ELECTRICAL PACING OF THE AMPULLARY Isthmic Junction FOR CONTRACEPTION

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ABSTRACT
This paper reports the results of a study of the effect of chronic long term stimulation of the AIJ on tubal functions and fertility in rabbits. Preliminary experiments show that a 6 Volt 48 Hz 1 ms pulse stimulation with implanted electrode the tubal diameter and the high activity motility bursts were also fewer after stimulation. Therefore the contraceptive action observed in rabbits could be due to altered ovum transport dynamics. Data suggests a new direction in female contraceptive studies.

INTRODUCTION
Research on fallopian tube indicates that there are some muscle cells which exhibit a phenomenon of 'natural pacing' that controls the normal functions of the tube [1-3]. The pacemaker activity of the tube increases in estrous and alters the mechanical transport. The activity shifts from one site to another during the cycle. However maximum activity remains localised at Ampullary isthmic junction. Therefore it seems logical that an electrical stimulus at the AIJ would alter the overall electrical state and thereby affect the ovum transport [4,5]. The present study aims at exploring the possibility of externally pacing the AIJ for contraception.

MATERIALS AND METHODS
A study was designed to investigate the effects of excitation on the fallopian tube in rabbits. Two electrode pairs need to be implanted onto the fallopian tube of five rabbits weighing between 1.2-1.5 kg used in the present study. Fig. 1 shows the electrodes pairs in situ and the schematic of instrumentation. The excitation electrode pair was located at the AIJ and the second pair at the isthmus was used for the monitoring of its effects on tubal motility using the method already standardized in our laboratory [6]. Lead wires were sutured to the skin outside the body to avoid accidental dislocation. A pair of lead wires from the AIJ were connected to a miniature electronic pulse generator giving 6 V constant amplitude monophasic rectangular pulses of frequency 48 Hz and pulse width 1 millisecond. Prior to stimulation the control motility patterns at the AIJ and isthmus were recorded. The effects of short and long term excitation were then observed (Fig. 2). During short periods of stimulation of around 3 minutes the pulsatile activity in the tube diminished markedly. The average diameter first increased and then remained decreased. If the stimulation was continued for longer time up to 12 hours, the changes in the average diameters appeared to be maintained at about 12 % below 2 mm. The pulsatile component did not remain at the diminished level. But it was seen that there were fewer high activity phases than during the control. These observations lead to the inescapable conclusion that the electrical stimulation over longer period effects the mechanical behaviour of the oviduct particularly at the AIJ. Although it could not be ascertained that effect was due direct stimulation of the nerve or the tubal musculature.
The next issue was to find whether these changes in oviductal mechanical functions as a result or stimulation would lead to any contraceptive effect. It is important that a contraceptive technique require minimal attention by the user. Translating this requirement to the present methodology, continuous stimulation should be preferred. Contraception would have to be achieved irrespective of the time of mating. A study in this direction was thus undertaken.

CONTRACEPTIVE STUDY

In this study it was proposed to investigate if a prolonged stimulation could lead to infertility. Since in the earlier experiment, stimulation 6 V, 48 Hz and 1 ms was found to affect mechanical functions, in the present experimental series also similar stimulation was used. Along with the power hourse the overall size of the stimulator became 50 X 40 X 15 mm. These stimulators were to be carried on the back of female rabbits. As the very presence of such a fairly large size object might possibly lead to variations in the sexual activities, the experiments were planned so as to eliminate the possibility of a bias due to the presence of a stimulator. Twenty five sexually mature female rabbits and ten male rabbits were used for the study. The female rabbits were divided into five groups (Table), each one was kept in an individual cage and had free access to dry pellet diet supplemented by green vegetables and water ad libitum. They were exposed to 12 hours of light and dark cycle.

Table Experimental groups for fertility trials: Numbers indicate the animals used in the study and the rabbits in which pregnancies were observed.

1. Control with no manipulation 5(5)
2. Unilaterally tubectomized 5(5)
3. Unilaterally tubectomized with stimulator at the back 5(5)
4. Unilaterally tubectomized with cuffs and stimulator in position died 1 but power switched off 10(8)
5. Study group as in 4 with power 10(9) switched on

For fertility trials males which were proven fertile and had good sexual drive were used. In all cases mounting was observed and vaginal swabs were also taken to confirm the coitus. One male rabbit was used for mating studies with two to four females. A twenty four hours rest period was given after every mating. Pregnancy in the experimental rabbits was confirmed by actual foetal delivery.

RESULTS AND DISCUSSION

The results from the first set of experiment suggest that stimulation of the AIJ leads to reduction in the transtubal diameter upto 8%. This data means that the tube contracts and remains contracted for long period upto 12 hours even after the withdrawal of stimulation. Short term stimulation resulted into diminished pulsatile motility component but this effect lasted only for a short duration. In comparison with the control animals the high activity phases were markedly reduced. From the above observations it seems that the electrical stimulation does not be ascertained whether this effect was due to nerve stimulation of a generalised stimulation of the musculature. Histology of the tube was carried out both for tissue at the monitoring and the excitation sites. A careful examination of the tissue bordering the fallopian tube just outside the cuff revealed some gaint cells but no marked inflammatory reaction or tissue necrosis was noted. Results suggest that the blood supply to the musculature was not impeded and that the probes did not produce any abnormalities at the monitoring or excitation sites. It is evident that the stimulation leads to reduction in pregnancy rate (p<0.005). This effect is due to change in the motility of AIJ and the consequent impairment of the ovum transport. While many other investigations must precede a full evaluation of the potential as a contraceptive efficacy technically there is no barrier to implant small sized pacemaker by minilaproctomy.

REFERENCES


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