Among less important factors affecting cure, coccal infections were shown to respond best, those due to *Bact. coli* and *Bact. aerogenes* well, whereas infections due to *Proteus*, *Ps. pyocyanea*, and paracolon bacilli were more resistant to treatment. There was a clear relationship between the *in vitro* sensitivity of the organism and the outcome of treatment, and the use of laboratory sensitivity tests is advocated to avoid the prescription of inappropriate drugs. For most species identification only is no longer sufficient. No clear evidence was obtained that any one of the drugs used most often (sulphatriad, sulphadimidine, sulphathiazole, penicillin, streptomycin, and chlortetracycline) was superior to the others.

We are grateful to our clinical colleagues for permitting us to use the material on which this investigation is based, and particularly to the Medical and Surgical Registrars for their collaboration. Among those who have been involved in heavy additional work we wish particularly to thank Miss E. J. Armour for tracing patients' records, and Mr. R. Andrew, Miss M. Rhodes, and Miss P. M. Waterworth for laboratory assistance.

REFERENCES

- Rhoads, P. S., Billings, C. E., and O'Connor, V. J. (1952). *J. Amer. med. Ass.*, **148**, 165.
 Romansky, M. J., Fusillo, M. H., Caldwell, E., and Robin, E. D. (1951). *Med. Clin. N. Amer.*, **35**, 535.
 Stenderup, A., Kismeyer-Nielsen, F., and Linnet-Jepsen, P. (1952). *Acta med. scand.*, **144**, 124.
 Thomson, E. (1952). *Med. J. Aust.*, **1**, 870.

FAILURE OF SULPHONAMIDES TO PREVENT URINARY INFECTIONS AFTER VAGINAL SURGERY

BY

M. P. DURHAM, M.B., F.R.C.S., M.R.C.O.G.

R. A. SHOOTER, M.D.

AND

M. P. CURWEN, M.A.

(From the Departments of Gynaecology and Obstetrics, Pathology, and Medical Statistics, St. Bartholomew's Hospital, London)

Urinary infections occur frequently in patients undergoing vaginal operations, and sulphonamides are often given for their prevention. As the majority of these infections are due to *Streptococcus faecalis*, an organism resistant to sulphonamides, or to coliform bacilli, many of which nowadays are also resistant, the value of this form of treatment is likely to be limited. This paper is an account of a trial designed to test this conclusion.

Procedure

The trial lasted from February 1, 1953, until January 31, 1954, and was conducted in two wards (A and B). For the first three months patients admitted to ward A for vaginal operations (detailed in Table I for the whole series) were given 1 g. of "sulphatriad" three times a day for the first seven days after operation, patients in ward B receiving no such special treatment. At the end of three months the arrangement was reversed, patients in ward B receiving sulphatriad, while no prophylactic treatment was given to patients in ward A, and this alternation was continued for one year. Administrative reasons precluded a closer method of control, such as the use of alternate patients.

Catheter specimens of urine were collected from patients from both wards in the theatre before operation and again

on the tenth post-operative day, or earlier if indicated by the patient's clinical condition. In all, 117 patients were involved. Of these, 15 were excluded (6 infected before operation, 8 because specimens of urine were not examined, and 1 who was treated with penicillin for a wound infection), leaving in the trial the 102 patients described in Table I.

TABLE I.—Composition of the Series

	Test Group (Sulphonamide Given)	Control Group (No Sulphonamide)
Number of patients	60	42
Mean age	53 years	52 years
Age range	28-76 years	32-73 years
Ward A	33	18
" B	27	24
Diagnosis		
Prolapse with stress incontinence ..	25	20
" without	24	17
Stress incontinence	6	2
Menorrhagia	4	3
Leucoplakia	1	—
Operation		
Colporrhaphy	47	36
Vaginal hysterectomy	10	6
Sling operation	2	—
Vulvectomy	1	—

Post-operative Catheterization

Three different procedures were adopted. Some patients were allowed to pass water unaided, or were catheterized if necessary. Others were left with an indwelling Malecot catheter, which was spigoted, the spigot being removed at approximately three-hourly intervals. The remainder were left with an indwelling catheter which drained into a jar containing 1/1,000 acriflavine. For several patients both methods of indwelling catheterization were used, but except in four instances it has been possible to classify the patients according to the type of catheterization predominantly employed. Table II shows how patients treated by these

TABLE II.—Methods of Catheterization

	Total	Ward A	Ward B	Test Group	Control Group
Indwelling catheter:					
With drain	53	36	17	30	23
" spigot	28	6	22	16	12
No indwelling catheter	17	6	11	11	6
Not classified	4	3	1	3	1

three methods were divided between the two wards and between the test and control groups. On an average indwelling catheters were retained for four days, after which patients were catheterized twice daily for three more days. The patient subject to most manipulation was one who, in addition to five days' drainage by an indwelling catheter, required catheterization 24 times. At the other end of the scale, of the patients left initially to pass water unaided, six never required catheterization.

Results

Table III shows the proportions of test and control patients with urine free from bacteria after operation, set out by wards and according to methods of catheterization. It

TABLE III.—Proportions of Patients Free from Infection after Operation

	Test Group (Sulphonamide Given)	Control Group (No Sulphonamide)
Total	9/60 (15%)	3/42 (7%)
Ward A	2/33	0/18
" B	7/27	3/24
Indwelling catheter		
With drain	2/30	0/23
" spigot	3/16	1/12
No indwelling catheter	4/11	2/6

is clear that the large majority in both groups became infected; no significance can be ascribed to the slightly better results in the test group. From the point of view of post-operative treatment, patients with no indwelling catheter did a little better than those so treated, but it should be pointed out that six of these patients were not catheterized, and of these five were free from infection. Of the remaining 11 who were repeatedly catheterized, only one remained free.

Effect of Prophylactic Sulphonamide on Type of Infection

Table IV shows the organisms found in post-operative specimens of urine from the two groups of patients. It demonstrates that, although sulphonamides may prevent infection

TABLE IV.—Organisms Found in Post-operative Specimens of Urine

	Test Group (Sulphonamide Given)	Control Group (No Sulphonamide)
* Coliform bacilli	6	22
* <i>Str. faecalis</i>	36	12
Coliform bacilli + <i>Str. faecalis</i>	2	2
Other organisms	7	3
Total ..	51	39

* Figures for coliform bacilli and *Str. faecalis* include cases with one of these organisms together with another, such as *Staph. pyogenes*.

with coliform bacilli, it is at the expense of infections due to *Str. faecalis*, as infections with this organism are much more likely to occur in patients given prophylactic sulphonamides. No evidence was obtained that the patient's clinical course was altered. Of the patients given sulphonamides 29% developed a post-operative temperature of 100° F. (37.8° C.) or more; in the control group a similar temperature was recorded for 31%.

Discussion

Tables I and II show that the two groups of patients in this trial are not exactly comparable, the most important variation being in the number of patients in the two wards. This led to differences in post-operative management and possibly in nursing technique, but does not alter the conclusion that urinary infection followed operation with regularity whatever regime was used. In the circumstances described here, prophylactic treatment with sulphonamides has failed to prevent urinary infections after vaginal operations.

No support was obtained for the view that post-operative urinary infections are common in gynaecological patients because patients are frequently infected before operation. Pre-operative infection was found in only 6 out of the 113 patients from whom specimens were obtained. The use of an indwelling catheter for several days, or repeated catheterization, necessitated by mechanical factors, presumably accounts for the high rate of infection.

Summary

A clinical trial is described in which 60 patients undergoing vaginal operations, who were given 1 g. of "sulphatriad" three times a day for the first seven post-operative days, were compared with 42 controls who had no prophylactic treatment.

In both groups the urine of a large majority of the patients became infected.

Str. faecalis infections were relatively more frequent, and coliform bacilli less frequent in the sulphatriad group than in the controls.

Our thanks are due to Mr. John Beattie, Mr. Donald Fraser, and Mr. John Howkins, whose patients were the subject of the investigation, and to the two ward sisters and the nursing staff for their invaluable co-operation.

THE EFFECT OF AN INDWELLING CATHETER ON THE BACTERIOLOGY OF THE MALE URETHRA AND BLADDER

BY

RALPH SHACKMAN, M.B., B.S., F.R.C.S.

AND

DAVID MESSENT, M.B., B.S., F.R.C.S.

From the Department of Surgery, Postgraduate Medical School of London, Hammersmith Hospital

Various bacteria inhabit the normal urethra of the male. Thomson-Walker (1914), quoting Petit and Wasserman (1891), has stated that Löffler's bacillus, *Streptobacillus urethrae*, *Bact. coli*, *Staph. albus*, *Staph. aureus*, and *Staph. citreus* are the most constant organisms, while Harkness (1950) has stated that staphylococci, micrococci, diphtheroids, haemolytic streptococci, *Str. faecalis*, and "Rosenthal's large diplococcus" are the organisms most often found. These bacteria exist without any clinical or microscopical evidence of urethritis, and are presumably saprophytic.

When an indwelling urethral catheter is retained for any length of time a urethritis, less severe when latex rubber catheters are used, almost always results. The urethral organisms are then said to be commonly *Staph. albus* and haemolytic streptococci, and sometimes *Str. faecalis* (Harkness, 1950).

An indwelling catheter also results in the vast majority of cases, and despite administration of sulphonamides and antibiotics, in a cystitis of varying degree. Topley and Wilson (1946) state in general that the commonest bacteria found in cases of cystitis are *Bact. coli*, *Bact. aerogenes*, *Pr. vulgaris*, *Str. faecalis*, *Ps. pyocyanea*, and staphylococci, but the bladder organisms in the specific circumstances when indwelling catheters are retained are not recorded in the literature available to us.

To investigate the nature of the bacterial flora which occurs in the urethra and bladder in the presence of an indwelling catheter, and to determine the relationship, if any, between the organisms coincident at the two sites, we took a series of urethral swabs and catheter specimens of urine for bacteriological examination from 20 patients at daily or two-daily intervals. In 6 of the 20 patients the studies were made before prostatectomy; in the remaining 14 patients the studies were made after prostatectomy. The urethral swabs were taken from the fossa navicularis; the urine specimens were taken simultaneously from the distal end of the catheter.

To supplement the investigation, we also determined, by similar methods, the nature of the bacterial flora of (i) the urethra of 9 urological and 4 non-urological male patients not previously instrumented or catheterized, (ii) the recently instrumented urethra in 11 patients, and (iii) the urine passed either shortly before (midstream) or withdrawn at the time of insertion of an indwelling urethral catheter in 18 patients.

The bacteriological cultures were made on blood agar and MacConkey agar plates, and were incubated aerobically at 37° C. for 24 hours. No anaerobic cultures were made.

Coagulase-positive staphylococci are referred to as *Staph. aureus*, and micrococci and coagulase-negative staphylococci are together referred to as *Staph. albus*.