

# SLOW BIOELECTRICAL POTENTIALS FROM THE ISOLATED FIBROID NONPREGNANT HUMAN UTERUS

A. P. Chervyakova

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Little information has been obtained by the study of the functional state of the human fibroid uterus, and it is based on investigation of the contractile activity of isolated pieces of this organ [3, 5].

The object of the present investigation was to study the functional state of various parts of the isolated human fibroid uterus by recording slow biopotentials.

It is well known that the bioelectrical activity of the uterus is closely connected with the metabolic processes taking place in it and that it reflects the excitability and the contractile power of the organ [1, 2, 4].

## EXPERIMENTAL METHOD

Experiments were conducted on 12 isolated fibroid uteruses taken from nonpregnant women. The indications for operative treatment of these patients were a disturbance of the ovarian and menstrual cycle or the rapid growth and large size of the tumor. The location of the fibroid nodules in the uterus varied.

After removal of the fibroid uterus at operation it was placed in a special vessel containing warm Ringer-Locke solution (37°) for transportation to the laboratory, where it was kept in an "Inka" incubator with maintenance of constant physiological conditions. The investigations began usually 10-15 min after removal of the uterus from the patient and they continued for 1.5-2 h. The bioelectrical potentials were recorded from various parts of the muscle tissue and from the fibroid nodules by means of Alvar button and needle chlorinated silver electrodes. The distance between the electrodes was 2.5-3 cm. Besides the "spontaneous" bioelectrical activity of the uterus, the reactivity of the myometrium and of the tumor tissue was studied. For this purpose, in the course of the investigation pituitrin was injected into the uterus midway between the electrodes in a dose of 0.2 ml. The apparatus used for recording the bioelectrical activity of the uterus had a linear frequency characteristic in the range 0-10 cps. The frequencies higher than 10 cps were cut out by means of special filters, thereby making the apparatus more stable in operation.

To record the bioelectrical activity of the uterus self-writing instruments of the type of the D-331 ammeter and the EPP-09 electronic potentiometer, producing ink tracings, were used. A power amplifier and a compensating device were included in the circuit.

Analysis of the uterine potentials (electrohysterograms - EHG) included measurement of the amplitude of the individual waves in millivolts and the period of the waves in seconds. The descriptive method of evaluation of the EHG was supplemented by determination of their quantitative characteristics. For this purpose a conventional index was introduced - the general level of bioelectrical activity of the uterus [2]. This was taken to be the difference between the length of the EHG and the isoelectric line over a period of 10 min when the speed of the tape-winding mechanism was 6 cm/min and the amplification was 1 mV/4 cm. The length of the EHG was measured by means of a curvimeter.

## EXPERIMENTAL RESULTS

On the EHG obtained by recording the biopotentials from the region of the myometrium in most cases, besides waves with an amplitude of 0.3-0.8 mV and a period of 20-30 sec, slow waves with a period longer than 1 min and an amplitude of more than 1 mV were observed (Fig. 1, A). In cases when the anatomical arrangement of the fibroid nodules permitted recordings to be made from different parts of the myometrium, it was noted that the bioelectrical activity of the muscle layers located closer to the cervix was less marked

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Laboratory of Clinical Physiology, Sverdlovsk Research Institute of Maternal and Child Welfare. Scientific Director of Research Dr. Med. Sci. G. M. Lisovskaya. (Presented by Active Member of the Academy of Medical Sciences of the USSR V. V. Parin). Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 64, No. 8, pp. 94-96, August, 1967. Original article submitted December 2, 1965.

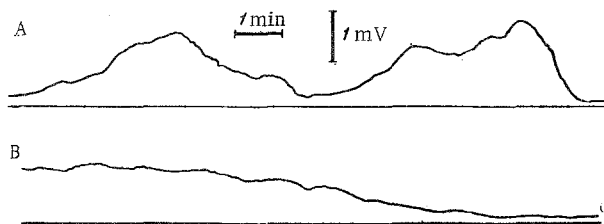


Fig. 1. Bioelectrical activity of isolated fibroid human uterus. A) recording from myometrium; B) recording from region of a fibroid nodule.

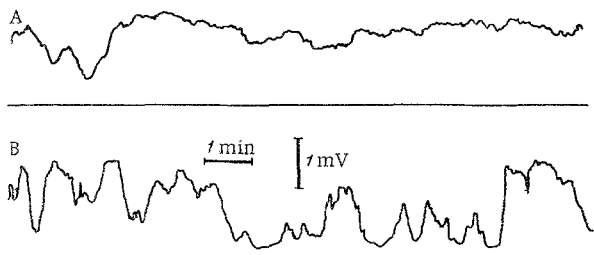


Fig. 2. Bioelectrical activity of the isolated fibroid human uterus before (A) and 8 min after (B) injection of pituitrin into the myometrium.

When pituitrin was injected into a fibroid nodule, in no case were changes observed in the bioelectrical activity.

The results of these investigations showed that the myometrium of the isolated fibroid uterus of non-pregnant women possesses high bioelectrical activity. This may possibly be due to hormonal changes in the body. This hypothesis is based on the fact that when the preparations removed were examined histologically in most cases, signs were found indicating estrogenic stimulation (glandular hyperplasia of the endometrium, the presence of adenomatous polyps, cystic degeneration and multiple follicular cysts in the ovaries, and endometriosis).

The fibroid tissue was characterized by a low level of spontaneous bioelectrical activity and by the absence of a reaction to injection of pituitrin, which may be explained by the structural features of the fibroids (irregular arrangement of the muscle fibers, signs of hyalinosis, edema, and necrosis).

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than that of the muscle zones in the region of the body of the uterus.

When the biopotentials were recorded directly from the region of the fibroid nodules, a low bioelectrical activity was observed. In these cases it was almost impossible to distinguish the individual waves on the EHG (Fig. 1, B). This phenomenon may be attributed to the fact that during histological investigation of the fibroid nodules from which the potentials were recorded, changes were found in the form of edema, hyalinosis, and necrosis.

The general level of bioelectrical activity when the biopotentials were recorded from the muscle of the isolated fibroid uterus of nonpregnant women varied from 10 to 65 (mean  $27.3 \pm 3.4$ ) conventional units. In the region of the fibroid nodules this index was much lower and varied from 0 to 7 (mean  $1.09 \pm 0.7$ ) conventional units ( $P < 0.0001$ ).

From 8 to 12 min after injection of pituitrin into the myometrium the bioelectrical activity increased, as shown by the appearance of regular waves on the EHG with an amplitude of 0.8–1.6 mV (Fig. 2). The general level of bioelectrical activity of the myometrium of the isolated uterus after injection of pituitrin rose from  $21.6 \pm 4.5$  to  $47.2 \pm 10.8$  conventional units ( $P < 0.05$ ).