THE INFLUENCE OF THE SURGICAL TECHNIQUE USED FOR VASECTOMY ON TESTIS FUNCTION IN RATS

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Recent studies have suggested that vasectomy or vasoligation can have deleterious effects on testis structure and function in rats. Sackler, Weltman, Pandhi & Schwartz (1973) found a decrease in the testis weights and total 17-ketosteroid excretion 28 weeks after bilateral vasectomy or vasoligation of immature rats performed without aseptic precautions; the decrease in 17-ketosteroid excretion was observed as early as 15 weeks after the operation. Thakur, Sheth & Rao (1972) reported decreased testis weights, but increased androgenic activity (as judged by prostatic maltase activity) in unilaterally and bilaterally vasoligated adult rats, using a 'semi-sterile' technique. These results are in conflict with earlier studies (Moore & Quick, 1924; Smith, 1962) in which only transient increases of testis weights were found after vasectomy.

It is possible that decreased testicular activity could be the result of the conditions under which the ductus is ligated or removed. To test this, vasectomies were performed under either relatively sterile or non-sterile conditions and the results were compared.

Fifty-one adult male Holtzman- (Sprague-Dawley) strain rats weighing 350 to 400 g were housed under a 14-hr light/10-hr dark schedule at 76°F, and were allowed free access to Purina Rat Chow. In rats subjected to 'sterile' vasectomy, the scrotum and abdomen were shaved, cleaned with soap and water, soaked liberally with 70% ethanol, and draped with sterile towels. All instruments and ligatures were kept in 70% ethanol when not in use, and for at least 30 min before use. After completion of the operation, the area was again cleaned with 70% ethanol, but was not dressed. In the 'non-sterile' technique, the area was shaved and clean instruments were used, but the area was not washed, soaked with ethanol, or draped, and the instruments were not kept in ethanol. With both techniques, either a scrotal or mid-line abdominal incision was used to expose the ductus deferens. Two silk ligatures (Ethicon 0-0) were placed approximately 1 cm apart around the ductus and a cut was made between them.

The primary comparison was between the 'sterile' and 'non-sterile' techniques, but comparisons were also made between the abdominal and scrotal approaches, with either technique. Within the group in which the 'sterile' technique was used, a comparison was also made between ligation and non-

Table 1. Comparison of the effects of 'sterile' and 'non-sterile' vasectomy on testis, prostate and adrenal weights of rats

<i>Vasectomy approach and related procedures</i>	<i>Time of autopsy*</i>	<i>No. of rats</i>	<i>Body wt (g)</i>	<i>Testis wt (g)</i> <i>Left</i> <i>Right</i>		<i>Ventral prostate wt (g)</i>	<i>Wt of adrenal glands (mg)</i>
<i>Control</i> †	15	6	463 ± 18	1.84 ± 0.04	1.83 ± 0.03	0.79 ± 0.04	51.7 ± 3.1
<i>'Sterile' technique</i>							
(1) Bilateral; scrotal; vessels not cut	16	4	524 ± 19	1.94 ± 0.06	1.99 ± 0.05	0.94 ± 0.05	53.5 ± 5.4
(2) Bilateral; scrotal; vessels cut	16	5	491 ± 8	1.87 ± 0.03	1.90 ± 0.05	0.91 ± 0.05	44.0 ± 3.4
(3) Unilateral; ‡ scrotal; vessels not cut	16	5	491 ± 18	1.96 ± 0.06	1.90 ± 0.05	0.81 ± 0.09	—
(4) Unilateral; scrotal; vessels cut	16	5	483 ± 12	1.92 ± 0.09	2.01 ± 0.14	0.76 ± 0.05	47.6 ± 3.5
(5) Unilateral; mid-line; vessels cut	20	6	525 ± 13	1.99 ± 0.03	1.96 ± 0.02	0.88 ± 0.06	40.7 ± 1.5
(6) Sham; mid-line	20	4	536 ± 17	1.98 ± 0.07	2.01 ± 0.09	0.97 ± 0.03	44.8 ± 2.1
<i>'Nonsterile' technique</i>							
(7) Bilateral; scrotal	16	1	548	1.87	1.87	0.74	42.0
(8) Unilateral; scrotal	20	4	487 ± 29	1.69 ± 0.27	1.85 ± 0.04	0.92 ± 0.14	50.3 ± 3.8
(9) Unilateral; mid-line	16	3	483 ± 8	1.48 ± 0.48	1.97 ± 0.15	0.90 ± 0.08	44.0 ± 3.1
(10) Unilateral; mid-line	20	4	439 ± 32	0.43 ± 0.48	1.92 ± 0.09	0.71 ± 0.12	52.8 ± 4.0
(11) Sham; mid-line	20	4	558 ± 16	2.18 ± 0.08	2.15 ± 0.08	1.13 ± 0.06	56.8 ± 5.1

All organ and body weight values are expressed as means ± S.E.M.

* Weeks after operation.

† No operations.

‡ Always on the left side.

ligation of the deferential blood vessels. In several groups, the effect of a given combination of procedures was observed by performing them on the left side only, the right testis serving as a control.

The rats were killed either 16 or 20 weeks after operation. The testes, adrenals, ventral prostate, seminal vesicles and coagulating glands were weighed, and the operation site was inspected for indications of infection or other effects of the surgery. The data were statistically analysed by one-way analysis of variance for unequal replicates, or by Student's *t* test.

In 95% of the 'sterile' and 'non-sterile' vasectomized rats, one or more discrete yellow masses, 0.4 to 3.0 cm in length, were found near the distal end of the ductus deferens. On microscopic examination, they were found to be spermatoceles, containing densely packed degenerated spermatozoa. Spermatoceles have also been described by other investigators, including Smith (1962) and Sackler *et al.* (1973), in association with vasectomy.

Within the 'sterile' group, there were no significant differences from the controls (sham or no operation) in the body, testis, prostate or adrenal weights, regardless of the site of the incision, ligation of blood vessels, or whether the vasectomy was unilateral or bilateral (Table 1). There was also no significant difference between the seminal vesicle or coagulating gland weights of the 'sterile' and 'non-sterile' groups, or within each group. None of the twenty-five vasectomized rats in the 'sterile' group showed any significant evidence of infection. By contrast, five of the eleven rats unilaterally vasectomized by the 'non-sterile' technique (in Groups 8, 9, 10, Table 1) had purulent abscesses in the area of the ligatures and numerous adhesions to the surrounding tissues. The testes on the ligated side in two of these animals were markedly reduced in weight (0.9 g and 0.5 g) and could not be identified in the remaining three. The contralateral testes in these rats were normal in weight and appearance. Four of the five infected rats had been vasectomized by the mid-line abdominal approach.

Analysis of variance indicated that, as far as the testis, ventral prostate and body weights were concerned, the rats in the 'sterile' group were a homogeneous population. This was not true for those in the 'non-sterile' group, probably because of the difference between Group 10 (Table 1) and the others. When the left testis weights in the 'non-sterile' group were compared with left testis weights in the 'sterile' group (by Student's *t* test), the mean of the former was significantly smaller ($P < 0.0005$) than that of the latter.

These results demonstrate that vasectomy performed under relatively sterile surgical conditions had no adverse effect on the testis or the male accessory organs. Vasectomy performed without any precautions to prevent infection, however, caused severe losses in testis weight in some animals. Our data suggest, therefore, that the alterations in testis structure and function described by Sackler *et al.* (1973) and Thakur *et al.* (1972) were primarily related to the complications of the surgical procedure rather than to a specific effect of vasectomy or vasoligation itself. The increased white blood cell counts in their experimental groups (when compared with the control animals) would tend to support this conclusion.

Our findings support those of Plaut (1973); he found little or no change in

testis size or function after vasectomy of rats treated post-surgically with antibiotics. Plaut found, however, that ligation of the deferential blood vessels, with bilateral vasectomy, caused a slight but significant decrease in the left but not in the right testis weight, in comparison with intact controls. He noted that adhesions, when present, were found only on the left side. This again suggests that the alterations observed were not due specifically to the vasectomy.

Sackler *et al.* (1973) used their findings to question the practice of human vasectomy as a means of contraception. Our data indicate that one must be cautious in comparing species, and especially so when the effects of a surgical procedure are involved.

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