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Acute Vesiculitis and Its Prostatic Complications Caused by *E. Coli* in the Rat

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Summary. Injection of solutions of *E. coli* leads to vesiculitis which regresses spontaneously, and to interstitial prostatitis. Castration preceding experimental injection of a bacterial solution modifies the progression of the vesiculitis which then becomes chronic. Infection does not seem to diffuse via the lymphatic system, even after castration.

Key words: Experimental, Vesiculitis, Prostatitis, *E. coli*.

A previous publication [1], demonstrated that the injection of a solution of *E. coli* into the rat epididymis caused a localised abscess. Inflammation spread via the lymphatics to the testis in 16.2% of the cases and caused necrosis. Ascending canalicular diffusion did not occur whereas in human clinical medicine, ascending diffusion has been reported frequently [2, 3].

To test the hypothesis that an absence of canalicular diffusion is related to the epididymis, the same experiments were carried out, using the seminal vesicle as the target organ.

The seminal vesicle was chosen because it has an excretory duct opening into the genital tract.

E. coli seems to be virulant in rats, and because it was the cause of epididymitis in 75% of men over the age of 35 [4], this organism was chosen for the experimental model described.

Material and Methods

The experimental procedure described by Luchetta et al. [1] was employed. Critical study of the experimental model confirmed that neither general anesthesia, surgical manipulations nor injections caused any histological lesions of the epididymis.

General anesthesia of Wistar male rats was achieved with chloroform; the right seminal vesicle was exposed by a supra-pubic incision. A standard volume of 0.2 ml of bacteria was injected into the cavity using a 0.5 mm diametre needle.

The following solutions were injected:

(i) 0.9% NaCl;

(ii) Bacterial culture of 10^6/ml concentration in dilutions of 1/1, 1/10, 1/100, 1/1000;

(iii) Bacteria killed by heat treatment in 1/1 dilutions.

Two rats were sacrificed 1, 2, 3, 4, 7, 10, 15, 30, 45 and 60 days after injection. The entire urogenital system was removed and fixed in Bouin's solution, then four micron sections were made and stained with Haematoxylin and Eosin or Masson's trichrome stain.

The same experimental procedure was carried out with animals which were castrated seven days before the injection; but in this case only 1/1 dilutions were used.

A study of castrated animals showed that atrophy is maximal at seven days, therefore the rats underwent bilateral orchidectomy one week before the experiments were carried out.

Results

Of 102 experimental animals, three died within 48 h after surgery, the deaths were probably anesthetic related.

A) Controls

Controls were injected with NaCl. Neither macroscopic nor microscopic lesions were observed.

B) Injection of E. coli Solution

The extent and progression of lesions were similar regardless of the bacterial concentrations used.

Seminal Vesicle. Macroscopically the seminal vesicle and the vas deferens of the treated side increased in volume by the second day. The seminal vesicle remained turgid two months after treatment. The untreated seminal vesicle, the prostate gland and epididymis, remained normal.

Histologically, the lumen of the treated seminal vesicle was infiltrated by leucocytes between the second and the

seventh day, the cells of epithelium developed vacuoles and sometimes showed signs of necrosis. The number of leucocytes was reduced in the lumen after the 10th day and the epithelium was realigned. The remaining leucocytes accumulated in the duct of the gland where they persisted for two months. Cellular infiltration was not observed in the interstitial tissue of the gland.

Prostate Gland. Oedema was apparent in several of the glands between the fourth and seventh days, then, after ten days, a trail of leucocytes appeared in the interstitial tissues of the gland near the excretory duct of the seminal vesicle.

Tiny abscesses were formed which were observed to destroy the epithelium and to erupt in the lumen of the gland.

These phenomena varied both in intensity and in localisation, and were independent of the dilution used, but consistently reached the prostate gland.

The vas deferens, secretory glands, epididymis and the contralateral seminal vesicle were normal on histological examination.

C) Injection of Killed Bacteria

Lesions only occurred in the epithelium of the treated vesicle 24 h after injection, the epithelial cells were vacuolated, damage was maximal three days after the experiment, leading to the destruction of the epithelium. From the fourth day onwards, the epithelial layer was rearranged and by the seventh day the seminal vesicle returned to normal.

D) Injection of E. Coli in Castrated Rats

Castration alters the evolution of infection; the intensity, extent and the duration of the response were observed to differ following bilateral orchidectomy.

The treated seminal vesicle produced a large abscess which destroyed the epithelium by invasion of both the submucous, and the mucous layers and of the lymphatic system of the adventitia. The abscess persisted for up to two months in various forms. The prostatic gland degenerated after castration and cellular infiltration was visible in the residual fibrous tissue.

Canalicular diffusion was not evident under these experimental conditions.

Discussion

These experiments showed that the seminal vesicle was highly resistant to infection. Leucocytes within the lumen of the gland disappeared gradually after the seventh day. Invasion took place when *E. coli* toxins destroy the epithelial cells, and regression commenced with epithelial regeneration.

There was a relationship between epithelial activity and progression of infection. This observation suggested that the seminal vesicle secreted a substance with antibacterial properties. Lactoferritin and lysozyme are present in human prostatic secretions and are known to have antibacterial action [5].

The progression of infection following castration conformed this hypothesis; there was a reduction in the local defense mechanism, because of reduced epithelial secretion.

The seminal vesicle was more resistant to infection than was the epididymis.

In these experiments the infection progressed via the lymphatic system towards the prostate. Even when experimental vesiculitis resolved prostatitis may continue as a chronic condition. These facts confirm observations carried out in man, that prostatitis is more frequent than is vesiculitis [6].

As in the case of epididymitis, canalicular diffusion was not observed following castration, which tends to prove that diffusion is not under hormonal control.

Conclusion

The seminal vesicle was resistant to infection as long as its secretion was not diminished as in the case of androgenic insufficiency in an experimental situation. Furthermore, this type of infection was generally complicated by interstitial prostatitis, because the infection spread via the lymphatic system. Canalicular diffusion was not observed, even after castration.

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