

EXPERIMENTAL BIOLOGY

EFFECT OF AN INTRAUTERINE CONTRACEPTIVE ON THE STATE OF FERTILIZED RAT OOCYTES

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An intrauterine contraceptive introduced into the rat uterine cornu does not disturb fertilization and cleavage of the oocytes during their passage along the oviduct, nor does it change the rate of movement of the oocytes during cleavage. If blastocysts enter the uterine cornu containing a contraceptive, they develop degenerative changes which give rise to their death before the development of decidual changes in the endometrial stroma.

The mechanism of action of intrauterine contraceptives has frequently been studied. However, there is as yet no clear idea of the mechanism of the contraceptive action of these devices. It has been shown [4, 6] that fertilization and normal cleavage of the oocytes during their passage along the oviduct take place in rats fitted with an intrauterine contraceptive, but in such experiments no blastocysts have ever been found in the uterine cavity.

Doyle and Margolis [4] consider that fertilized oocytes are expelled from the uterine cornu in the presence of a contraceptive as the result of increased peristalsis. According to some evidence [5] intrauterine contraceptives induce inflammatory changes in the uterus, leading to death of the oocytes. According to Craig [3], under the influence of a contraceptive the uterus becomes unable to develop a decidual reaction and the fertilized oocytes die because the conditions for implantation are not present.

Fertilization, cleavage, and implantation of rat oocytes were studied in the early periods of pregnancy in the presence of an intrauterine contraceptive.

EXPERIMENTAL METHOD

Sexually mature female Wistar rats weighing 180–200 g were used. The intrauterine contraceptive was a polyethylene tube, 5–7 mm long, one end of which was cut crosswise into four parts and the free edges of the incision were everted to the side. The contraceptive was inserted into the uterine cornu via the genital tract of the rat [2]. The animals mated eight to ten days later. Pregnancy was diagnosed from the presence of spermatozoa in vaginal smears taken from rats in a state of estrus. On the second, third, fourth, fifth, and sixth days after mating the animals were anesthetized with ether and the oviducts and the uterine cornua were removed and rinsed out with physiological saline. Oocytes were found in the washings under a binocular loupe and the state of their development was determined. As the control were used oocytes obtained at the same time from the uterine cornu of rats undergoing all the manipulations associated with introduction of the contraceptive, but without leaving the contraceptive in situ. The uterine cornua for histological investigation were fixed in 10% formalin, and paraffin sections were stained with hematoxylin-eosin and mucicarmine.

EXPERIMENTAL RESULTS

Altogether 47 rats were investigated: seven on the second and third days after mating, 11 on the fourth day, 10 on the fifth day, and 12 on the sixth day.

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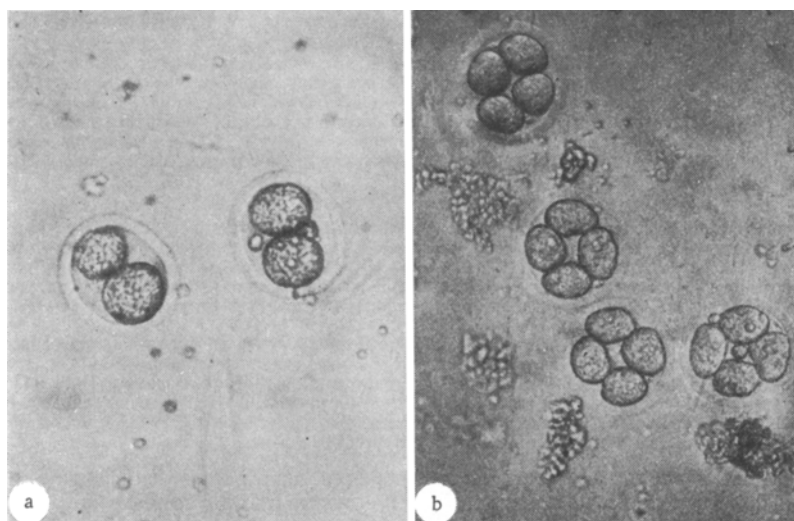


Fig. 1. Fertilized oocytes from oviducts of uterine cornua of rats with an intrauterine contraceptive in situ (45 \times): a) stage of two blastomeres; b) stage of four blastomeres.

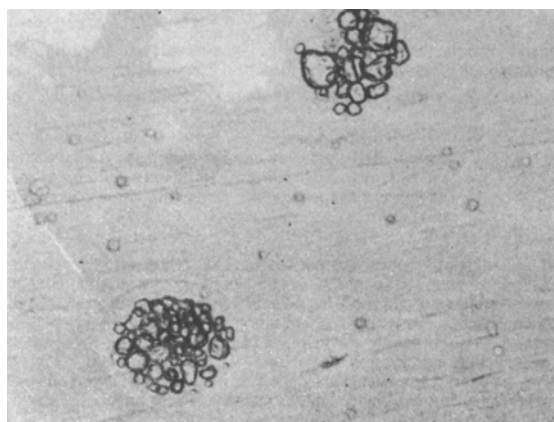


Fig. 2. Development of degenerative changes in blastocysts of rats on entering uterine cornu containing a contraceptive (45 \times).

and 15 oocytes from the oviducts of the control animals. All oocytes from the control and experimental animals were at the morula stage. No oocytes likewise were found in the uterine cornua at this period.

No degenerative changes could be found in any of the fertilized oocytes obtained at the above times from the experimental or control animals (Fig. 1).

On the fifth day oocytes were found in the cavity of the uterine cornu: 17 in the cornu with a contraceptive, 19 in the cornua on the opposite side, and 24 in the cornua of the control animals, all in the morula stage or at the beginning of blastocyst formation. However, degenerative changes were found in the blastocysts from the cornu with the contraceptive: irregular fragmentation of the blastomeres, granular degeneration of the cytoplasm, destruction of the zona pellucida, and final disintegration of the blastocyst (Fig. 2).

On the sixth day after mating no blastocysts were found in the washings from the uterine cornua containing contraceptives, whereas in those from the opposite cornua and the uterine cornua of the control animals, normal oocytes at the blastocyst stage were found.

On the sixth day after mating, the cells of the stroma adjacent to the endometrial epithelium in the uterine cornua without a contraceptive became loose in structure, enlarged in size and with enlarged nuclei,

and pale in color. Cells with high secretory activity appeared in the endometrial epithelium, as shown by the increased content of mucus on staining with mucicarmine. The changes described can be regarded as the initial signs of appearance of decidual transformation of the stromal cells and gravid transformation of the endometrial glands.

At this time the decidual transformation of the stromal cells in the cornu with a contraceptive was much less marked or absent. The secretory changes were ill-defined.

The results of these experiments thus showed that introduction of an intrauterine contraceptive into the uterine cornu of the rat does not disturb fertilization and cleavage of the oocytes during their passage along the oviduct. In both the experimental and control animals oocytes entered the uterine cavity on the fifth day after mating at the morula stage or at the beginning of blastocyst formation. It can be concluded from these findings that the rate of movement of the fertilized oocytes along the oviduct was unchanged. However, degenerative changes terminating in rapid death and lysis of the blastocysts were invariably found in blastocysts discovered in the cavity of the uterine cornu with a contraceptive. Death of the fertilized oocytes was evidently due to several causes and, in particular, to absence of the conditions necessary for implantation or to the harmful action of the contents of the uterine cornu. The experiment showed that blastocysts died in the uterine cavity on the fifth day after mating, i.e., before development of the decidual reaction which normally occurs on the sixth day of pregnancy [1]. This suggests that the cause of death of the blastocysts on their entry into the cavity of the uterine cornu containing the contraceptive was the harmful action of the intrauterine environment.

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