Treatment of the bladder after suprapubic cystostomy / P.W. Nathan.

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TREATMENT OF THE BLADDER AFTER SUPRAPUBIC CYSTOSTOMY

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DURING the campaign in Italy the two neurosurgical units of the British Army in that country received many cases of traumatic paraplegia or paraparesis. When these cases became numerous, the problems of the treatment of the bladder in which a suprapubic cystostomy had been performed urgently demanded a solution. As there is no generally accepted treatment for the bladder with an indwelling suprapubic catheter, the following investigation was undertaken.

TREATMENT

The treatments investigated fall into three groups: (1) mechanical treatment, (2) sulpha chemotherapy, and (3) combined mechanical and sulpha chemotherapy. A fourth, control, group consisted of patients having no treatment and those having penicillin intramuscularly. The latter category of control was necessary, because many of the patients were receiving at the time penicillin for the wounds involving the meninges, and it seemed possible that this might have had some effect in sterilising the urinary tract.

MECHANICAL

(1) *Tidal drainage.*—The apparatus used was that described by Lawrie and Nathan (1939). It was attached to the suprapubic catheter. This method has the disadvantage that, for a few days after the catheter is changed, there is leaking round the catheter whenever the pressure rises. The irrigating fluid used in all the mechanical methods was either proflavine sulphate 1 in 10,000 in isotonic saline, or neutralised acriflavine 1 in 5000 in isotonic saline; the relative value of these two solutions was not investigated.

(2) *Tidal drainage with acid buffered solution.*—It was thought that, if the urine could be kept sufficiently acid (or sufficiently alkaline), bacteriostasis might be maintained. The strengths of solutions were found which were necessary to maintain the urine at pH 5·2 for three hours and at various values of pH above this. When it soon became obvious that this was an inefficient method of controlling infection, an attempt was made to combine the buffered acid solution with a solution of mandelic acid; but by this time other methods had proved much more successful, so this was abandoned.

(3) *Washouts.*—These were done three times a day with the solutions mentioned. Washing out was continued until the returning solution was free from particles when held up in a glass; the bladders were washed out in short sharp gushes with a bladder syringe. In all these cases, besides the suprapubic catheter, a thin soft very flexible tube was left in the suprapubic stoma; this was inserted before the catheter, so that its end would lie on the floor of the bladder. In washing out, the syringe was connected to the fine rubber tube, so that the fluid rushing out of it would stir up the sediment on the floor of the bladder and would then pour out unimpeded through the relatively large de Pezzer or Malecôt catheter. The solution was used at body temperature. When draining, the catheter was connected by tubing to a bottle attached to the bed at pubic level; this system was sterilised, the neck of the bottle being plugged with cotton-wool.

The washouts were done by R.A.M.C. orderlies. Though this was necessary because of the amount of work falling on the shoulders of doctors and nurses, it was considered that such personnel was typical of the personnel throughout the British and other armies, and was like the nursing staff which these patients would be under for years to come on return to the U.K. The point in the investigation was not to find out an ideal treatment under perfect conditions, but to work out the best and most practical treatment under the conditions reigning in the hospitals abroad and at home.

(4) *Combined washout and tidal drainage.*—The defect of tidal drainage seemed to be that it was too gentle; a sediment always remained at the base of the bladder which was not washed out during siphonage. The apparatus was therefore modified so that it could be combined with washouts by syringe. This was done by syringing through the thin rubber tube mentioned above; the glass connexion of the lead-in tube of the tidal-drainage apparatus was replaced by a glass Y-tube, so that, when the bladder was being washed out, the fluid could flow out of the one arm of the Y, while the other remained in the circuit of the tidal-drainage apparatus, clipped off.

MECHANICAL TREATMENT AND SULPHA CHEMOTHERAPY

(5) *Tidal drainage and sulphanilamide* (2 g. per day): this small dose was tried, as in the intact bladder it is usually sufficient to clear an infection.

(6) *Tidal drainage and sulphadiazine* (6 g. per day).

(7) *Washouts and sulphathiazole* (6 g. per day).

(8) *Washouts and sulphadiazine* (6 g. per day).

SULPHA CHEMOTHERAPY ALONE

(9) *Sulphanilamide* (2 g. per day).

(10) *Sulphathiazole* (6 g. per day).

(11) *Sulphadiazine* (6 g. per day). In many cases, for the first few days after wounding, more than 6 g. of sulphadiazine was given. This was because of the wound involving the spinal cord or meninges, and not because of the bladder.

From the point of view of this investigation it is of no importance, as the results of giving 6 g. or of giving more than this are the same.

(12) *Sulphadiazine* (4 g. per day).

CONTROLS

(13) No treatment.
(14) Penicillin only, by intramuscular injection.

RESULTS

The effect of treatment was judged by (1) the amount of pus ; (2) the presence of constitutional signs of infection which could be attributed to a urinary infection ; and (3) the amount of bacteria.

The amount of pus was considered a better criterion than the amount of bacteria. The indication of the nocuous effects of bacteria on the mucosa is shown by the amount of pus formed. It seems that the presence of *Bact. coli* or of a non-pathogenic staphylococcus is not in itself harmful. It sometimes happened that, though no organisms could be grown from the urine which contained no pus when aspirated from the bladder, the urine taken out of the bottle attached to the bed grew *Bact. coli*. Swabs taken from the inside of the tube attached to the catheter within twelve hours or so of boiling often grew *Bact. coli*, streptococci, staphylococci, and diphtheroids ; and swabs of the suprapubic wounds would grow various organisms. As, then, the environment of the bladder often contained more organisms than the urine from the bladder, it seemed that the number of leucocytes was a better criterion of urinary infection than was the number of bacteria. Also a leucocyte count is more feasible than an attempt to grade the number of bacteria present. The urinary leucocyte counts were performed on a specimen of uncentrifuged urine taken from the suprapubic catheter ; it was performed by counting the number of cells seen in a field under the low power ; twenty fields were counted.

The twelve methods of treatment and the two controls have been placed in three groups—bad, good, and best. The criteria for these groups are :

Best Methods.—The urine was sterile on culture and/or contained no leucocytes. Also included in this group are those cases in which there were less than 10 leucocytes per field.

Good Methods.—In this group were placed those which showed 10–20 leucocytes per field, or in which the pathologist reported " occasional leucocyte."

Bad Methods.—In this group were placed those which showed 20 or more leucocytes per field, or what was reported as " pus plus plus," " moderate pus," or " albumin plus plus." All those showing constitutional signs of urinary infection were placed in this group.

Table I gives the number of cases for each form of treatment which come into each group of results. To

obtain significant results from so few cases, they will be considered in four groups only. Table II shows the results collected into the four treatment groups.

It will be seen that the control group (no treatment and penicillin only) falls entirely into the bad category.

Mechanical methods proved no better than the control methods. In addition to the figures given in the tables, it must be pointed out that only 3 cases of the entire series had fever attributed to urinary infection, and all 3 were in the mechanical treatment group. It may therefore be concluded that mechanical methods of treatment are more harmful than no treatment at all. The tables also show that combining a mechanical method with chemotherapy detracts from the success of the chemotherapy.

Four-fifths of those in the best group were those treated by chemotherapy. When it is remembered that for cases to be placed in this best group the urine had to be sterile or had to contain less than 10 leucocytes per field, it will be realised that we have in the sulpha drugs an efficient means of dealing with urinary infection in the paralysed bladder. Sulphathiazole and sulphadiazine seem to be equally good, 4 g. in twenty-four hours being sufficient.

Further information may be obtained by considering a few of the cases in greater detail. It was found that sulphadiazine always cleared a *Staph. aureus*

TABLE I—SEPARATE RESULTS OF ALL METHODS OF TREATMENT USED

Method of treatment	No. of cases			
	Bad group	Good group	Best group	Total
(1) Tidal drainage	4	0	0	4
(2) Tidal drainage with acid buffered solution	1	0	0	1
(3) Washouts	3	0	1	4
(4) Combined washout with tidal drainage	1	1	0	2
(5) Tidal drainage and sulphanilamide	1	0	0	1
(6) Tidal drainage and sulphadiazine	0	1	1	2
(7) Washouts and sulphathiazole	0	1	0	1
(8) Washouts and sulphadiazine	0	0	2	2
(9) Sulphanilamide 2 g. ..	0	2	0	2
(10) Sulphathiazole 6 g... ..	0	0	2	2
(11) Sulphadiazine 6 g.	1	2	12	15
(12) Sulphadiazine 4 g.	0	0	2	2
(13) No treatment	3	0	0	3
(14) Penicillin intramuscularly..	4	0	0	4
Total	18	7	20	45

infection. A *B. proteus* infection developed in only 1 of the 45 cases, the one treated by tidal drainage with solution buffered at 5·2. While having the bladder irrigated with this acid solution the patient developed fever, which immediately ceased when this form of treatment was stopped.

Patients having what is apparently inadequate treatment do not always suffer from it.

One patient reached the neurosurgical base fifty days after the onset of the paraparesis. For the first month of this time he had had one or two washouts a week with Duke's apparatus, and for the last ten days a washout three times a day with a funnel and tube. His urine showed only 2 leucocytes per field, contained no albumin, and grew *Bact. coli* only.

TABLE II—RESULTS IN GROUPS OF METHODS

Group	No. of cases treated				
	Mechanical	Combined	Chemotherapy	Control	Total
Bad ..	8	2	1	7	18
Good ..	0	3	4	0	7
Best ..	1	3	16	0	20
Total	9	8	21	7	45

Once the bladder is free from infection, there being no leucocytes and the urine being sterile, one cannot cease giving sulphadiazine.

In 4 cases with sterile urine and less than 10 leucocytes per field sulphadiazine was stopped and no treatment was given. In the first case, *Bact. coli* was grown from the urine on the third day ; on the seventh day hæmolytic streptococci were also grown the patient was then given sulphadiazine again ; after a week of this, no leucocytes were found in twenty fields ; culture still grew *Bact. coli* but no hæmolytic streptococci. In the second case a week after sulphadiazine was stopped the urine contained much pus. In the third case four days after sulphadiazine was stopped there was a slight infection. In the fourth case eight days after sulphadiazine was stopped there was a *Bact. coli* infection, with a moderate amount of pus.

Sulphadiazine was given in doses of 6 g. in twenty-four hours ; no patient had this for more than three weeks.

One case raised the question whether this prolonged administration of a large dose damaged the bladder mucosa : while the catheter was being changed after three weeks' sulphadiazine, a semi-organised shred was found, which was shaped like the bladder and microscopically seemed to be thick mucus. The sulphadiazine was reduced to 4 g. in twenty-four hours;

the urine continued to consist of thick glairy mucus, though it contained less than 6 leucocytes per field and grew only *Bact. coli*. No other case having sulphadiazine for three weeks showed any ill effects.

The leucocyte count remained normal, and there were no symptoms or signs of blockage of the renal tubules. Hæmaturia or renal pains have been seen in patients having larger doses of the drug, but were never seen in patients having 6 g. in twenty-four hours. But with this dose of sulphadiazine or sulphathiazole, sulpha crystals were often found in the urine.

Owing to regular evacuations of cases to the United Kingdom, no case was seen for longer than fifty days. Therefore this investigation was of the treatment of the urinary tract in the first few weeks of paraplegia only. In this time it is clear that the best method of treatment of the bladder after suprapubic cystostomy is to give oral sulphadiazine. It remains to work out the length of time for which this drug can be given and the minimal necessary dose. Here, not less than 4 g. in twenty-four hours was tried ; but half this or less may be adequate.

Siegel (1945) has shown that with 2 g. per day, a blood level of 3·2–13·9 mg., with an average of 7·2 mg., per 100 ml. is obtained, and that with 1 g. the blood level is 1·7–8·1 mg., with an average of 3·5 mg., per 100 ml.

Prolonged administration of small doses of sulphadiazine to vast numbers of men has been reported by Coburn (1945). He gave sulphadiazine 1 g. daily to 300,000 U.S. Naval personnel for 3–6 months. With this dose he found no renal complications, a mild dermal reaction in 0·5%, "severe sulphonamide diseases" (exfoliative dermatitis or granulocytopenia) in 1 in 10,000 men. He also found that, with such a dose, sensitisation to the drug was not produced, nor was the development of drug-fast organisms shown ; those cases which, in spite of this prophylactic dose, got an upper respiratory tract infection with hæmolytic streptococci reacted entirely normally to the routine therapeutic dose of the drug.

Coburn showed that this dose (1 g.) of sulphadiazine was an excellent prophylactic against infective respiratory disorders : the number of patients admitted to hospital per month for respiratory disorders was 5–18 in his 300,000 controls, but less than 1 in the 600,000 having daily doses of 0·5 g. or 1 g. This prophylactic effect is relevant to cases of paraplegia, which are liable to succumb to respiratory infections, if they escape death from urinary tract infection.

Lehr (1945) has shown that sulphacetamide is far less toxic than sulphadiazine or sulphathiazole. He never found evidence of renal damage in rats receiving enormous doses of this compound. It has the great advantage that it is highly soluble in acid urine.

The success of oral sulphadiazine in controlling urinary infection in the paralysed bladder raises the question

whether this form of treatment has not rendered obsolete all mechanical forms of treatment, such as tidal drainage and washouts. This applies to all cases where there is an indwelling catheter and to all cases before and after prostatectomy; in these old bronchitic subjects the prophylactic effect of the drug on the respiratory tract is an additional reason for preferring it. It remains also to investigate the newer sulpha drugs, sulphamerazine and sulphamezathine.

SUMMARY

An investigation of various forms of treatment of the bladder after suprapubic cystostomy was undertaken.

With mechanical methods, which included tidal drainage and washouts, the results were worse than in controls having no treatment.

The effects of sulphonamide therapy were excellent. Sulphadiazine and sulphathiazole were more satisfactory than sulphanilamide, and can be given in small doses with safety for six months.

I take this opportunity of thanking Mr. F. J. F. Barrington, who helped me with advice and criticism.

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