

the fact that the bacteriuria is for a longer or shorter time the prominent symptom.

Diagnosis.—If the urine is uniformly hazy, and that haze is cleared neither by chemicals, nor by the centrifuge, nor by standing, and there is no purulent deposit, bacteriuria is present. Bacteriuria may be suspected by the urinary appearance and odour. It can be diagnosed only by the centrifuge (which fails to clear the urine) and the microscope (which shows what little deposit there is to be almost entirely bacterial).

The distinction between pyelo-nephritic and prostatic bacteriuria may not be easy in a given case. Indeed, the two doubtless often coexist. Yet an alkaline bacteriuria is almost invariably prostatic, a bacteriuria following gonorrhoea or due to instrumentation or to stricture is probably prostatic. A bacteriuria occurring during the course of a prostatitis or of a prostatic hypertrophy is doubtless prostatic. Finally, the expressed prostatic secretion (after urethral and vesical irrigation) will be found to contain the incriminated bacteria in great numbers if the bacteriuria is prostatic.

On the other hand, if the bacteriuria is pyelo-nephritic, the urine is acid and contains casts and albumin, and the clinical picture of pyelo-nephritis may be discerned.

Treatment.—Bacteriuria may continue indefinitely if left untreated, but unless of long standing it is usually very amenable to treatment. The treatment is that of pyelo-nephritis or of prostatitis, or, if no underlying lesion can be determined, the treatment is by urotropin and diluents (p. 373). Typhoid bacteriuria, for example, almost always yields readily to this treatment.

CHAPTER XXIV

THE TREATMENT OF URINARY INFECTIONS AND INFLAMMATIONS

So closely connected and so often confused are bacteriuria, cystitis, and pyelo-nephritis, and so many points of treatment do they possess in common, that it is convenient to group here their general therapeutic features, and to refer back to them in the succeeding chapters in such a way as to impress upon the surgeon the necessity of taking a broad view of the whole field. Thus, without losing sight of the particular details proper to each case and to each disease, he may appreciate what might be termed the Principles of Urinary Therapeutics applicable alike to the prevention and the cure of inflammation of the upper urinary tract. The subject may be subdivided into Prophylaxis, Palliative Treatment, and Radical Treatment.

PROPHYLAXIS

Clinically speaking, the prevention of urinary infection presents itself under three aspects:

1. The prevention of spontaneous infection when some disease of the urinary organs (notably prostatic retention) renders them especially liable to become inflamed.
2. The prevention of infection from urethral instruments.
3. The prevention of infection during or after operations upon the urinary organs.

1. **The Prevention of Spontaneous Infection.**—Since spontaneous infection of the urinary organs does not occur unless these organs are made vulnerable by the action of some predisposing cause (p. 359), the ideal preventive is the removal of such a cause. Thus the removal of stone, stricture, or tumour safeguards the bladder and kidneys absolutely. But in many cases, notably in prostatic hypertrophy, such radical treatment may well seem more formidable than the disease itself. Then the patient must be forewarned of the constant danger of infection, and forearmed against it by instructing him in the rules of what we have elsewhere termed Prostatic Hy-

giene. He must model his every movement on the avoidance of congestion and excess by moderation in diet, exercise, and exposure, by regulation of the bowels, by regular catheterization, if necessary, and with it urinary antiseptics. The details of this manner of life have already been considered (p. 275).

2. The Prevention of Catheteral Infection.—If there is one disease to which the term surgical is attached with opprobrium—viz., the surgical kidney—it is because of the gross carelessness shown by many surgeons in urethral instrumentation. Catheterism is such a vulgar operation and the bladder and kidneys resist infection so sturdily, that many a surgeon never learns to be gentle and soon forgets to be clean—for in the urethra cleanliness is next to gentleness—so that when he encounters a bladder or a kidney whose resistance is weakened, he omits the necessary precautions, and if a surgical kidney results from his catheterism it results indeed from his own act. The precautions with which urethral instrumentation should be surrounded—cleanliness before operation, gentleness during it, and antiseptics after it—have been detailed (p. 218). As we have suggested, these precautions may often be disregarded with impunity. If the urinary channels are entirely healthy, the *gentle* introduction of a catheter will do no harm in 99 cases out of 100 even though scant attention be paid to cleanliness. If the anterior urethra is inflamed an indiscreet catheterism will result in prostatitis and epididymitis far oftener than in cystitis. A clumsy or rough manoeuvre will have the same result. But if there is predisposing disease, retention, paralysis, stone, or tumour, the minutest precautions often fail to prevent infection of the bladder and kidneys. In these cases every detail of gentleness, cleanliness, and antiseptics must be observed, not forgetting the so-called urinary antiseptics (p. 372).

3. The Prevention of Operative Infection.—The antiseptic principles governing the surgery of the urinary organs are not quite those of general surgery. The urologist bases his hopes of a clean wound chiefly upon efficient drainage. The general surgeon depends upon absolute cleanliness. Both drainage and cleanliness are essential. Yet of the two *drainage* is the more important. The majority of urinary operations, notably the operations for stricture, prostate, and surgical kidney, are performed almost solely for the purpose of re-establishing or maintaining the urinary right of way, and the constant practice of dealing with organs bathed in a flow of purulent urine tends to beget a certain scorn for a minute asepsis. So many cases do well under the coarsest asepsis that one is tempted to forget that they may do better under an aseptic *régime*. The detail of drainage belongs to each special operation.

Asepsis and antiseptics are of secondary importance to drainage, inasmuch as drainage is the essence of the operation and cannot be dispensed with, whereas in many cases it is possible to neglect a strict asepsis. Yet asepsis and antiseptics are of the first importance in that they are essential to some operations, beneficial in all, and absolutely necessary to the surgeon's instinct. Unless the surgeon is accustomed to keeping his fingers clean in all operations he cannot be depended upon to keep them clean in any. Therefore the usual rules for clean hands, clean instruments, and a clean patient must be observed in urinary operations as much as in any others. But besides the surgical asepsis a urinary antiseptics must be observed. If the urine is befouled, as it so often is, every effort must be made to clear it before operation as far as the nature of the case admits, and even if the urine is not infected it is advantageous to render it antiseptic in order that it may exert a bactericidal effect upon the wound after operation. The urinary antiseptics that may be depended upon to accomplish this are enumerated below. Urotropin is the best of them, since it produces the strongest antiseptic effect upon the urine, and since it seems clinically to prevent post-operative suppression and urinary fever better than any other drug.

Besides this urinary antiseptics by the administration of drugs much good may be done by local antiseptics in the bladder (p. 371).

PALLIATIVE TREATMENT

In the treatment of infection of the urinary tract some measures are employed purely for the purpose of alleviating symptoms. Many others, however, hold an intermediate position, as it were. They are sometimes palliative, sometimes curative. Thus the cure of a bacteriuria may often be accomplished by means that would only alleviate a chronic cystitis. Again, a cystitis behind a hypertrophied prostate may perhaps be effectually cured by urinary antiseptics, yet so long as the prostatic obstruction is not removed the imminent danger of relapse remains, and in course of time the inflammation will doubtless recur, so that the cure is often only a temporary one—a palliation, not an absolute cure.

Thus I prefer to class as palliative measures all forms of treatment that have for their object the reduction of inflammation, even though they may in certain cases effect complete and permanent abolition of the disease. These palliative measures may be classed as—

1. Anodynes, Balsamics, Alkalies.
2. Local Urinary Antiseptics.
3. General Urinary Antiseptics.
4. Diluents.

1. Anodynes, Balsamics, Alkalies.—**Anodynes.**—Whatever pain is associated with renal inflammations is not caused by any concentration or acidity of the urine. But the pain of cystitis is often considerably increased by a concentrated irritating urine, and the pains of urethritis even more so. The anodynes employed, whether by rectum, by mouth, or locally, are discussed elsewhere (p. 114). But of all the drugs employed to relieve these pains anodynes are the least desirable. They exercise no beneficial influence except by giving rest and allaying spasm. In acute conditions it may be necessary to use them, but in chronic conditions they should be studiously avoided, and used if at all only with the constant purpose of dropping them at the earliest possible moment.

Balsamics.—Balsamics are far more useful. They exhibit marked antiseptic and anodyne qualities in inflammations of the urethra and prostate, but they are of little use in inflammations of the urinary organs. Renal inflammations are not modified by them, and vesical inflammations are only influenced inasmuch as the prostate shares in the disease. Hence the cystitis of gonorrhoea or of hypertrophy of the prostate is more influenced by balsamics, as a rule, than any other form of the disease. Their virtues have been discussed (p. 115).

Alkalies.—Alkalies have a more direct bearing upon the urinary organs proper. They render service in the treatment of all forms of cystitis, (1) by overcoming hyperacidity of the urine; (2) by diluting the urine by virtue of their diuretic properties; (3) by a slight antiseptic influence. The advantage of reducing the urinary acidity is notable even in alkaline cystitis, for, unless there is ammoniacal pyelitis as well (which is unusual), the urine when it reaches the bladder is always sufficiently acid to irritate the inflamed mucous membrane with which it comes in contact. Neutralization of this acidity eliminates the irritation without increasing any tendency to ammoniacal inflammation which may exist. Indeed, the feeble antiseptic property of the alkalies helps to diminish the inflammation of any mucous membrane with which they come in contact. The diuretic property of the alkalies is further useful in preventing undue concentration of the urine and in assuring a free urinary outflow. The special properties of the alkalies most frequently used have been considered elsewhere (p. 113).

To sum up: Anodynes, balsamics, and alkalies are useful in the treatment of urethritis, prostatitis, and cystitis. Their purpose is to lessen the disagreeable symptoms of these diseases and to render the urine innocuous. The more chronic the inflammation the less serviceable are these remedies. They may sometimes effect a cure, but are usually relied upon merely as adjuvants to local treatment.

2. Local Urinary Antiseptics.—Topical applications to the urethra and bladder have long been employed in the treatment of inflammations of these organs. Recently lavage of the inflamed kidney pelvis has been advocated. Although enthusiastically supported by certain surgeons it has not yet passed the experimental stage (p. 479). We shall therefore confine our remarks to those antiseptics that have been found useful in the bladder.

Nitrate of Silver.—Of the older applications nitrate of silver is the best, and among the newer ones it stands in the first rank. It is employed by instillation (p. 133) or by irrigation (p. 122). Whatever the method employed, the strength of the solution should be carefully graduated according to the sensitiveness of the patient. Some patients cannot endure nitrate of silver except after a prolonged course of preparatory treatment. The prevailing practice of disregarding the patient's sensitiveness and burning him cruelly with each injection cannot be too strongly condemned. Tubercular cystitis is made worse by nitrate of silver.

Irrigations are chiefly employed for the general cystitis of prostate, stone, or tumour. Instillations are generally more serviceable in posterior urethritis and in acute cystitis. When irrigations are employed the first strength should be between 1:24,000 and 1:16,000. If the patient bears this well, the treatment is repeated daily, or on alternate days, increasing the strength of the solution by about one third each time. This course is followed as long as the urine is rendered clearer and while the symptoms are diminishing. But any evidence of irritation, whether by an increase in the intensity of the symptoms or in the quantity of pus, is a signal that the dose is too strong or too frequently repeated. The next irrigation should be postponed a day and administered in less strength than the last; or it may seem wise to change to another remedy, or to administer an anodyne, and temporarily to desist from all local treatment. Although the tissues grow quite rapidly tolerant of stronger solutions, the action of these solutions cannot but be intense and the tissues require a longer time to react. Thus, solutions of 1:6,000 should not be employed oftener than every other day, nor solutions of 1:3,000 oftener than twice a week. Many patients cannot go higher than 1:4,000, while others take 1:1,000 without serious protest.

Instillations may begin between 1:2,000 and 1:1,200. They are employed every other day or twice a week. Two or three visits are usually required to accustom the urethra to the drug, which may then be run up rapidly to 1% or even 5%, when a maximum effect may be expected.

In acute gonorrhoeal cystitis no local application compares with an

instillation of nitrate of silver (p. 139). In other forms of acute cystitis I have not found it remarkably efficient. In chronic cystitis of any kind it is one of the best of local applications (p. 393).

Protargol.—Of the newer synthetic silver salts protargol seems the most useful. I have employed citrate of silver, argonin, and argentamin, but with unsatisfactory results. Protargol is most useful in the urethra (p. 135); but it may be used in the bladder when nitrate of silver is too irritating. The dose by instillation is from 1% up to 20%, beginning at the low figure; by irrigation from 0.5% to 10%.

Potassium Permanganate.—This drug is to the urethra what the silver salts are to the bladder. In the latter organ potassium permanganate may be employed when nitrate of silver irritates. It is especially useful in acute cystitis when the silver instillation fails. It is employed only by irrigation. I have used it in strengths varying from 1:8,000 to 1:4,000.

Boric Acid.—Boric acid is very mildly aseptic; it has no very specific action upon the bladder, and yet it holds a place in bladder lavage from which it will not be easily dislodged. This is on account of its entire innocuousness. It may be placed in the hands of the patient with the assurance that it will do him a definite good and can do him no harm. As far as I know, it is the only wash that can be entrusted to the stupidest patient with entire safety. The reason of this is that even in saturated solution it is entirely unirritating. The saturated (4%) solution is always employed. About 10 grammes of the crystalline boric acid (pulverized boric acid dissolves less rapidly) is mixed with 200 c. c. of hot water. After stirring for a minute or so the residue is allowed to sink to the bottom and the solution is ready in sufficiently accurate strength for all practical purposes.

The ease with which the boric-acid solution is prepared makes it superior to salicylic-acid solution, Thiersch's solution, or physiological salt solution. I use it for all mechanical irrigating, for the purpose of cleansing the bladder and filling it for cystoscopy, stone-searching, etc. It is also most useful for the daily prophylactic irrigation of prostatics. It will not cure cystitis, but it helps to prevent it.

The numerous local remedies not mentioned above, of which thallin sulphate and mercuriol are the most important, are useful chiefly in inflammations of the urethra and of the prostate (p. 134). Corrosive sublimate is useful only in tubercular cystitis (p. 406). Carbolic acid is not suited to vesical irrigations.

3. General Urinary Antiseptics.—Thus far we have been concerned with remedies whose sphere of influence does not extend

above the bladder. The last two classes with which we shall deal relate chiefly to renal inflammations, though their influence may be marked in inflammation of the bladder as well.

Under the term general urinary antiseptics I mean to include those remedies which when administered by the mouth produce such change in the urine as to render it a germicidal fluid. The number of drugs that exercise this influence in some slight degree is doubtless very great. Several of the alkalies and most of the balsamics already enumerated give the urine some antiseptic properties; but the urinary antiseptics of these drugs is overshadowed by the stronger influence of certain remedies about to be described. The four chief ones are urotropin, salol, benzoic acid, and boric acid.

Urotropin.—Hexamethylenetetramin, the ammonium salt of formaldehyd, is the most valuable drug we possess for combating pyelonephritis and many other urinary diseases. Unfortunately it is sold only under such trade names as urotropin, cystogen, and aminoform. The drug was introduced to the profession by Nicolaier,¹ and it is to him that we owe most of our knowledge of its chemical, physical, and physiological properties. The most notable characteristics of urotropin are:

1. Its action is entirely confined to the urinary organs. (In a few cases I have known it to interfere somewhat with digestion.)
2. Its action upon the urinary organs is due in large part to its splitting up under the influence of the urinary acids, with the result that formaldehyd is liberated in the urine.
3. Its alleged effects are five: antiseptic, irritant, antiphosphatic, antiuric, and diuretic.

Antiseptic Effects.—Urotropin is the best urinary bactericide we possess. Yet it is not infallible. Sometimes it will even fail when other urinary antiseptics will succeed, and it will often fail unless used undestandingly, its merits appreciated, its deficiencies recognized, and its limitations defined.

Urotropin is employed in bacteriuria, in pyelonephritis, in cystitis, and in posterior urethritis. In the treatment of total *bacteriuria* urotropin is invaluable. It prevents and controls almost all cases of typhoid bacilluria (p. 366) and pyelitic coli bacilluria. It may be necessary to employ it to the limit of toleration, even in doses of 3 to 6 grammes a day, in order to control an existing catarrhal pyelonephritis; but once the bacilli have been driven from the urine they may be kept away by smaller doses, which, however, may

¹ Centralbl. f. d. med. Wiss., 1894, xxxii, 897. Zeitschr. f. klin. Med., 1899, xxxviii, 350.