

Faecal Stasis and Bacteriuria: Experimental Research in Rats

G. Breda¹, G. P. Bianchi¹, U. Bonomi², I. Piacentini², and G. Farello³

¹ Cattedra di Urologia dell'Università di Padova - Sede di Verona

² Istituti Ospitalieri di Verona - Laboratorio di Microbiologia, Virologia, Immunologia

³ Istituto di Patologia Chirurgica dell'Università di Padova - Sede di Verona, Verona, Italy

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Summary. In view of the paucity of research into the role of coprostasis in urinary infection an investigation was initiated. The experimental model consisted of provoking prolonged faecal stasis in rats. The passage of faecal bacteria in the urine has been demonstrated in a significant percentage.

Key words: Rats, faecal stasis, bacteriuria.

In 1922 Heitz Boyer first realised that intestinal disturbances could be the cause of infection in the urinary tract and proposed the concept of an enterorenal syndrome.

Since then clinical confirmation of this concept has been reported (4, 10, 7, 2, 5). Experimental research in animals (11, 3), tended to demonstrate the passage of bacteria from the gut to the urinary apparatus as a result of lesions of the intestinal mucosa.

Stimulated by the rarity in the literature of experimental evidence defining the role of faecal stasis in the incidence of bacteriuria, we proposed, in the present investigation, to examine the possibility of the passage of bacteria from the intestine to the urinary apparatus under conditions of prolonged faecal stasis.

Materials and Methods

Sprague-Dowley rats weighing 250 g were used. In provoking faecal stasis of long duration, we used 2 different experimental methods. In one group of rats we placed a tampon of cellon¹ 2 cm in length in the rectum, assuring its placement with an intramucosal suture (tobacco pouch suture) on the internal border of the anal edge.

In the second group we sutured the anal orifice with three tobacco pouch sutures in some cases, and with agraffes in other cases. Urine samples were obtained by the following method: ligature of the urethra in the perineum; sacrifice of the animal after 3 hours; puncture of the bladder by laparotomy. The volume of the sample thus obtained varied only from 2 to 4 ml. The colon was extirpated for the faecal cultures and histological study.

Bacteriological examination of the urine was performed by culturing a fixed quantity of two dilutions of urine on plates of agar-milk and of MacConkey. After incubation at 37°C overnight isolations and colony counts were made. Quantitative bacterial counts were made and organisms identified by standard bacteriological techniques (6, 12, 9).

In this series of experiments we used 74 rats subdivided as follows:

I group: simple controls (36 rats); this group served to demonstrate the rate of spontaneous bacteriuria in the rats from our laboratory, and to confirm the sterility of the method of drawing the urine samples.

II group: special controls (10 rats); to five, 2 agraffes were fixed on the anal margin, in another 5 four stitches of linen were applied to the rectal mucosa, without producing occlusion. The purpose was to exclude the possibility that the sutures we used in groups IV and V could be the cause of the bacteriuria. Such rats were sacrificed after 9 days.

III group: Ligature of the inferior mesenteric

¹ Plaster gauze used in Orthopaedics

vein (6 rats): this was proposed to see if a hyper-acute lesion, namely a massive intestinal infarct, could result in the passage of bacteria into the urine. These rats were sacrificed after 6 hrs in a comatose state.

IV group: prolonged faecal stasis was obtained by means of a tampon of cellona in the rectum and intramucosal suture of the anal margin with a tobacco pouch suture of linen (10 rats). After the operation these animals were settled in clean cages and sacrificed on the ninth post-operative day, after having verified the absence of faecal matter in the same cages.

V group: prolonged faecal stasis due to suturing of the anal orifice (12 rats). A perfect seal from the suture was verified as in the preceding group; the rats were sacrificed after 9 days.

Furthermore we wished to define the normal bacteriological flora in the colonic faeces of the 74 rats used (See table 2).

Results

The results are summarized in tables 1 and 2. In the 46 control rats the urine was sterile (100%), as it was in group III (6 rats).

In the animals of groups IV and V, with faecal stasis for 9 days, the urinary cultures were positive in 40 % and 33.3 % respectively. The bacterial counts varied from 250 to 40 000 colonies/ml. The urinary germs were always of the same type as those of the faeces, with a nett prevalence of *Proteus* and *Escherichia*.

Table 1. Incidence of bacteriuria in the groups of rats used for the experiment

	I	II		III	IV	V
Groups of rats	Simple controls	Special controls		Ligature of the inferior mesenteric vein	Tampon of cellona in the rectum and intramucosal suture of the anal margin	Suture of the anal orifice
		Agraffes on the anal margin	Stitches of linen on the rectal mucosa			
Number of rats	36	5	5	6	10	12
Positive urine cultures	0	0	0	0	4 (40 %)	4 (33.3 %)

Table 2. Bacterial strains most frequently found in the colon of rats (74 samples), and their frequency in the urines of groups IV and V

Identified bacteria	<i>Escherichia</i>	<i>Proteus</i>	<i>Pseudomonas</i>	<i>Staphylococci</i>	<i>Streptococci</i>	<i>Klebsiella</i>
Faeces	94.6 %	86.5 %	51.3 %	51.3 %	8.3 %	21.6 %
Urine	50 %	75 %	-	-	25 %	-

The bacteria more commonly verified in the faeces taken from the colons of the 74 rats, are recorded in table 2.

The histological examination of the rectal and colonic mucosa did not demonstrate significant lesions, apart from the presence of sporadic polymorphonucleocyte infiltrates in the chorion that is of dubious significance.

Discussion

The incidence of bacteriuria in rats with coprostasis seems significant, when compared with the controls.

It is generally accepted that a bacteriuria must surpass 100 000 colonies/ml., in order to be significant(8). There are nevertheless authors who attribute importance also to bacterial counts of 1,000/ml. (1). In our case, considering that all 46 controls (simple and specific) were sterile, very low bacterial counts assume significance, as the organisms cultured in the urine were always isolated from the faeces of the same animal.

In conclusion, from the analysis of the results we have obtained, it seems justifiable to affirm that it is possible, under conditions of faecal stasis, for bacteria from the intestine to pass to the urinary apparatus.

It is also interesting to note that, in accordance with daily clinical experience, the bacteria we have most frequently identified in the urine of the rats are of the families *Escherichia* and *Proteus*.

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Dr. G. Breda
Cattedra di Urologia della
Università di Padova
Sede di Verona
Verona
Italy