SHORT COMMUNICATION

THE ONSET OF PUBERTY AFTER X-IRRADIATION

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Notwithstanding the possible genetic risk involved, some gynaecologists recommend irradiation of the human ovary for treatment of sterility, claiming that X-rays induce ovulation by a direct stimulation of follicular development (Kaplan, 1948). Experimental evidence supporting these claims is scanty, and is partly based on the report that female rats irradiated shortly after birth undergo precocious puberty associated with an acceleration of follicular development (Mandel & Grisewood, 1934; Mandel, 1935). In Mandel & Grisewood’s study, doses of 540–1240 r. were administered to the dorso-lumbar region on the 7th or 10th day after birth, and the exposure was repeated after an interval of 1 week. The mean ages at the time of vaginal opening were 22 days in irradiated animals (twenty-three animals derived from eleven litters; range not given) and 47 days (range 43–60 days) in litter-mate controls.

In contrast to the above reports, the onset of puberty was not accelerated in either female rats exposed to 100 r. during foetal life (Beaumont, to be published) or animals exposed to 2200–4400 r. between the ages of 18 and 29 days (Mandl & Zuckerman, 1961). In view of the clinical bearing of these observations, a further attempt was made to confirm the findings of Mandel & Grisewood.

Eighteen animals (derived from eight litters) were exposed to 645 r. on both the 7th and 14th days after birth. A further seventeen animals served as unirradiated controls; of these, four received a ‘control’ injection of anaesthetic (tribromoethanol). During exposure the anaesthetized animal was almost completely shielded with lead. The applicator (3 cm. in diameter) was focused over a gap in the shield, approx. 5 mm. wide, carefully placed above the ovarian region. Two animals were shielded less rigorously, only the anterior half of the body being screened. The X-ray apparatus was set at 100 kv and 5 mA. Each exposure of 645 r. lasted 90 sec.

From the age of 18 days onwards, the animals were examined daily for vaginal opening. When this occurred, age and body weight were recorded. Vaginal smears were then taken daily until autopsy. Twenty animals (ten irradiated and ten controls, derived from five litters) were killed at the age of 50 days, when body weight and the weights of the ovaries, uterus, adrenal glands and pituitary were noted.

The results of the present study demonstrate that the onset of puberty is not accelerated following ovarian irradiation during the first 2 weeks after birth (Table 1). They also indicate that the secretory capacity of the ovaries is decreased following irradiation. While the vaginal oestrous changes were comparable in the two groups of

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The subject of that only precocious fact gland is irradiation reflected fied Age degenerating atrophy. rats. animals, Weight Uterine Weight Ovarian

Table 1. Age and body weight at vaginal opening and body and organ weights at autopsy in irradiated and control animals

<table>
<thead>
<tr>
<th></th>
<th>Irradiated animals</th>
<th>Control animals</th>
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<tbody>
<tr>
<td>Age at vaginal opening (days)</td>
<td>18 44·6 (39–49)</td>
<td>17 44·2 (34–51)</td>
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<tr>
<td>Body weight at vaginal opening (g.)</td>
<td>18 101 (72–110)</td>
<td>17 112 (94–125)</td>
</tr>
<tr>
<td>Body weight at autopsy (g.)</td>
<td>10 110 (86–118)</td>
<td>10 127 (118–143)</td>
</tr>
<tr>
<td>Ovarian weight (mg.)</td>
<td>10 20·2 (9·7–30·1)</td>
<td>10 43·8 (35·7–64·0)</td>
</tr>
<tr>
<td>Uterine weight (mg.)</td>
<td>10 97 (51–164)</td>
<td>10 201 (98–476)</td>
</tr>
<tr>
<td>Weight of adrenal glands (mg.)</td>
<td>10 30·3 (22·7–35·0)</td>
<td>10 34·7 (29·8–44·8)</td>
</tr>
<tr>
<td>Weight of pituitary (mg.)</td>
<td>10 7·0 (5·2–8·0)</td>
<td>10 6·1 (5·6–6·6)</td>
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animals, the weight of the uterus was lower in the irradiated than in the control rats. The reduction in secretory function appeared to be correlated with ovarian atrophy. Although a few oocytes at the later stages of follicular growth were identified in most of the irradiated ovaries, the latter also contained numerous cystic and degenerating follicles and cystic corpora lutea. These degenerative changes were reflected by a reduction in ovarian weight. The conclusion that ovarian irradiation is followed by a diminution in the output of oestrogen is supported by the observation that the experimental animals showed slight hypertrophy of the pituitary gland and slight involution of the adrenal gland (cf. Mandl & Zuckerman, 1956).

The present results thus fail to confirm the hypothesis (Mandel, 1935) that X-irradiation ‘stimulates’ ovarian function by causing excessive follicular growth. The fact that precocious vaginal opening was not observed in the two animals in which only the anterior half of the body was shielded during exposure to X-rays suggests that the direct effects of irradiation are insufficient per se to induce early breakdown of the vaginal closure membrane. At the same time, Mandl & Grisewood failed to subject their control animals to the same degree of ‘non-specific stress’ (i.e. anaesthesia) as their experimental animals. Thus the possibility that the induction of precocious puberty was entirely of a ‘non-specific’ nature cannot be eliminated.

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REFERENCES