DISTRIBUTION OF SPERMATOZOA IN THE OVIDUCT AND FERTILITY IN DOMESTIC BIRDS

VIII. THE EFFECT OF A FOREIGN OBJECT IN THE UTERUS ON SECRETIONS OF THE SPERM-HOST GLANDS AND THE SURVIVAL OF SPERMATOZOA IN THE OVIDUCT OF THE DOMESTIC HEN

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Summary. The effect of a surgical thread placed in the uterus (shell-gland) on the function of the sperm-host glands was investigated. It was confirmed by histological examination that treated birds, whether inseminated before or after surgery, had fewer spermatozoa in the glands than did untreated birds. No effect on the glandular secretions was revealed. These observations are discussed in relation to glandular function and the survival of spermatozoa within the oviduct.

INTRODUCTION

Lake & Gilbert (1964a) noted that fewer spermatozoa were found in the sperm-host glands when a surgical thread was placed in the uterus (shell-gland) of the domestic hen, and, therefore, concluded that survival of the spermatozoa in the oviduct was affected adversely. The mechanism for this action of the thread was unknown, although it was suggested that a neural mechanism was involved in effects on other regions of the oviduct (Gilbert, Lake & Wood-Gush, 1966).

Recently, Gilbert, Reynolds & Lorenz (1968a) showed that the secretory granules of the host glands contained lipid, probably complexes of phospholipid. The present study was undertaken since it was felt that the results observed by Lake & Gilbert (1964a) may have been due to some derangement of secretion of the gland cells caused by the thread in the uterus. If so, it was thought possible that more information might be obtained to help unravel the problems of the entry of spermatozoa into the host glands and the possible relationship between glandular secretions and the survival of spermatozoa.

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MATERIALS AND METHODS

Twelve, laying, Single Comb White Leghorn, adult hens were selected at random from the flock of the Department of Animal Physiology, Davis, and four hens were assigned to each of the following experimental groups: (1) thread placed in the uterus about 2 weeks before artificial insemination; (2) thread placed in the uterus 6 hr after artificial insemination; (3) controls, without surgery.

The thread was placed in the uterus essentially as described by Lake & Gilbert (1964b): the bird was anaesthetized with sodium pentobarbitone intravenously and an incision was made in the abdominal body wall, exposing the uterus. A length of surgical silk thread (size 3/0) was placed through the right wall of the uterus, brought out through the left wall and tied loosely below the ventral surface of the ventral ligament.

Artificial insemination (A.I.) was carried out according to the procedure of Lake (1962), using pooled semen (0.1 ml/hen) from cocks of known semen quality.

Twenty-four hours after insemination, the birds were killed by an overdose of sodium pentobarbitone. The tissue containing the host glands was rapidly excised and divided into two parts. One was embedded in paraffin, sectioned at 5 μ , and stained with haematoxylin and eosin. The other was frozen in a mixture of isopentane and solid CO₂ at -75° C, and frozen sections were cut in a cryostat at -15° C; these were stained with the lipid stains (Oil Red O, Nile blue sulphate, Sudan Black B, benzpyrene and phosphine) and the carbohydrate stains described by Gilbert *et al.* (1968a).

A standard procedure was adopted for evaluation of the number of spermatozoa within the glands similar to that described by Ogasawara, Lorenz & Bobr (1966). Five paraffin sections were taken at random from the total available for a given bird. The number of segments of host-gland, full and empty of spermatozoa, in each section was counted under a microscope. The number of segments containing spermatozoa for each bird was expressed as a percentage of the total segments of gland. This was repeated for all twelve birds. The method is not necessarily a determination of the absolute number of glands containing spermatozoa in each bird but it was felt that the results were comparable between birds.

RESULTS

Histochemically, it was impossible to distinguish between the glands of birds from the different experimental groups. The host glands, whatever the treatment received by the hens, were identical in appearance to those reported on previously (Gilbert *et al.*, 1968a); neither the type of secretion nor the distribution of the stained material within the gland cells was affected.

Nevertheless, the presence of a thread in the uterus markedly affected the number of gland segments containing spermatozoa (Table 1). About 50% of segments contained spermatozoa in control birds, whereas only about 35% contained spermatozoa in birds of each of the other experimental groups.

The Student-test for a comparison between means showed no significant difference between the two 'thread' groups ($P > 0.05$), but the controls differed significantly from both ($P < 0.01$ in each case).

TABLE 1

THE EFFECT OF A SURGICAL THREAD PLACED IN THE UTERUS OF THE DOMESTIC HEN ON THE PERCENTAGE OF SPERM-HOST GLAND SEGMENTS WHICH CONTAIN SPERMATOZOA

Treatment	% of segments with spermatozoa	
	Values for each bird	Mean
Group A (A.I. after surgery)	38, 39, 35, 29	35
Group B (A.I. before surgery)	36, 30, 36, 35	34
Group C (Controls)	45, 53, 45, 58	50

DISCUSSION

The results clearly confirmed the findings of Lake & Gilbert (1964a) that a thread in the uterus leads to a reduction of the number of glands containing spermatozoa. However, no parallel adverse effect on glandular secretions was observed.

The fewer glands with spermatozoa could indicate either that normal numbers of spermatozoa were unable to enter the glands of the treated hens or that, after entry into the glands, the spermatozoa were rapidly reduced in number. There is little evidence as yet to indicate which is the case. Fewer glands were filled with spermatozoa in birds that received surgery after insemination, although it may be presumed that spermatozoa entered the glands of these birds in the normal manner. This may indicate that the thread caused the premature release of spermatozoa from the glands or adversely affected their survival within the glands. On the other hand, the presence of a thread within the uterus also may have affected the number of spermatozoa entering the glands. If so, this could indicate that the secretions are not related to the entry of spermatozoa.

Lake & Gilbert (1962) suggested that a thread in the uterus caused loss of muscle tone and/or hyperactivity in the more distal regions of the oviduct and that a mechanical barrier to the movement of spermatozoa (and thus to entry into the host glands) may exist. A further possibility is that other (undetected) secretions of the gland may be involved. The importance of the secretions of the host glands in relation to glandular function is still obscure.

It is not known how the stimulus of a thread in the uterus leads to a reduction of spermatozoa within the glands. It is unlikely that nervous pathways are solely involved since there is no evidence that the host glands are innervated. However, the vascular supply is extensive and could conceivably be involved (Gilbert, Reynolds & Lorenz, 1968b).

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