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HEMIPROSTATECTOMY FOR UNILATERAL ADENOMATOUS ENLARGEMENT

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This paper deals exclusively with cases in which obstruction to urination is due to adenomatous enlargement of one lateral lobe of the prostate, while the other remains of normal size. It includes in its survey those numerous cases in which, though no increase of either lateral lobe is appreciable on rectal examination, cystoscopy reveals a middle lobe pushed up behind the urethral outlet by incipient enlargement of one or other lateral lobe. Pure middle-lobe obstructions nearly always belong to the class of unilateral enlargements.

In 1895, at a time when suprapubic operations for enlarged prostate were usually restricted to the removal of the vesical projection, and when consequent failure to relieve obstruction was erroneously attributed to atony of the bladder, Eugene Fuller of New York maintained: "If, however, all the hypertrophies, median, lateral, and round about the prostatic urethra, are removed . . . the results, as far as the bladder is concerned, are, barring mortality, satisfactory." Thomson-Walker in 1930 commented on this statement: "Here for the first time was laid down that the routine operation of prostatectomy must include the hypertrophies along the prostatic urethra . . . in other words, the extravescical or rectal enlargement as well as the intravesical projection."

But to remove "all the hypertrophies" does not in all cases involve a bilateral operation. It may be suggested that routine operations are not always good surgery, and that the infinite variety of pathological conditions should imply a corresponding flexibility and variability in surgical treatment. It has long been known that adenomatous enlargement of the prostate may be unilateral, but hitherto no practical conclusions have been drawn from this fact, and for such cases total prostatectomy has remained the rule. The object of this paper is to show that in unilateral cases Eugene Fuller's demand for the complete removal of all the hypertrophies can be fulfilled by a strictly unilateral operation—a hemiprostatectomy—restricted to the enlarged half of the prostate, and that complete relief of the urinary obstruction follows. *Prima facie* evidence is adduced that the unilateral operation is safer and simpler, and unattended by a serious degree of shock. It should certainly be preferred in all unilateral cases in which the immediate risk of a total enucleation appears greater than usual. Two such cases are here recorded, both operated upon this year and both in medical men. In the first case prostatectomy had been deferred by the patient's reluctance for eight years, with such deterioration of his condition that a well-known specialist recently advised permanent suprapubic drainage of the bladder. A further reason for caution was the dependence of the patient's family upon his Service pension. In the second case the

patient had only partially recovered from a complete hemiplegia of six months' standing.

I have performed hemiprostatectomy about six times. The records of my earlier cases, dating back perhaps fifteen years, are inaccessible owing to war conditions. But the evidence suffices to establish a *prima facie* case, perhaps all the stronger because I make no claims to specialist authority on the prostate. On the other hand, I have no apology to offer for my intrusion upon the urological domain. It is in my opinion essential for the future of surgery that general surgeons shall maintain their right of entry to the common lands which, with such success and advantage, have been fenced and cultivated by the various specialties. I recall with some satisfaction that at a Birmingham meeting of the Association of Surgeons I pointed out that clot retention in the bladder can be relieved by the intravesical injection per urethram of a few ounces of a peptonizing solution, without passing any urethral instrument. Received with scepticism at the time, this suggestion has since had specialist endorsement from Mr. E. W. Riches, who advises injection of 1 oz. of glyc. pepsini undiluted.

I am not prepared to deny that if the patient is a good risk it may be better, even in unilateral enlargement, to do a complete prostatectomy, so as to avert the possibility that the unaffected lobe may in later years undergo hypertrophy. The field of application of the unilateral operation is thus a restricted one, but in my opinion in about one case in five it may prove to be the operation of choice. It is generally admitted that the usual cause of urinary obstruction is the mutual lateral pressure of the two halves of the prostate. Remove the enlarged half and it seems unlikely that serious lateral pressure will recur, even if the remaining half of the prostate at a later date undergoes moderate hypertrophy. My limited clinical experience bears out this conclusion.

Recognition of Unilateral Hypertrophy

Rectal examination in these cases shows that the median prostatic sulcus does not divide the prostatic surface into equal halves. A lateral sweep of the finger-tip, first to the left and then to the right of the sulcus, as far as the prostatic margin, gives a fairly accurate measure of the relative size of the two parts, and enables a provisional diagnosis of unilaterality to be made. A cystoscopic examination shows that the urethra is not median in position with respect to the floor of the bladder. Frequently in unilateral enlargement a post-urethral "median lobe" is present—a protrusion from the enlarged lateral lobe; or an intravesical eminence may border the urethral margin laterally on the side of the enlargement. Final confirmation of unilaterality awaits bimanual examination when the

bladder has been opened. With one finger in the rectum and another in the bladder, and a bladder sound in position, a precise estimate of the relative size of the two lobes is easy.

I must pause here to discuss what is the real nature of the operation known as prostatectomy.

Prostatectomy really an Adenectomy

The late Sir John Thomson-Walker said in the preface to his standard work, *Genito-Urinary Surgery*: "In recent works there is a tendency to slur over the science and to make prominent the art of urinary surgery. With this I am not in sympathy. It is, I believe, impossible to carry out good work on a superficial knowledge of the pathological conditions with which the surgeon has to deal." He goes on: "The pathology given in the following pages is not the pathology of the post-mortem room. It is the living pathology of the operating theatre, and as such is of vital importance to proper treatment."

His book was intended as an aid to clinical work, and his exclusion of post-mortem pathology was no doubt deliberate. But a discord which only post-mortem pathology can solve runs through prostatic literature even to the present day and bears directly upon the subject of this paper. On the one hand, authorities like Freyer and Thomson-Walker maintained or assumed that the operation of prostatectomy consists in the removal of the anatomical prostate with its capsule. Other authorities maintain that prostatectomy is really a prostatic adenectomy—a removal from the prostate of adenomatous masses. The "surgical capsule" of the adenoma, formed by pressure atrophy from the surrounding prostatic substance, remains in the body as the floor of the enucleation cavity. The supporters of the former opinion believe that the plane of separation in which the enucleating finger works lies between the anatomical prostatic capsule and the prostatic sheath of pelvic fascia. Those who support the latter opinion believe that enucleation is done in an intraprostatic plane—namely, the plane around the adenoma and just outside its proper capsule. The residuum of compressed prostate is left *in situ*.

There is no shadow of doubt that in some cases the operation done is the enucleation of an adenoma from the prostate. In Case 1, recorded here, there was enucleated from the left lobe, with complete relief of obstructive symptoms, an adenoma of the shape and size of the scaphoid bone of the carpus, with a median projection upwards into the bladder, a constriction corresponding to the grip of the internal sphincter, and a lower portion lying in the left lobe of the prostate. The tumour presented no feature of normal anatomy, and the prostatic urethra remained intact. Just as a uterine myoma may by a process of pressure atrophy free itself from the grip of the uterine muscle and become subserous or submucous, a prostatic adenoma may by a similar process come to lie just under the mucosa of the bladder or of the prostatic urethra. Its relations with the prostatic urethra may in some cases be so close that it may be impossible to take away the adenoma without also bringing away the adherent portion of the prostatic urethra. Some prostates come away in separate halves. In such cases an adenoma has formed in each lateral lobe, but the tumours have remained separate. Others come away as a single mass recognizable as resulting from the fusion of two adenomata behind the urethra, often with a middle lobe formed by the extension upwards of one of the lateral lobes. In front of the urethra the specimen shows no anterior commissure. The prostatic urethra may or may not be removed as part of the specimen. Yet other prostates come away as a single mass entirely surrounding the prostatic urethra, which is found complete, attached to the specimen, upon which the

anterior commissure is plainly recognizable. Such cases lend apparent support to the view that prostatectomy is the removal of the complete anatomical prostate. A case of this kind was investigated by W. G. Richardson of Newcastle as far back as 1904. Following the death of the patient a microscopical examination showed that the bed from which the tumour had been enucleated was composed of compressed prostatic tissue. Richardson asserts that after enucleation of prostatic tumours "a complete bed is always found composed of prostatic tissue, and the undamaged sheath of the prostate is always external to the bed." These observations of Richardson's are fundamental for prostatic surgery, and it is surprising that they have been ignored in the English literature of the subject up to the present time.

American opinion appears to uphold the view that prostatectomy is adenectomy. Prof. Hugh Cabot of the Mayo Foundation trenchantly says regarding Freyer's claim that his operation removed "the entire prostate with its capsule, the line of separation lying between the capsule and the recto-vesical sheath":

"This remarkable statement is, of course, quite without basis in anatomical fact. The operation which he did, and which was technically similar to that of Fuller, sought to enucleate the masses of fibro-adenomatous hyperplasia from within the prostate. The capsule to which Freyer referred was, of course, not the true capsule of the prostate, but what had for many years, at least in this country, been known as the 'surgical capsule' of the prostate. This consists of compressed prostatic tissue flattened by the growing masses of fibro-adenomatous hyperplasia."

This is exactly what Richardson proved in 1904 by his careful post-mortem work. Prostatectomy is adenectomy.

Analogy between Uterine Myoma and Prostatic Adenoma

Richardson says: "There appears to be an analogy between chronic enlargement of the prostate and myomata of the uterus. Both organs are essential to reproduction . . . during the declining years of fertile life both are specially liable to be affected by innocent growths of their essential tissues." It may be added that the analogy between adenomyoma of the uterus and adenoma of the prostate is especially close. The analogy must not be pressed too far. The uterus masculinus, and not the prostate, is the morphological equivalent of the uterus. Moreover, while total hysterectomy is easy, total removal of the prostate is a doubtful possibility. But the analogy does extend to surgical treatment. Hysterectomy is now often replaced by myomectomy. The replacement in unilateral cases of a bilateral adenectomy (prostatectomy) by a unilateral adenectomy (hemiprostatectomy) would be a parallel conservative development.

Frequency of Unilateral Enlargement

Thomson-Walker says: "Both lobes are usually enlarged to an equal degree, but one may be larger than the other, and, rarely, the enlargement may be confined to one lobe. In all such cases that I have examined the apparently normal lobe shows changes on section and microscopical examination which correspond exactly to those in the large lobe." These remarks seem not quite in accordance with the same author's statistical findings, based upon 54 enucleated prostates, with regard to the character of the intravesical projection (*Genito-Urinary Surgery*, p. 745).

(1) Median lobe alone	9
(2) Median and lateral lobes as a collar or distinct	18
(3) Both lateral lobes	15
(4) One lateral lobe	12
Total	54

From this table it seems possible to form an idea of the percentage of cases in which hemiprostatectomy may be

preferable to the bilateral operation. Cases in Groups 1 and 4 are candidates for the smaller operation, unless there is evidence that the lobe not projecting into the bladder is nevertheless enlarged. For the present no more precise statement upon the question is possible.

Advantages of Unilateral over Bilateral Operation

In the strictly unilateral adenomatous prostate it is meddlesome and unnecessary to remove the normal-sized lobe. To do so adds to the severity and risk of the operation without any compensating advantages except the remote and contingent ones to which I shall later refer.

The retention of the normal half of the prostate has great positive advantages. Along with it there is necessarily left the corresponding half of the prostatic urethra, forming along one side of the enucleation cavity a smooth epithelium-lined gutter guiding the urine from the bladder to the urethra. The continuity of the vesical and urethral mucous membranes—often interrupted in the bilateral operation—is maintained throughout. Nature's reconstruction of the complete tube must thus be assisted and facilitated. The residual half of the organ forms, in fact, a kind of splint or support for the enucleation cavity while it is healing and acquiring a new epithelial lining. The formation of a transverse post-prostatic bar obstructing the outflow of urine is impossible, since the residual half of the prostate holds the urethral outlet open and prevents the transverse fold of mucosa which corresponds to the posterior edge of the prostate from closing over it. The inner edge of the funnel formed by the removal of one lobe is supported and made rigid by the other lateral lobe, and so its patency is maintained.

Absence of Shock in Hemiprostectomy

It is my experience that, except during the actual enucleation, which may cause some temporary disturbance of pulse and respiration, very little shock attends a hemiprostectomy, even in old and feeble patients. I have done the operation but a few times, so that this must be regarded merely as a preliminary communication, but I have not lost a case. In the last case operated upon the pulse at the end of the operation was 84, and within a short time of the patient's return to bed it was 72 and of good volume. The evidence, so far as it goes, points to the greater safety of the limited operation, which has invariably proved fully efficient in restoring easy and painless micturition.

The nerve supply of a prostatic adenoma must be a rudimentary and improvised mechanism, if indeed such a tumour contains nerves at all—a point upon which no evidence appears to be available. On the other hand, the nerve apparatus of the prostatic urethra is a delicate and highly organized affair, having intimate relations with the higher centres of the cord and brain. The shock of prostatectomy is probably mainly due to urethral trauma. Though bilateral prostatectomy is possible in certain cases without injury to the prostatic urethra, as Freyer showed, it frequently involves great interference with, and sometimes complete removal of, this part of the urethra. It seems likely that the shock of prostatectomy is proportionate to the degree of injury to the prostatic urethra.

In hemiprostectomy the urethra may remain quite uninjured. Even if it is so adherent to the adenoma that one lateral half of the prostatic urethra is removed, the degree of shock produced may be estimated as one-half the shock of a total prostatectomy. By safeguarding the integrity of the urethra so far as is possible hemiprostectomy lessens the immediate risk of operation.

The First Hemiprostectomy.—The first one on record appears to have been performed by W. G. Richardson about

1904. In a man suffering from signs of urinary obstruction an acute orchitis occurred. Abscess followed, and the left testicle atrophied. Fifteen months later Richardson "enucleated a large adenoma from the right half of the prostate, but there was only a minute tumour which was not enucleated in the left half" (*The Prostate Gland*, p. 85).

Middle-lobe Obstruction

In some cases though rectal enlargement of the prostate is not felt a middle lobe is seen with the cystoscope. Thomson-Walker showed that in most cases the middle lobe springs from one of the lateral lobes, and is due to incipient enlargement of that lateral lobe finding room by passing upwards in the direction of least resistance through the internal sphincter of the bladder. He also showed that obstruction to the passage of urine in such cases is not as a rule due to a corkage action of the middle lobe but to sideways pressure upon the prostatic urethra. These are in my opinion ideal cases for hemiprostectomy.

Transurethral Resection versus Hemiprostectomy

For such cases mere removal of the middle lobe is known to be unsatisfactory. The treatment of them by the Young punch or by urethral diathermy and removal piecemeal of the middle lobe and parts of one or both lateral lobes has proved safe and successful in the hands of a few experts. Nevertheless I believe that these median-lobe enlargements, belonging as most of them do to the strictly unilateral cases with which this paper is concerned, can be dealt with by unilateral enucleation with at least equal safety and success. What is accomplished by diathermy or transurethral resection is at best a partial removal of the adenomatous mass, the rest of which may continue to grow with a return of obstructive symptoms. In certain cases of this kind a prostatectomy has ultimately to be done, and the enucleation is made more difficult and dangerous by the fibrotic reaction of the tissues to the previous resection. Furthermore, it would seem that a clean enucleation of the enlarged lobe offers more security against later carcinoma.

With careful selection of cases the immediate mortality of transurethral resection is given by Mr. Kenneth Walker, who has done so much to develop the method, as under 5%. The period in hospital is about halved as compared with an enucleation. But, according to Mr. Walker, "there is a growing tendency among resectionists to avoid massive removal of tissue at one sitting, and to substitute when necessary several sessions for one." Thus in the long run the period of stay in hospital may not be reduced. He believes that perurethral resection is particularly indicated where it is the vesical rather than the urethral aspect of the prostate that is affected—for example, cases of obstruction due to an enlarged middle lobe, also for the small fibrous prostate, for carcinoma, and in the various forms of prostatic bar. I would dissent from his opinion only in regard to middle-lobe cases. He also says:

"The key to success in perurethral work lies in the careful selection of cases. It is because the method has been abused by certain enthusiasts that it has sometimes been brought into disrepute and its value lost sight of. It should be realized once for all that the perurethral approach is not a general substitute for prostatectomy; it is rather a method of treatment that is applicable to special types of case or to special circumstances."

Dr. Hugh Young, speaking with what must be a unique experience of all types of prostatic operation, but with a known preference for the perineal route, says:

"We are still convinced that in transurethral surgery by means of our prostatic excisor we have the safest method of attacking conditions for which it was originally offered—namely, contractions, bars, valves, median hypertrophies, valves of the posterior

urethra in children, and other such conditions. . . . We are still convinced that perineal prostatectomy is better in large hypertrophies and has a lower mortality. . . . We believe that with the clean enucleation of lateral, median, and other lobes one has the ability to obtain haemostasis, adequate drainage by an open wound, through which antiseptic treatment may be applied to combat infection, which has been so serious, particularly after transurethral electric resection."

These opinions date from 1936, and in my view are still valid, though most surgeons will prefer the suprapubic to the perineal route. But it should be recorded that Mr. W. M. Wardill of Newcastle, convinced by the results of Gershom Thompson of the Mayo Clinic, who in 1935 published a series of 451 cases in which prostatic obstruction was treated by the cold-punch method without a single death, has adopted the method almost as a routine. The total number of his cases is 230, with a mortality of 10.4%. In his last 100 cases the mortality has fallen to 5%. Of these cases 47 were bad surgical risks, and the mortality was confined to this group. In Mr. Wardill's opinion the safety of the operation excels that of any other treatment available, and it is not contraindicated by the presence of calculi or infected urine.

In spite of the technical improvements of recent years, haemorrhage and clot retention after endoscopic resection remain serious risks. Doyle and Feggetter in 1935 recorded a series of 150 cases done with the McCarthy resectoscope. Of these patients 21 had excessive haemorrhage with or without clot retention, and 6 died. In 156 cases 18 deaths occurred, a mortality of 11%.

Mr. E. W. Riches in 1936 advocated, as a preliminary to endoscopic resection, the injection of percarine and adrenaline into the prostatic substance so as to constrict its vessels and minimize bleeding. A special intra-urethral needle is employed, and low spinal anaesthesia after the method of Hasler. Nevertheless even with this improved technique the risks of reactionary and secondary haemorrhage remain far from negligible, and in 100 cases of endoscopic resection Riches had 6 cases of clot retention and one death.

It will be impossible for some years to pass judgment on the relative place of punch prostatectomy and hemiprostatectomy in the treatment of unilateral cases; but it seems likely that hemiprostatectomy will have a lower mortality, and will offer more security against the recurrence of obstruction. The piecemeal removal of a prostatic tumour through the urethra is a brilliant technical achievement, but is it in accordance with the general surgical principle that simple tumours should be approached by the most direct route and removed completely?

Advantages of Hemiprostatectomy

The probable presence in the normal-sized lateral lobe of early adenomatous changes may be an argument against unilateral operation in a patient who is a good operative risk; but it cannot be held to be decisive in a bad subject. The mere presence of slight adenomatous change in the residual lobe is in itself of little importance once obstruction has been relieved. The remote risks of carcinoma and of later enlargement of the residual lobe are outweighed by the outstanding advantage that the smaller operation is safer, and equally efficient for a prolonged period in relieving obstruction. Two partial operations are at any rate better than one fatal total operation. Moreover, at present this objection is a theoretical one, for in my small experience no such case has occurred. If I remove an adenoma from the breast it is not my custom to remove also the healthy breast because possibly it may later develop a similar tumour. A like rule seems appropriate for the twin halves of the prostate.

Illustrative Cases

Case 1.—A retired naval surgeon aged 72 consulted me in March, 1941, for increasing difficulty in micturition of eight years' duration. In 1933, and on several occasions since, prostatectomy had been advised by experts. Recently a well-known urologist advised permanent suprapubic drainage, and this advice shows how much the patient's general condition had deteriorated. He had lost weight and was anaemic and sallow. His normally cheerful and friendly disposition had entirely altered, and his drawn and anxious expression reflected a highly irritable and pessimistic mental outlook. Dr. C. H. Whittle reported heavy infection of the urine with *Strep. faecalis*. A suprapubic cystotomy showed the left half of the prostate enlarged, while the right half was of normal size. An extension from the enlarged left lobe projected upwards as a middle lobe behind the urethral outlet, lying immediately under the mucosa of the bladder. Ten days later an hour-glass-shaped adenoma, its upper portion forming the middle lobe, was enucleated from the left lateral lobe of the prostate without difficulty after tearing through the mucosa over the middle lobe. It presented no feature of normal anatomy, and was nowhere covered by epithelium. It was of about the size and shape of the scaphoid bone of the wrist, and its removal left the prostatic urethra quite intact, though the residue of the left lobe appeared to be a mere shell around the enucleation cavity. A careful bimanual examination confirmed that the right lobe was of normal size.

The enucleation cavity was packed with vaselined gauze, removed without difficulty in forty-eight hours. Very little shock attended the operation, and the pulse and temperature were only slightly disturbed. Oozing of blood persisted for some days and the urine became thick and ammoniacal, but cleared and became acid under mandelax and bladder irrigation. The patient was in hospital eight weeks, and left with the wound healed, passing urine freely and easily. He had expected to die of septic poisoning after the operation, but upon discharge he was anxious because he was not passing his urine often enough!

A few weeks later he wrote to say he was getting on excellently and had walked five miles. He went on: "As for the waterworks, excellent is again the word, and I feel nothing amiss now, except for an occasional small involuntary dribble; but this is getting much more infrequent. I have gained weight . . . my appetite also is excellent, and I sleep grandly. . . . Everyone here tells me how much better I look."

Case 2.—A doctor aged 70 consulted me in June, 1941, for frequency and difficulty in micturition of some years' standing and for recent haematuria. The urine was brightly coloured with blood, but there was no distension of the bladder. No urethral instrument was passed. On rectal examination the right lobe of the prostate was large, bulging, smooth, and elastic. A well-marked sulcus separated it from the left lobe, which appeared of normal size. The blood urea was 40 mg. per 100 c.cm., and the urine was acid and clear, though *B. coli* was found in it the day after the cystotomy.

The patient in January, 1941, had had an attack of complete hemiplegia, unattended by loss of consciousness, and could still walk only with difficulty and uncertainty. But his urinary discomforts were so great that I advised a cystotomy with a view to later hemiprostatectomy. A course of injections of staphylococcus "vaccoid" was given to minimize the risk of thrombosis. On June 29 I opened the bladder above the pubes, and removed about ten small uric acid calculi. A Mont-Blanc-like eminence occupied the right lateral vesical aspect of the prostate, but the left lobe appeared of normal size on bimanual examination. The bladder could not be entered by a coude catheter. The cystotomy caused little disturbance, and on July 8, under omnopon and evipan given by Dr. C. H. Campbell Ferguson, I did a right unilateral adenectomy. The adenoma was easily enucleated and the shell of the right lobe was packed with vaselined gauze. A large coude catheter, which now passed quite easily, was tied in. At the end of the operation the pulse was 84, and within an hour of his return to bed it was 72 and of good volume. No rise of temperature followed the operation for some days, nor was there any sign of shock. Omission of bladder irrigation on the ninth day was followed by a rigor and pyrexia, but resumption of it brought the temperature down. The patient got up sixteen days after the operation. The bladder wound closed

on July 29, two days after an indwelling catheter was resumed, and on July 30 his pulse was a steady 72 and his temperature normal. The catheter was removed on July 31. Even before its removal fluid injected into the bladder by the catheter returned freely by the urethra outside the catheter. On July 31 a rigor occurred with a temperature of 105° and an acute right orchitis. With

Drawing of right half-prostate of Case 2; natural size, weight 1½ oz.

Dr. G. S. Haynes's concurrence sulphapyridine was given; the temperature fell in forty-eight hours, and subsequent convalescence was uneventful. Urine was passed naturally and easily after August 1, and the patient describes the stream as "better than normal."

The specimen after removal was an almost globular mass 4½ cm. in diameter, and weighing 1½ oz. On section

the mass was a typical adenoma without cysts. On the left aspect was visible, adherent to but separable from it, a smooth elastic band representing the right half of the prostatic urethra. Above, this broadened out to terminate in a torn edge at the urethral outlet of the bladder. Below, it narrowed to a point short of the verumontanum, where the urethra had been half torn across (see Fig.).

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METHODS FOR THE LOCAL APPLICATION OF SULPHANILAMIDE

BY

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Earlier papers have described the antibacterial effects of local applications of the sulphonamides to experimental wounds infected with the organisms of gas gangrene, and the concentrations in the blood and in the tissues around the wound resulting from such local applications (Hawking, 1941a, 1941b, 1941c). During this experimental work various practical methods have been devised, and these are here described in the hope that they may be helpful to those employing local applications of sulphonamide compounds to human lesions. For the sake of conciseness most references to other workers have been omitted. The compounds used have been either sulphanilamide or sulphathiazole.

Powder

In shallow open wounds this is the simplest form in which to apply the substance. It can be distributed by means of a spoon, a pepper-pot, or an insufflator. Whichever method is used, enough powder should be applied to cover the whole surface liberally, and yet not enough to form large concretions, which take a very long time to dissolve. Gently massaging the powder into the tissues with a spatula will help to get it effectively distributed and dissolved. For use in the operating theatre on fresh wounds it is convenient to have a supply of the powder in 5-gramme lots, put up either in paper packets or in screw-capped bottles. In order to obviate the very slight

risk of fortuitous contamination of the powder, during its manufacture or afterwards, by tetanus or other spores of pathogenic bacteria, it can be sterilized in such packets or bottles by dry heat at 150° C. for one hour. (If sterilized in the autoclave with the cap unscrewed the powder is apt to become crystalline and is no longer suitable for use in an insufflator.) For routine ward work the use of unsterilized powder would seem to be justifiable.

Gauze

In narrow deep sinuses which are packed at regular intervals with ribbon gauze the powder can be inserted into the depths on the packing. This can be done most simply by pouring the powder on to the gauze as it is pushed in, but a better way is to incorporate the powder on to the gauze beforehand. For this purpose small glass pots with a metal screw cap, such as are used for ointments, are taken. A wide slot is cut in the lid. The pot and the gauze are sterilized separately. The gauze is then passed through a thick paste of sulphanilamide and water under sterile precautions and is placed in the pot, the end of the ribbon protruding through the slot. The top of the pot is covered with a piece of sterile oiled silk. For use in the wards the ribbon is pulled out as required. If the gauze is autoclaved *after* smearing with the paste most of the sulphanilamide forms powdery crystals, which cease to adhere to the ribbon.

Tablets

It is difficult to transfer powder to the bottom of a deep sinus. The best method in these cases is the use of small tablets made of the compressed compound—e.g., tablets containing about 0.2 gramme of material and measuring about 8 mm. across. Such tablets were first suggested by Dr. A. S. Parkes; they were kindly prepared by the British Drug Houses Ltd. and May and Baker Ltd. The tablets can easily be inserted into the desired position by sinus forceps, and they are then crushed to hasten disintegration; eventually they are completely absorbed and leave no residue which might act as a foreign body. With sulphanilamide, which is fairly soluble, tablets of the pure compound will probably be dissolved in a reasonable time, although it is advantageous to crush them in order to accelerate the process. With sulphathiazole, tablets of the pure compound (uncrushed) were found to persist in a sinus for over two days without much visible change. It is better to use tablets consisting of 0.1 gramme of sulphathiazole and 0.1 gramme of glucose, the glucose being added in order to promote the disintegration of the tablet; when these are crushed after insertion most of the material is dissolved in twenty-four hours. Tablets could also be used in a wound when it was desired to secure a steady supply of sulphonamide over a prolonged period; by choosing tablets of an appropriate size the duration of action could be varied as required. The surface of the tablets can be sterilized by dry heat at 85° C. for one hour; heating to 115° C. causes the tablets which contain glucose to turn brown. This degree of sterilization will not kill spores, but the position is the same as that described for the powder.

Pastes

The results described in this section form the preliminary part of a wider programme, which will be described in more detail when it has been completed. Briefly, the ideal sulphanilamide paste for application to wounds, burns, etc., should have the following properties:

1. It should be satisfactory pharmaceutically—i.e., stable, non-odorous, non-rancid, etc.
2. Its physical consistency should be suitable for the required purpose; burnt surfaces might require a thinner preparation than that used for plugging wounds.