A METHOD OF INJURING THE RABBIT MYOCARDIUM IN THE INTRAUTERINE PERIOD

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A method of injuring the myocardium in rabbit embryos on the 20th-24th day of pregnancy is described. After laparotomy and incision of the uterus the fetal membranes and chest wall are punctured. In this way the fetal heart is injured. Two alternative techniques are described, differing in that in one case the fetal membranes are completely separated from the uterine cavity, whereas in the other they remain in the uterus and are punctured through an incision in the uterine wall. If the operation does not end in abortion, the animals go on to produce viable young at term.

KEY WORDS: rabbit fetus; myocardium; mechanical trauma.

The method of studying regeneration of the myocardium in mammalian embryos and fetuses hitherto used [1-4] has several disadvantages. The most important is that the small fragment of myocardium, kept under artificial conditions, is deprived of correlative influences from the fetal and maternal organisms, with the result that the regenerative power of the myocardium cannot be fully manifested.

A basically novel method is suggested for studying regeneration of the heart muscle cells of animals in utero. The essence of the method is that the myocardium is injured in vivo. The method was developed on pregnant chinchilla rabbits weighing 4-5 kg. The operation was performed on the 20th-24th day of pregnancy, under open ether anesthesia, after preliminary intramuscular injection of thiopental sodium in a dose of 50 mg/kg.

Through a midline incision starting 3-4 cm below the lower costal margin, 7-9 cm in length, the abdominal wall is opened in layers. The uterus containing the fetuses is brought out into the operation wound. To prevent cooling of the fetuses during the operation the temperature in the region of the operation wound is maintained at 36-38° by means of two reflector lamps. The uterus is covered with a sterile gauze towel, which is periodically moistened with sterile physiological saline at 36-38°C.

An incision about 1.5 cm long is made at the upper pole of the uterus above one of the fetuses and the fetus in its membranes is completely withdrawn through it. The fetus in this situation is rotated through 180°C (with the chest wall uppermost) and fixed in that position with the fingers. By means of a steel needle with guard the fetal membranes are first punctured, after which the needle is inserted into the fetal chest wall in the mid thoracic line at the level of the 4th-7th intercostal space. In this way the needle enters the heart. After withdrawal of the needle the amniotic sac is closed with catgut (purse-string suture) and returned into the uterus. The uterus is closed by a continuous catgut suture. Similar manipulations are carried out on each fetus in the uterus, after which the uterus is returned into the abdominal cavity. After 100,00-150,000 units of penicillin have been introduced into the peritoneal cavity the abdominal wall is closed in layers. Depending on the number of fetuses, the operation lasts on average from 2 to 4 h.

By using this method 40 operations have been carried out, 19 of which (47.5%) have ended with the normal birth of viable fetuses and 21 (52.5%) in abortions and the birth of dead or living, but nonviable fetuses. Abortion usually takes place on the 2nd-3rd day after the operation.

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Another, simplified variant of the method has been developed in which the incision in the uterus is not longer than 1-1.2 cm. In this variant the amniotic sac bulges into the incision but it is not completely withdrawn from the uterus. The fetus in utero is rotated through 180° and manipulated toward the incision in the uterus so that its chest wall at the site destined to be punctured is immediately beneath the incision and is clearly visible to the eye. In this position the fetus is fixed with the fingers and the subsequent course of the operation is as before.

A second variant of the method has been used in 52 operations. A positive result was obtained in 36 cases (about 69.2%) and 16 operations terminated in abortion (30.8%).

The fetal heart is punctured with a steel needle 5 cm long and 1.5 mm in diameter, tapering below to a point. At a distance of 0.8 cm from the lower end of the needle there is a guard which prevents the needle from penetrating too deeply into the fetus.

The method of injuring the myocardium described in this paper presents no risk to the mother's health. No deaths following the operation were observed. The mothers get up on the average 3-5 h after the operation. If the operation is successful they give birth to viable animals at term, which grow and develop normally. Some time (usually 1-2 months) after the operation some of the females have become pregnant again and given birth to normal young. The suggested method thus has no significant effect on the reproductive function of the female. As a rule, the operations on these females can be repeated.

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ANALYSIS OF ELECTRICAL ACTIVITY OF A MUSCLE DURING INDIRECT REPETITIVE STIMULATION

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A mathematical model of the transformation of electrical signals in the peripheral neuromuscular apparatus and a method of analysis of the experimental data obtained during indirect repetitive stimulation of a muscle and the muscle fibers of the rat diaphragm are described. By analysis of the record of electrical activity parameters characterizing the muscle with respect to the properties of frequency potentiation and depression were determined.

KEY WORDS: simulation of neuromuscular transmission; neuromuscular apparatus; action potential of muscle fiber.

This paper is devoted to the use of a mathematical model of transmission and transformation of signals in the neuromuscular apparatus (NMA) and of methods of analysis of the data obtained in experiments in which the transmission of electrical activity in a muscle fiber and muscle in response to its indirect repetitive stimulation were studied. The results are used to examine the distinguishing features and to determine the quantitative parameters of the processes studied under normal conditions and in some types of neuromuscular pathology.

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