

# POSSIBILITIES IN THE APPLICATION OF ULTRASOUND IN OBSTETRICS AND GYNECOLOGY

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The effective employment of ultrasound in medicine is one of the notable achievements of contemporary science and technology. In 1958, the first data were published [4] on the possibilities of applying ultrasound for diagnosing certain gynecological disorders and of using it in obstetrical practice for determining fetal presentation, multiple pregnancy, hydramnios, vesicular mole, changes in certain measurements of the fetal head and in fetal weight, etc. [5,6]. Ultrasonic diagnosis is simple and rapid and does not lead to such damaging results as can follow x-ray examination.

The high sensitivity of the ovaries to various physical factors demands a deep study of the effects which ultrasound may have upon them and this study is still far from being completed.

The action of ultrasound on the ovaries has been examined in the present work.

We set ourselves the problem of making the experimental conditions close to those found in clinical practice. On the basis of the ultrasonic apparatus UZD-4, made in the ultrasonic laboratory (Head, M. D. Gurevich) of the All-Union Scientific Research Institute of Medical Instruments and Equipment, a special impulse generator IG-2 has been constructed in the same laboratory for experimental purposes (Fig. 1).

## EXPERIMENTAL METHODS

The ultrasonic transmitter was used at 1.5 Mc (probing, or penetration of the tissues, by ultrasound is possible at not less than 10 cm; the length of the to-and-fro movement of the piezogenerator was up to 80 mm and the area of the radiating surface was  $5.3 \text{ cm}^2$ ). The piezogenerator was moved from one ovary or uterine horn to the other and acted on both ovaries and uterine horns (and during pregnancy on the contained fetuses) almost simultaneously and with an intensity of approximately  $0.5 \text{ w per cm}^2$ .

The experiments were made on 18 nonpregnant and eight pregnant rabbits, approximately one year old and weighing from 2700 to 4500 g. The hair on the back of the animal, from the part on a level with the ovaries and uterine horns, was carefully shaved before the beginning of the experiment. The exposed skin was thickly smeared with vaseline oil and the rabbit was placed on its back on the rubber sheet of the transmitter. From the reading of the oscillograph, it could be seen whether the contact between animal and transmitter remained unbroken. The action of the ultrasound was continued for 2 h, six times a day.

## EXPERIMENTAL RESULTS

Ultrasonic energy of  $0.04\text{--}0.2 \text{ w per cm}^2$  of surface examined is sufficient for diagnostic purposes in obstetrical and gynecological practice. Thus, the reproductive glands of the nonpregnant and pregnant rabbits and the fetus from the first day of development were subjected to a stronger and more prolonged action than that which is necessary for, and adopted in, clinical practice.

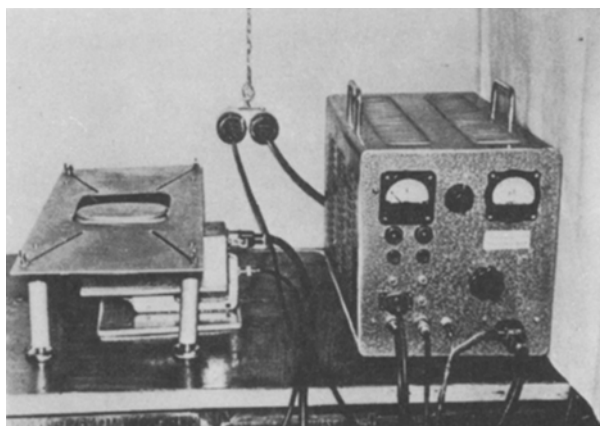


Fig. 1. Ultrasonic impulse generator IG-2 for experimental purposes.

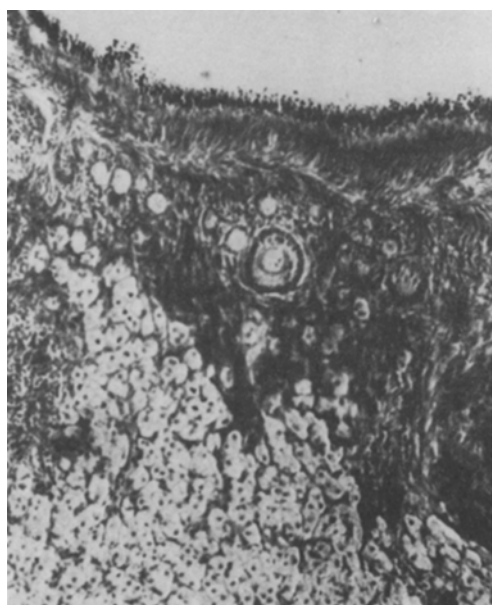


Fig. 2. Ovary of nonpregnant rabbit. Primordial and growing follicles, as well as cells of the interstitial glands, are seen in the cortical layer.

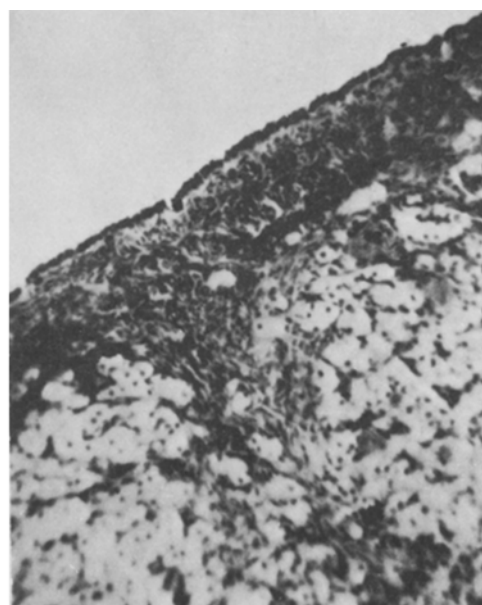


Fig. 3. Ovary of pregnant rabbit. The surface is paved with embryonic epithelium; the cortical layer and two yellow bodies, having large, clear cells containing frothy protoplasm, may be seen.

The experiment did not affect the condition and the behaviour of the animals. There were no premature births or abortions. All the rabbits appeared to be of normal weight and of well-defined, physiological maturity which we diagnosed by methods accepted in the laboratory directed by Professor I. A. Arshavskii [1]. Both the maternal and fetal placentas of the pregnant rabbits were of normal weight and structure. When the experimental animals were dissected, no changes in the internal organs or ovaries\* were observed and no changes in microstructure (Figs. 2 and 3).

Some authors [7,8, and others] have recorded injuries to the genital glands of experimental animals, also premature births and disturbances in fetal development. Later, it was established that these effects could be attributed

\*The histological examinations of the preparations were made by the pathohistologist, senior scientist in the Central Scientific Research Laboratory II of the Pirogova cand. med. science I. M. Sapelkinoi Medical Institute, Moscow.

to the excessively high intensity of the ultrasound. D. Kamochai [3] demonstrated that ultrasound applied to the ovaries of pregnant and nonpregnant rats at doses of 0.5 to 1 w per cm<sup>2</sup> for 3 to 5 min, five or six times a day, produced no unfavorable result on the reproductive glands, on the course of pregnancy or on the offspring. These results were confirmed by Zhordania and Dzidziguri [2].

The results of our experiments showed that no ill effects followed the use of ultrasound for diagnostic purposes.

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