All of Campbell's observations are sonographic measurements, so they are not strictly comparable. In the categories of 13-16 weeks, the numbers of observations of fetal weight, biparietal diameter, and foot length are fewer than the total number of cases. The numbers are provided in Note 1a which follows Table 1.

Results of the comparison between sonographic biparietal diameter and clinical measurement are shown in Figure 1. Of 104 comparisons, 79% (N = 82) were within one millimeter, and only 5 showed a difference of four or more millimeters. The mean difference in measurements was 0.063mm and the median was 0.076mm, with a standard error of .183mm and a standard deviation of 1.6. Pearson's correlation was $r = 0.97$. The standard error of estimate was 1.6mm. The formula $BP = .3 + .99 (SOBP)$ expresses the relationship between the clinical and sonographic biparietal measurements. This may be compared with Bartolucci's result of $BP = .96 + .989 (SOBP)$ and a correlation of $r = .996$. However, only 4 of his 15 comparisons involved a biparietal diameter of less than 9.5cm.

Other pre-operative correlations with clinical biparietal diameter proved to be considerably less accurate. The least accurate was a correlation using the beginning date of the last normal menstrual period. Fully 19% of the cases could not be used because the date was not known or was obviously unrelated to the length of pregnancy. The remainder (N = 84) had a correlation of .62 (Fig. 2). Correlation using the height of the uterine fundus in centimeters above the symphysis pubis was slightly more accurate (Fig. 3), and the physician's estimate of length of gestation was, likewise, accurate (Fig. 4). The accuracy of

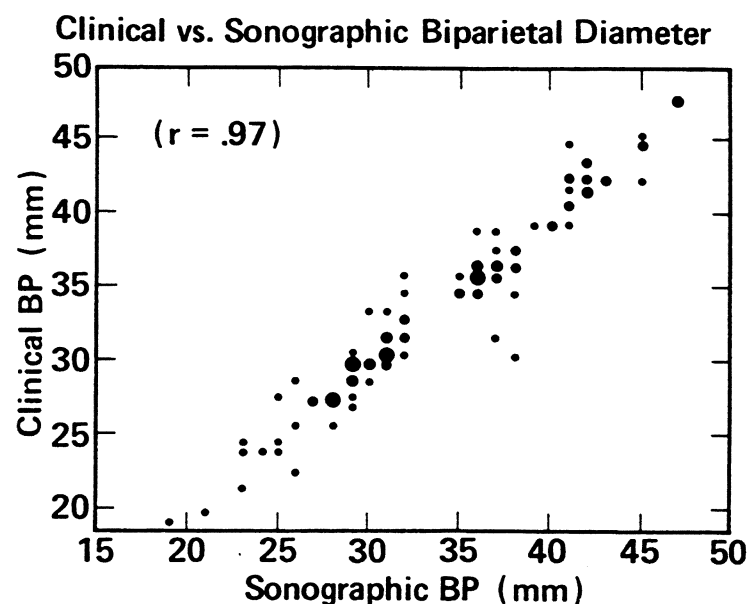


Fig. 1

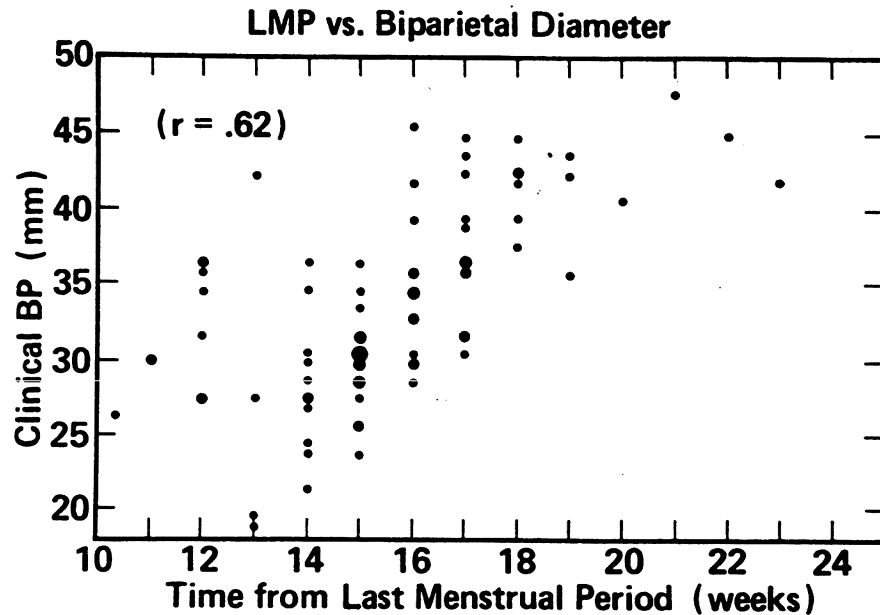


Fig. 2

the latter estimate, however, was attained only after several years' experience and many errors.

Postoperative correlation of clinical biparietal diameter with fetal weight revealed a curvilinear distribution similar to that reported by Bartolucci (Fig. 5), whereas the correlation of biparietal diameter with fetal foot length was linear (Fig. 6). Conversion formulae expressing the relationships between different fetal measurements are shown in Figure 7. The

formulae are not accurate beyond 20 menstrual weeks because of the small numbers of cases.

Discussion

Sonographic examination prior to D & E abortion has proven to be extremely valuable in this series, particularly in the determination of biparietal diameter. On several occasions, it has demonstrated the presence of an earlier pregnancy than was suspected, obviating the

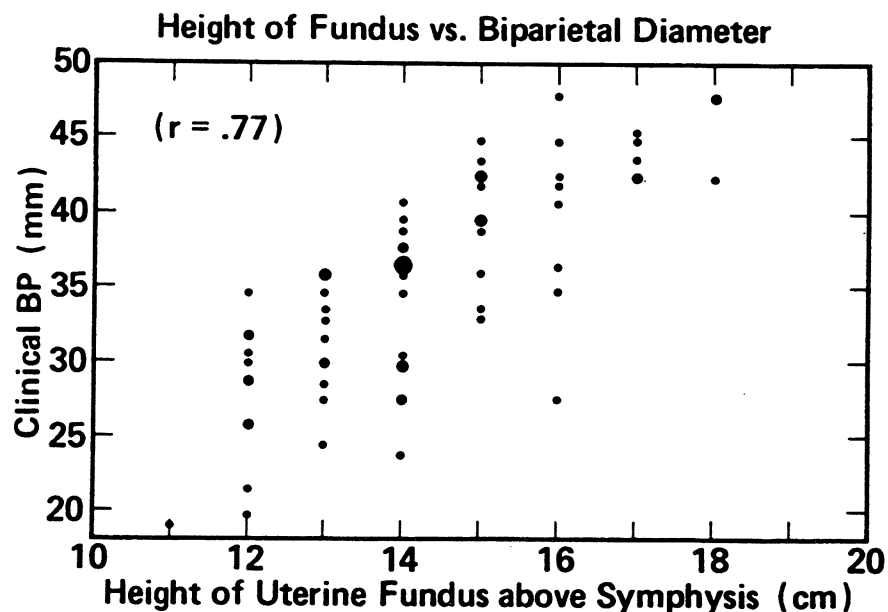


Fig. 3

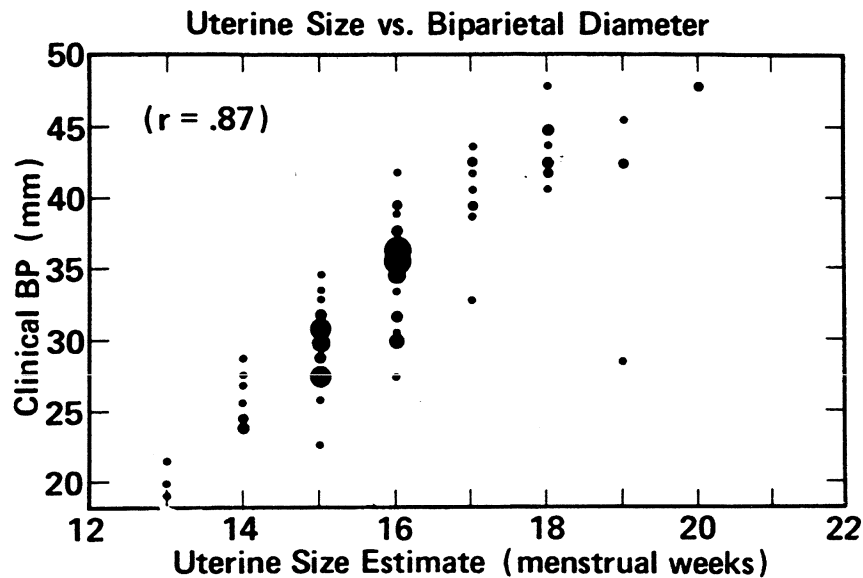


Fig. 4

need for a multiple laminaria D & E procedure. On other occasions, it showed a pregnancy too advanced for the limits set for the D & E procedure.

One patient thought to have a very advanced pregnancy was given a sonographic examination to determine the exact length of gestation. She was found to have a pregnancy consistent with an LMP of 16 weeks, complicated by the presence of a 10cm ovarian cyst in the pelvis. The pregnancy was terminated by

D & E with some difficulty due to the posterior placement of the cyst; however, D & E would not have been attempted at all if sonography had not demonstrated the true situation.

Extreme obesity made the uterus of a patient with a 24-week gestation impossible to palpate, a situation made more difficult by the patient's irregular menses. Another patient presented with menstrual dates of 12 weeks from LMP and a previous clinical evaluation of 16 menstrual weeks, multiple gestation.

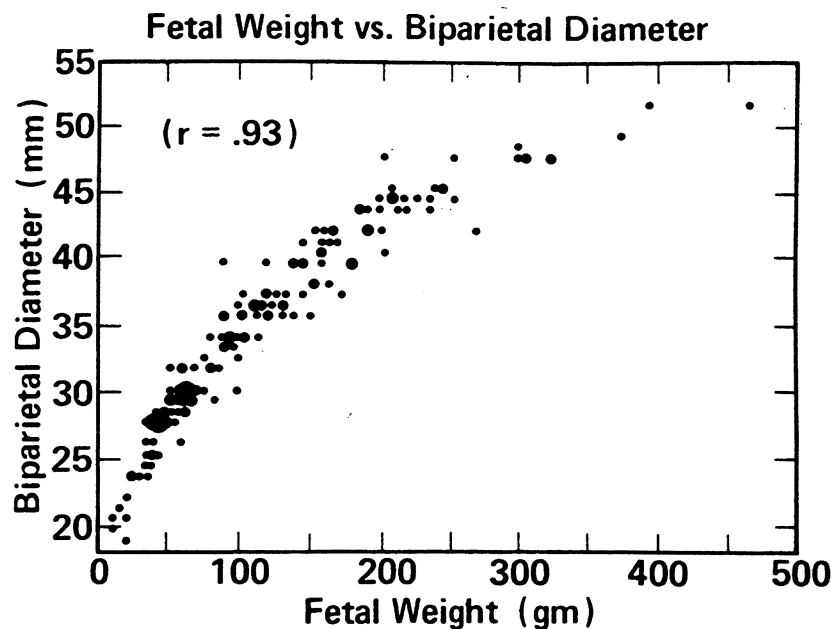


Fig. 5

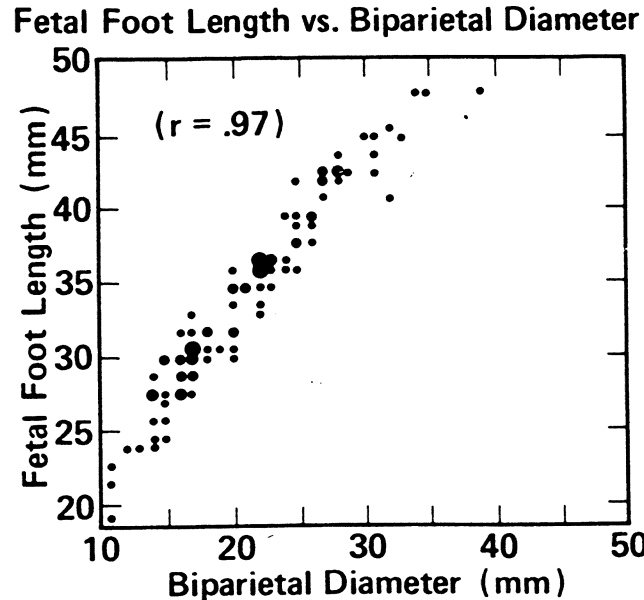


Fig. 6

Examination revealed what appeared to be a didelphys uterus with both fundi 4cm below the umbilicus. Sonography revealed a septate, but not didelphys, uterus with 16 menstrual weeks of gestation and a single pregnancy. The pregnancy was terminated by an uncomplicated D & E procedure, confirming the sonographic findings.

Locating the placenta has proven to be interesting, but of equivocal clinical significance. The presence of placenta praevia has been noted in numerous cases, but no unusual bleeding has occurred in these patients during the multiple laminaria treatment. In fact, patients with sonographic diagnosis of placenta praevia have had a lower average blood loss, due to the immediate presentation of the

placenta in the procedure. Posterior location of the placenta is sometimes associated with heavier bleeding, but accurate evaluation of this relationship must be postponed until more experience has been accumulated.

Sources of error in biparietal measurement include fetal positioning during sonography and maceration of tissues during the D & E procedure. The most accurate results in sonographic measurement are obtained when the transducer can be easily moved in a plane perpendicular to the fetal falx cerebri; the measurement is less accurate when this becomes more difficult. Collapse and delivery of the fetal skull during the uterine evacuation is often accomplished with minimal maceration, but measurement remains tedious and easily

$$BP = .3 + .99 (SOBP)$$

$$Foot = -9.2 + .88 (BP)$$

$$BP = 12.0 + 1.06 (Foot)$$

$$WT\ FE = 210.9 - 16.45 (BP) + .375 (BP)^2$$

Fig. 7

subject to errors of several millimeters. Fragmentation does not permit even an approximate measurement.

Accurate measurement of foot length, however, is almost always possible. For this reason, correlation of foot length with biparietal diameter is presented to permit an indirect correlation of clinical results with previous sonographic biparietal measurement and confirmation of gestational age.

Conclusion

These results indicate that there is a "spectrum of accuracy" of pre-operative and post-operative methods of evaluation in the determination of fetal age. The most accurate pre-

operative evaluation is obtained with sonographic cephalometry, followed by clinical estimate by an experienced physician and measurement of the height of the uterine fundus. The date of the last menstrual period is almost wholly unreliable. The most consistently accurate source for the determination of fetal age is through the fetal foot length, followed by measurements of the biparietal diameter and the fetal weight.

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