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Experimental Bacterial Prostatitis in Dogs

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Summary. Bacterial prostatitis was successfully induced in 30 dogs by the injection of E. coli into a branch of a prostatic artery. Inflammation was proven histologically in all cases and by the appearance of E. coli in the prostatic secretion in all but two dogs. In these two dogs cultures from prostatic tissue were positive for E. coli. The pH changes in the prostatic secretion were inconclusive, and the zinc levels increased slightly in the acutely inflamed gland. Antibody coating of the bacteria could not be demonstrated by immunofluorescence.

Key words: Prostatitis - Dogs - Experimental surgery.

Studies concerning the aetiology and therapy of bacterial prostatitis have, in the past, been carried out in dogs and in patients undergoing transurethral resection of the prostate. The dogs used for studies of concentration of various antibacterial substances in prostatic tissue and secretion have had normal prostates whereas most of the patients have had either prostatic hyperplasia or carcinoma (2-4). Since neither method provides reliable information about possible changes in the inflamed gland, we have developed a canine model of bacterial prostatitis, simulating the haematogenous route of infection.

MATERIAL AND METHODS

In 30 dogs the prostate gland was freed from its surrounding fat, the bladder neck occluded with a rubber tourniquet and vasectomy carried out. After stimulation with intravenous pilocarpine (0.3 mg/kg) pure prostatic secretion was obtained via an urethral catheter. One branch of a prostatic artery was punctured with a 25 gauge needle, extended by a plastic tube and a suspension of 10^6 E. coli in 0.5 ml saline was injected. To prevent spread of the inflammation into the periprostatic tissue, the surrounding tissues were rinsed with ampicillin solution before closure.

Bacterial cultures and, in 8 dogs, zinc levels (determined by flame photometry) of the prostatic secretion were obtained before and at various time intervals (1 week to 2 months) after introduction of the infection. The glands were then removed for histological investigation.

Immunofluorescence tests to demonstrate possible antibody coating of E. coli in the prostatic secretion were carried out in 3 dogs with established infections (5).

The pH of the prostatic secretion was measured on a BMS 3 MK 2 blood microsystem.

RESULTS

Following injection of bacteria into the prostatic artery all dogs developed signs of acute prostatitis as determined by repeated rectal palpation.

All except 2 animals had positive cultures of E. coli from their prostatic secretion following induction of the infection, whereas all cultures were negative prior to injection of the organisms. The two dogs with negative prostatic secretion cultures after injection produced a heavy growth of E. coli directly from the cut surface of the prostate and histologically there were the typical findings of an inflammatory process.

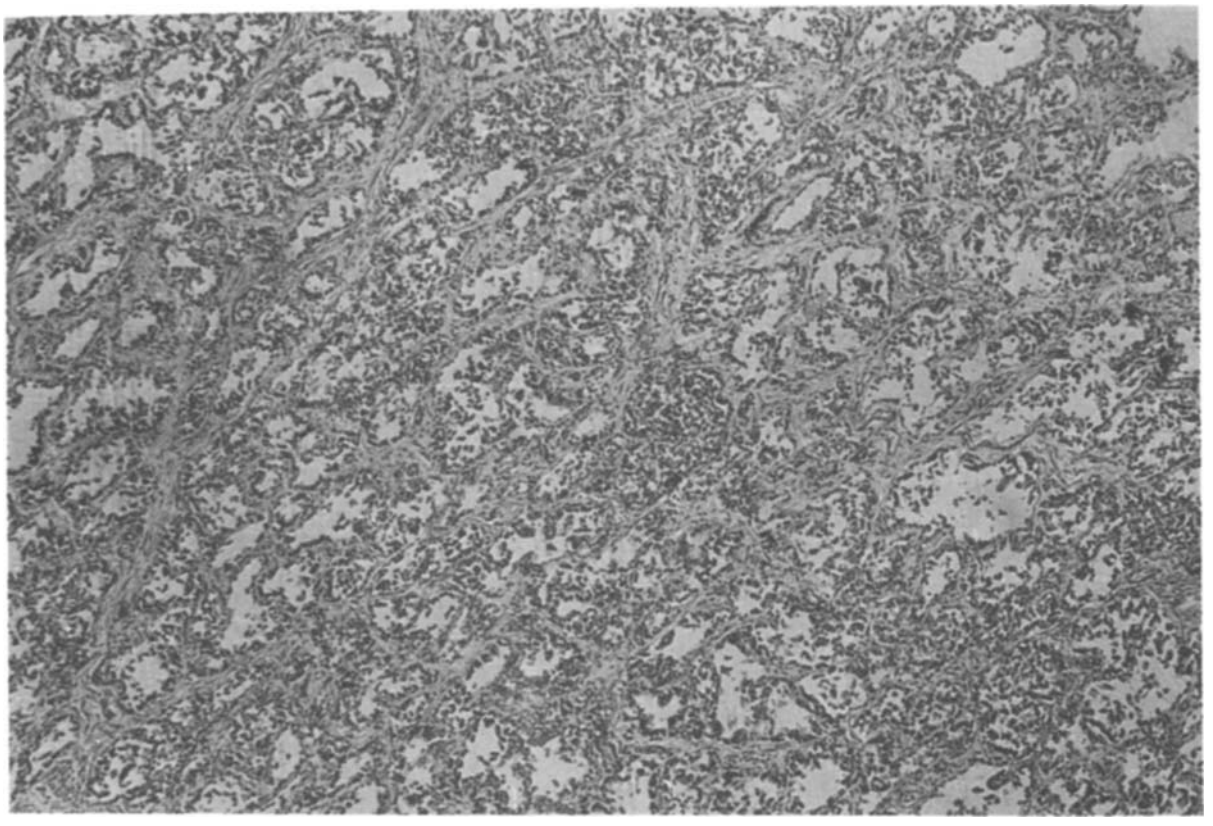

Fig. 1. Acute experimental prostatitis in a dog. Note leucocytes within prostatic acini

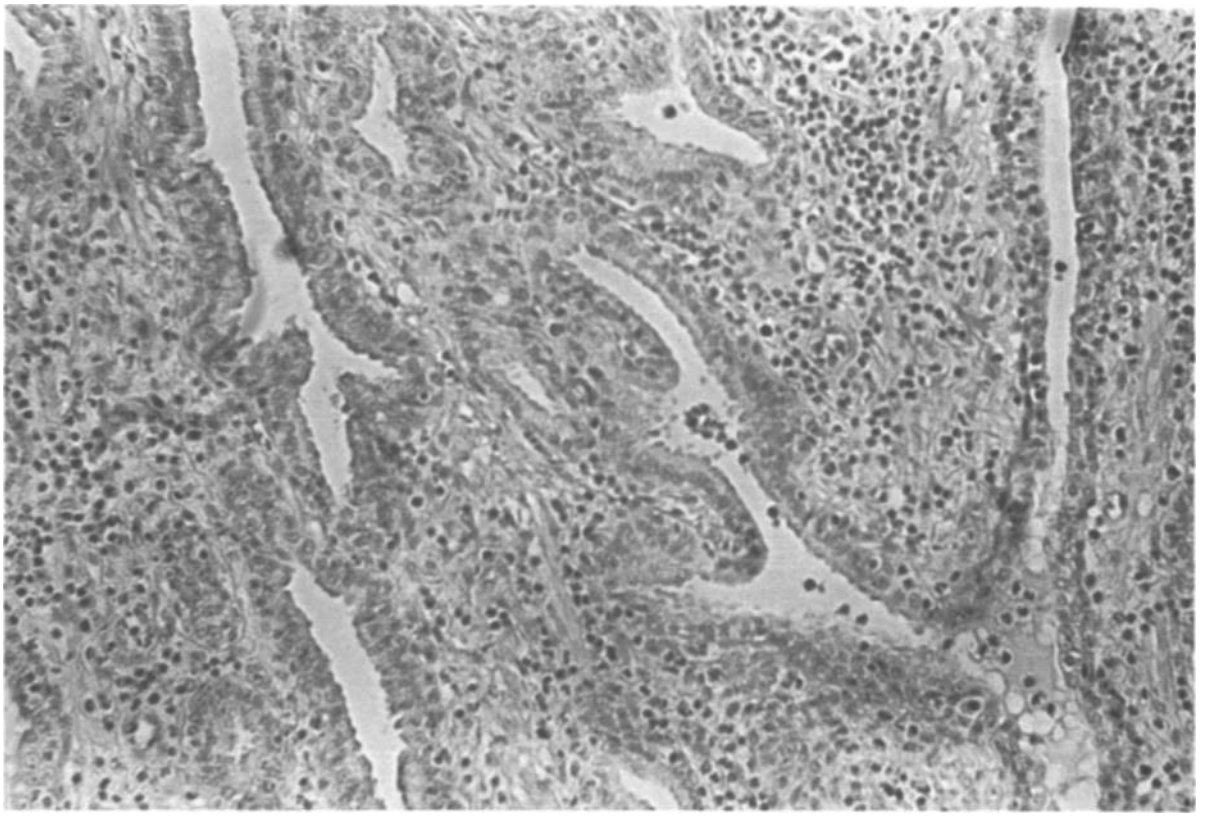

Fig. 2. Chronic experimental prostatitis in a dog. Reaction mainly in connective tissue, while acini are practically free

Table 1. Zinc level in prostatic secretion before and after infection (μg/100 ml)

Dog no.	Zinc concentration	
	Before	After
18	12.5	74.8
21	1.26	42.1
23	90.2	41.1
25	41.4	41.4
26	3.6	40.3
27	14.8	37.8
28	25.6	32.4
29	23.6	13.1
mean ± 1SE	26.6 ± 10.2	40.3 ± 6.5
paired t-test: p	0.3	

Histological examination revealed that in the acute stage the major changes took place in the prostatic acini (Fig. 1). The acini were filled with inflammatory exudate, the cellular picture being dominated by macrophages and some lymphocytes.

In the chronic state (Fig. 2), the inflammatory changes were seen mainly in the interstitial tissue and consisted of only few leucocytes with hypertrophy of the interstitial tissue combined with oedema of the prostatic epithelium.

Attempts to demonstrate antibody coating of bacteria in the prostatic secretion by immunofluorescence failed, although bacteria were observed in the prostatic secretion sediment.

The mean zinc level in the prostatic secretion increased from 26.6 ± 10.2 μg/ml (± 1 SE) to 40.3 ± 6.5, but this increase was not statistically significant (paired t-test $p < 0.3$) (Table 1).

The pH values of the prostatic secretion decreased slightly in the acute phase of the inflammation, but the change was not statistically significant. There were no significant pH changes of the prostatic secretion in the chronic stages.

DISCUSSION

The attempt to create an experimental model of bacterial prostatitis was consistently successful. The phenomenon of sterile prostatic secretion but infected prostatic tissue which was observed in two dogs may resemble the clinical problem of patients with signs and symptoms of prostatitis but no growth from the expressed prostatic secretion.

It is noteworthy that the results of attempts to demonstrate antibody coating of bacteria in the prostatic secretion by immunofluorescence were negative. This suggests that antibodies in the blood do not cross the canine prostatic epithelium. This may explain the persistence of bacteria in the prostate despite an intact defence mechanism.

In recent publications several authors have described an antibacterial factor in prostatic secretion which may prevent bacterial invasion of the prostate gland. This factor was reported by Fair (1) to consist of a zinc-salt. We therefore measured the zinc concentration in the prostatic secretion before and after infection. Surprisingly, rather than a decrease, there was a slight increase in zinc content although this was not statistically significant. The explanation for such an increase in acute bacterial prostatitis may be the release of intracellular zinc into the prostatic ducts as a result of acute necrosis. In later stages scarring may lead to a decrease in zinc concentration.

It is planned to use this model of experimental bacterial prostatitis for an evaluation of the pathophysiology and treatment of bacterial prostatitis, especially the investigation of the secretion of antibacterial agents by the inflamed prostate. This may have clinical application in the selection of drugs for the treatment of acute and chronic bacterial prostatitis.

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