EXCHANGE OF EXPERIENCE

ULTRASONIC MEASUREMENT OF THE INTERPARIETAL DIAMETER OF THE FETAL HEAD

R. A. Khentov and I. A. Skorunskii

Ultrasound is used to demonstrate intracranial tumors and hematomas, organic diseases of heart and large vessels, of the liver, biliary and urinary passages, eye, mammary carcinoma, and in recent years, in gynecology and obstetrics.

It has been shown in a number of recent investigations [1-6] that diagnostic doses of ultrasound have no unfavorable effects of any kind on the body (even on sex glands, embryos or fetuses, all of which are particularly sensitive to physical agencies).

Certain tumors of the internal female sex organs, particularly uterine myoma and ovarian cyst, can be distinguished by means of ultrasonics. The obstetrical position and situation of the fetus, the presenting part in multiple pregnancies, etc., can be determined with almost complete certainly [7-11].

The possibility of measuring the greatest transverse (interparietal) diameter of the fetal head is a matter of considerable interest. Timely establishment of the relation between the size of the fetal head and the size of the female pelvis is one of the most important of the obstetrician's tasks. Although, in most cases the cause of "disproportion" lies in the existence of a large head and contracted pelvis, a large fetal head may, even if the pelvis is normal, render natural birth impossible.

Just as functional assessment of the female pelvis during birth should be preceded by its anatomical assessment, the size of the fetal head should be determined before labor.

The relationship between fetal head and maternal pelvis will be determined largely by the greatest transverse (interparietal) diameter. This is indicated more particularly by adaptational mechanisms such as the production of change in the shape of the head, which becomes particularly marked during birth in the presence of one or other form of contracted pelvis. The change in the shape of the head is not, however, always sufficient, and this is particularly likely to be the case when the cranial bones are unusually rigid or when pregnancy goes beyond term. Direct measurement of the interparietal diameter is, of course, impossible. Until recently, the only method available was radiography [12-14]. Its use has, however, been restricted, mainly because of possible danger to the sex glands of mother and fetus from ionizing radiation.

Papers [15-18] have appeared recently describing a new method for measurement of the interparietal diameter of the fetal head—ultrasonic echo-encephalography. No detailed description of the apparatus or techniques used has yet been given.

The method is based on the reception of ultrasonic signals reflected from, first, the nearest and then, the more distant wall of the cranium of the intrauterine fetus, and measurement of the distance between them. As yet, there have been no similar investigations in the USSR.

With a view to confirming that such ultrasonic measurements were possible and reliable, the authors studied hundreds of echo-encephalograms obtained from 100 infant cadavers. The work was carried out in the morgue of the Botkin Clinical Hospital, Moscow. The examinations were made directly on the heads of infant cadavers, in a special water-filled incubator and also under conditions approximating to the natural conditions.

Our experimental investigations confirmed that accurate measurement of the interparietal diameter of the fetal head was possible, but only when the examiner was familiar with the typical echo-encephalographic patterns. If an ultrasonic emitter is applied to the region of the parietal eminence, which has been smeared with vaseline, a typical echo-encephalographic picture, consisting of three reflected signals, can be obtained on the screen of the ultrasonic apparatus (Fig. 1). When the distance from the first to the last

Fig. 1. Typical echo-encephalogram for measurement of interparietal diameter.
a) Initial complex (reflected from the nearest cranial wall). b) M-echo reflected from midline structures (mainly third ventricle and pineal body).
c) Terminal complex (reflected from opposite wall of cranium).

Fig. 2. Measurement of interparietal diameter of the fetal head in clinical practice.

complex, as calculated from the echo-encephalogram, was compared with the interparietal diameter, measured with calipers, the values were found to be almost the same; the echo-encephalographic measurements were, in fact, 2 mm less than the caliper measurements. This difference is due to the fact that the leading edge of the terminal echo is reflected from the inner surface of the parietal bone of the opposite side of the skull (in the full-term nonate the thickness of skull and integument is 1.5–2.0 mm).

The presence of an M-echo in the echo-encephalogram of the head of the fetus in utero indicates that the measurement has been correctly made, that the beam has travelled exactly along the interparietal diameter; also, the measurement can be made by doubling the distance from the M-echo to the terminal complex, as this is simpler than determining the distance between the two complexes.

The knowledge of the measurement technique and of the features of echo-encephalograms gained from the examination of postmortem material made it possible to apply the method in the clinic.

The clinical investigations were carried out in Moscow Maternity Hospital No. 26 with ultrasonic diagnostic apparatuses UZD-5 and UDA-724 with a unidimensional emitter at a frequency of 1.76 Mcps. The interparietal diameter of the fetal head was measured by the ultrasonic method in 78 cases shortly before birth (usually when the pregnant woman was admitted to the hospital). Soon after birth (and not later than 2 days) the same measurement was made on the head of the neonate.

Comparison of the measurements showed that the mean error of the ultrasonic measurements did not exceed 2.5 mm. This error is not at all indicative of the ultimate accuracy of the method; improvement of the apparatuses will increase their accuracy.

Ultrasonic measurement of the interparietal diameter is possible when the fetal head is above the inlet or just engaged in the inlet of the true pelvis. The procedure does not require any special preparation of the pregnant woman or woman in labour, apart from emptying of the bladder and the smearing of the abdominal wall with vaseline (to give better contact between the wall and the emitter); the measurements are made on an ordinary bed (Fig. 2), do not cause the patient any discomfort, and take not more than 6 min.

The examination has no effect on the course of the pregnancy or labor, on the condition of the woman before or during childbirth, or on the fetus or neonate. Improvement of ultrasonic diagnostic apparatuses, simplification and reduction of their cost will make the use of this new, accurate and safe method of examination practicable in obstetric practice.

CONCLUSIONS

1. The interparietal diameter of the fetal head can be accurately measured by the ultrasonic method. The new ultrasonic diagnostic apparatuses UZD-5 and UDA-724 made in this country can be used successfully for this purpose.

2. The method is relatively simple, and safe for mother and fetus.