

# The Effect of *E. Coli* and *E. Coli* Endotoxin on Peristalsis in the Canine Ureter

N. W. Struthers

St. Michael's Hospital, and Department of Urology, University of Toronto, Canada

Received: July 1, 1976

---

**Summary.** The association of ureteric dilatation and urinary infection has been attributed to a direct toxic effect of *E. Coli* endotoxin on ureteric muscle. A specific causal relationship could not be established in this study in dogs.

**Key words:** Urinary infection - Ureteric dilatation - *E. coli* endotoxin.

---

The clinical impression that urinary infection may produce dilatation of the ureter, possibly due to a direct toxic effect on the muscle cells (5) received support from the experimental studies of Teague and Boyarsky (3).

This paper reports a further evaluation of the toxic absorption hypothesis in a long term study in four dogs, in which a ureter in each animal was perfused with *E. Coli* and its endotoxin.

## MATERIAL AND METHODS

Four female mongrel dogs. Nos. 4, 8, 9 and 10, weighing 16 to 30 kg were prepared with an explanted renal pelvis permitting access to the ureter (2).

During each perfusion experiment the conscious dog lay in a padded trough and the ureter was catheterized with a polyethylene catheter (Bardic 1817-R). The ureter was perfused through this tube with normal saline at a rate of 0.5 ml/min, using a Harvard pump, and the pressure in the system was recorded with a Statham transducer and Polygraph recorder. The bladder was continuously drained by catheter.

After a stable ureteric tracing had been obtained for 15 min, one of the following solutions was perfused for a minimum period of 20 min.

1. Broth (Soybean-Casein Digest medium, USP.)
2. Haemolytic *E. Coli* overnight broth culture.

3. *E. Coli* Endotoxin (Difco-lipopolysaccharide B.E. *Coli* 0127: B28) 2 mg/ml.

Each perfusion experiment was repeated on three occasions in each dog. After perfusion with haemolytic *E. Coli*, the ureter and bladder were irrigated with neosporin solution.

## RESULTS

None of the twelve broth perfusion experiments produced any change in the pattern of control peristalsis as is shown in the table of results (Table 1). Perfusion with haemolytic *E. Coli* broth (Fig. 1) also failed with the exception of one experiment to affect peristalsis. In the exception, there was an increase in frequency and amplitude of the peristaltic wave. Perfusion of the ureter with 1 mg *E. Coli* endotoxin per minute either failed to affect peristalsis or less commonly produced hyperperistalsis (Fig. 2). Suppression of peristalsis did not occur in any of the experiments.

## DISCUSSION

The failure to inhibit ureteric contractions with either *E. Coli* or *E. Coli* endotoxin is at variance with the results of Teague and Boyarsky (3). These workers noted rapid inhibition of ureteric contraction waves in ap-

Table 1. Results of ureteric perfusion experiments 0 = no effect; + = increase in frequency or amplitude of wave; ++ = increase in frequency and amplitude of wave

Dog	Broth	Broth E. Coli	E. Coli Endotoxin
4	0,0,0	0,0,0	0,+,0
8	0,0,0	0,0,0	++,0,+
9	0,0,0	0,0,0	+,0,0
10	0,0,0	++,0,0	0,+,0

proximately half their experiments in which E. Coli or endotoxin was retrogradely injected into the dog ureter, and considered that the endotoxin had a direct effect on the ureteric muscle. In the present study, in which the ureter was exposed to at least 10 mg of endotoxin, hyperperistalsis occurred in almost half the experiments. Urbaschek and Versteijl (4) also recorded a stimulating effect of endotoxin on uterine smooth muscle. On the other hand Grana, Donnellan and Swenson (1) produced complete absence of peristaltic activity after perfusing the ureter with 4 mg endotoxin over 10 hours, but this inactivity was accompanied

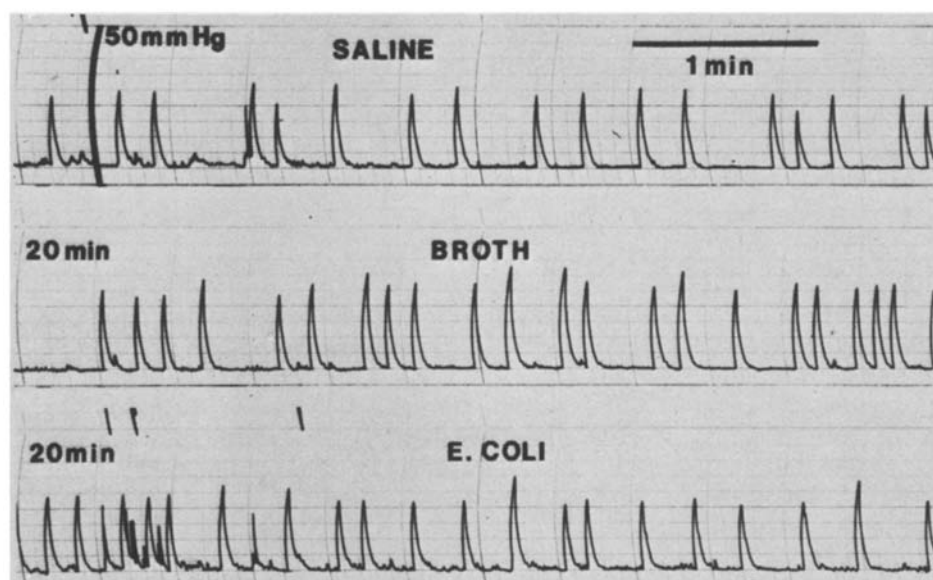


Fig. 1. Ureteric peristalsis unaffected after 20 minutes perfusion with broth and haemolytic E. Coli broth culture

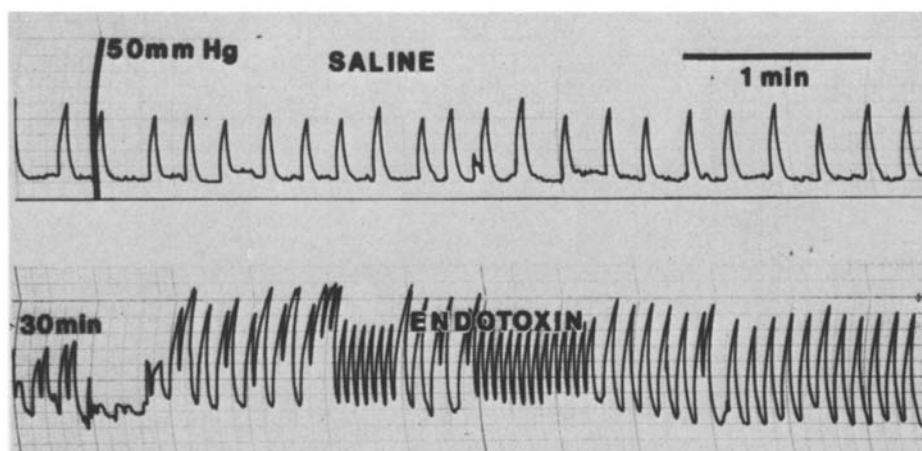


Fig. 2. Hyperperistalsis of the ureter produced by perfusion with 1 mg E. Coli endotoxin per minute

by marked histological changes, suggesting that duration of exposure may be more important than concentration. Clearly further study of the effects of E. Coli endotoxin on the ureter is required before ureteric dilatation associated with infection can be attributed to a direct toxic effect on the ureteric muscle.

Acknowledgement. This study was supported by a grant from the Medical Research Council of Canada (MA-4319).

#### REFERENCES

1. Grana, L., Donnellan, W.L., Swenson, O.: Effects of gram-negative bacteria on ureteral structure and function. *Journal of Urology* 99, 539 (1968)
2. Struthers, N.W.: An experimental model for evaluating drug effects on the ureter. *British Journal of Urology* 45, 23 (1973)
3. Teague, N., Boyarsky, S.: Further effects of coliform bacteria on ureteral peristalsis. *Journal of Urology* 99, 720 (1968)
4. Urbaschek, B., and Versteyl, R.: Increase of the effect of histamine by E. Coli endotoxin on the smooth muscle. *Nature* 207, 763 (1965)
5. Williams, D.I.: The chronically dilated ureter. *Annals of the Royal College of Surgeons* 14, 107 (1954)

N.W. Struthers, M.B.  
St. Michael's Hospital  
Toronto, Canada