II

TREATMENT OF GONOCOCCAL INFECTION BY DIATHERMY

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BEFORE describing the results which we have obtained in the treatment of gonococcal infection in female patients, an account will be given of our methods of applying diathermy to male patients who are the subject of the same disease.

It is now our custom to subject the prostate and seminal vesicles to diathermy in all cases. If there is metastatic arthritis, we have found that the application of diathermy to the prostate and seminal vesicles is sufficient; it is not necessary to apply it to the joints. If the testis, epididymis, and vas are affected, these parts are included in the diathermy at the same time as the prostate and vesicles. The contents of the scrotum are included, because pain is more quickly relieved. It is, however, not essential to include them in the diathermy; we have found that the symptoms will subside even if the diathermy is confined to the prostate and vesicles. If the infection is confined to the anterior urethra, one of the electrodes is placed in the rectum for reasons of technique; as a consequence the prostate and vesicles are included in the diathermy. This will serve a useful purpose if it is uncertain whether infection has proceeded beyond the anterior urethra.

Method of applying Diathermy to the Prostate and Vesicles.—The method which we have devised is the following: Two electrodes are used; one is the *active* electrode, and the other is the *directing* electrode. The active electrode consists of a hollow metal case, 8 inches long, oval in cross-section, and $\frac{1}{2}$ inch wide in its maximum diameter. One end is rounded and closed; the other carries a terminal for attachment to the cable from the diathermy machine. In its interior is a tube for insertion of a thermometer. The directing electrode is a belt of

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thin sheet lead like that used when the urethra and cervix of the female are treated. The active electrode is passed for 4 inches into the rectum. The patient lies on his back on a couch, with his head and shoulders supported. The outer end of the electrode is depressed on to the couch by means of a sandbag. The directing electrode is made to encircle the pelvis or waist. If it is in the latter position, it is probable that the current will pass through all parts of the vesicles in addition to the major portion of the prostate. If in the former position, it is likely that the current will pass through all parts of the prostate and through the proximal parts of the vesicles. In either position, however, it is likely that all parts of the prostate and vesicles will be heated together with the tissues in the vicinity of the active electrode. The parts not traversed by the current will be heated to some degree by convection. The current is started and gradually increased. The patient soon becomes aware of the sensation of heat within the rectum. The heat increases, and when the current reaches a certain strength the patient begins to feel pain. The current is then reduced until pain just disappears. The current is allowed to flow for twenty minutes, and is then reduced to zero. The treatment is repeated twice weekly.

With an electrode of the dimensions just given, a thermometer placed within the electrode will indicate a temperature of 110° F. With a smaller electrode, for instance, with one circular in section with a diameter of $\frac{7}{16}$ inch, a temperature of 114° F. may be recorded.

Method of applying Diathermy to the Testis, Epididymis, and Vas Deferens.—Two electrodes are required; both are *active*. One is applied to the scrotum so as to enclose the affected testis and epididymis. If the scrotum is insufficiently lax, it is enclosed in its entirety. Strips of lint, soaked in salt solution, are applied to the scrotum and covered with thin sheet lead cut to a shape that will allow it to be applied to the lint and make a complete covering with uniform pressure. The circuit is completed by means of the rectal electrode described above. The current is started and gradually increased until the heat is the maximum that the patient can bear without pain. The treatment should last twenty minutes and be repeated twice weekly. It is seldom necessary to give more than three applications to the scrotum.

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Results of Treatment of Gonococcal Infection by Diathermy.

—(1) *Arthritis*. By the end of 1923 we had treated thirty-nine cases. In all save two, in which the treatment could not be completed, the following results were obtained: Pain and tenderness were abolished, swelling was reduced, and the range of movement was increased. Cases of short duration, in which permanent organic changes had not taken place in the joints, lost all signs and symptoms, and it is justifiable to say that a cure was effected. In the cases of long duration, in which permanent structural changes had taken place, such as destruction of cartilage and thickening of the synovial membrane and capsule, there remained some physical signs of abnormality, but the pain and tenderness were abolished and the disability was reduced. In these cases the disease was *arrested*, and the patients were then able to undergo treatment by additional physical measures, such as massage, movements, and the sinusoidal and galvanic currents. This treatment caused no return of symptoms, and additional usefulness of the joints was procured. In one case a stiff joint was forcibly moved under general anæsthesia without a subsequent return of the original symptoms. In all the cases which were kept under observation no return of arthritis was discovered. Results no less satisfactory have been obtained in the cases which we have treated during 1924. The late Sir William Osler, writing on gonococcal arthritis, stated that "in many respects this is the most disastrous, disabling, and serious of all the complications of gonorrhœa." Speaking from our experience in the treatment of this complication, we are justified in saying that the application of diathermy to the foci from which the infection is disseminated will cure or arrest gonococcal arthritis.

The following are the particulars of one of the cases :—

A woman, aged forty-one, came for treatment of an acutely inflamed wrist joint. The extensor tendon sheaths were affected and there was an extremely painful, tender, and tense swelling on the extensor aspect of the wrist. The slightest movement of the fingers or wrist gave rise to severe pain. The hand and forearm were fixed on a splint. Rest at night was rendered impossible, although sedatives were administered. Gonococci were found in large numbers in the discharge from the cervix.

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Diathermy was applied to the urethra and cervix. She slept well the same night. When she came for her next treatment three days afterwards, the swelling was found to be less tense, and slight voluntary movements of the fingers were possible without pain. After six treatments given during a period of three weeks the splint was removed, and massage and movements of the joints of the hand and wrist were commenced. This treatment was applied on four occasions during two weeks. At the expiration of this time (*i.e.*, five weeks from the commencement of the diathermy) the patient was able to resume work as a scrubber. The final result was complete restoration of the function of the joint.

(2) *Epididymitis*. The results obtained in the treatment of gonorrhœal epididymitis are striking.

In epididymitis which is recent in origin, that is to say, which is acute or subacute, a rapid subsidence of the inflammation is obtained by applying the current to the prostate and vesicles in the manner already described. Three treatments during a period of ten days are sufficient to procure disappearance of pain and tenderness and all swelling, except a small painless nodule sometimes remaining in the lower extremity of the epididymis. Further diathermy applications have no effect on this remaining nodule.

Relief of pain may be obtained more rapidly by applying the current directly to the inflamed organ, some relief occurring during the first treatment.

Cases of chronic gonorrhœal inflammation of the epididymis with thickening of the vas require three or four weeks' treatment. At the end of this time the thickening of the vas disappears, there is no pain or tenderness, and no swelling except the nodule at the lower extremity of the epididymis.

(3) *Urethritis in the Female and Endocervicitis*. Twenty patients suffering from urethritis or endocervicitis, or both, in whom there was no metastatic infection (save in one), received treatment by diathermy. Gonococci were discovered in the urethra or cervix, or in both parts, before the treatment. After the diathermy, the organisms were not discovered in eighteen cases; in two they persisted in spite of treatment. In one of the two unsuccessful cases the treatment was at first effective; after four applications gonococci were not discovered

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One, two and three months later they were not discovered. Three months later a fourth examination was made, and gonococci were found. This patient's husband had had gonorrhœa three times before marriage, so that re-infection of the wife may be regarded as probable. The other case was one in which metastatic arthritis was present. The application of diathermy to the urethra and cervix was followed by complete functional restoration of the joints and a termination of the arthritis, but gonococci were discovered in the parts primarily infected, although treatment was continued over a long period. It was not discovered whether this patient's husband had gonorrhœa.

In the eighteen cases in which gonococci were not discovered after diathermy, the length of the course of treatment varied. Some required not more than three applications. Two cases required six, and one required nine. Three required more than nine. Two of those which needed more than nine were certainly cases of reinfection; diathermy was successful after the patients were separated from their husbands. The other case in which prolonged treatment was necessary was that of the first patient treated by diathermy for infection of the cervix and urethra; the technique was in process of evolution, and insufficient current was at first applied. When the current was increased the treatment was successful.

In many of the patients above mentioned the discharge from the cervix disappeared and the part regained its normal appearance. In four a purulent discharge remained, although gonococci were not found in it. These cases were subjected to ionisation with copper. This treatment caused the disappearance of the discharge in three cases, and its reduction in the fourth.

In private patients we have not found it necessary to give more than five applications of diathermy, and we believe that a maximum number of five is sufficient if re-infection does not occur. Two private patients married after completion of a course of diathermy. One was seen three years afterwards. She stated that there had been no transfer of infection to her husband. The other wrote ten months after her marriage and said that all was well, and that she had lost all discharge.

It cannot be said that the failure to find gonococci is

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proof that they no longer exist in tissues which have been infected ; but cure may be justly claimed if to the failure to find them are added the facts that discharge has ceased, the normal appearance of the parts has returned, and metastasis, if previously present, has disappeared.

All the cases which we have treated by diathermy had been previously subjected to other forms of treatment, which had failed to rid the discharge of gonococci.

We claim that diathermy treatment does, in fact, procure successful therapeutic results when other methods fail.

(4) *Salpingitis*. The application of diathermy to the urethra and cervix in cases in which salpingitis is present is followed by results no less satisfactory than those obtained when the joints are affected. Pain begins to subside after the first application. The treatment is repeated twice weekly, and usually after the fourth application there is no tenderness and the swelling is slight or impalpable.

In some cases we found that the heating of the cervix was followed by pain in the lower part of the abdomen. In some it persisted for more than a day or even a week, and was severe. When this occurs, we cease the treatment of the cervix by the method previously described and apply the diathermy by a special vaginal electrode, so as to secure a gentle heating of the pelvic organs. After four such applications the cervix may sometimes be treated without producing pain, and result in subsidence of the salpingitis. It is obvious, however, that in a certain proportion of cases removal of the tube will be necessary.

Among our cases, one which was recently treated was that of a patient who had a copious vaginal discharge and a painful tender swelling in the region of the left Fallopian tube. Her temperature was 103° F. Diathermy was applied to the cervix uteri on three occasions during ten days. At the end of this time there was no pain, tenderness or swelling, the temperature had sunk to normal, and the discharge had disappeared.

(5) *Prostatitis and Vesiculitis*. Our experience in the treatment of gonococcal prostatitis and vesiculitis without arthritis or epididymitis is small. Negative evidence is all that can be furnished in support of any claim regarding the therapeutic value of diathermy in the treatment of gonococcal infection of the prostate and

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vesicles in cases in which these parts alone are infected. Negative evidence is only of value if it can be obtained in a large number of cases.

That diathermy undoubtedly possesses therapeutic value in the treatment of gonococcal infection of the prostate and vesicles is shown by the disappearance of metastasis in the joints and epididymis. We have had many cases in which the application of diathermy to the last-mentioned parts caused cure or arrest of arthritis and disappearance of pain and swelling from the epididymis. These results are invariable.

Further evidence of the therapeutic action of diathermy is furnished by the disappearance of gonococci and cessation of the discharge when present before diathermy was commenced. In some of the cases of arthritis a discharge containing gonococci was present before diathermy was commenced. Except in a few instances, after the course of treatments, the secretion obtained by prostatic massage contained no gonococci.

It may be mentioned that in some of our cases of epididymitis the pain and swelling of the scrotum occurred after massage of the prostate. We have not noted the development of this complication after massage of the prostate when the gland had been subjected to a course of diathermy.

The following four cases illustrate the action of diathermy on the prostate, as well as the parts secondarily affected. In three there was arthritis in addition to prostatitis, and in one there was epididymitis:—

Case 1.—(H. H.) The joints affected were the knees and feet. There had been urethral discharge for two months. Diathermy was applied to the prostate and urethra only. The patient had six treatments during seventeen days. The inflammation of the feet and knees disappeared. At the end of the course of treatment there was no discharge. Fourteen days later he was sent to the Special Treatment Centre for examination, but no discharge could be obtained. Seven days later another examination was made. Some discharge was obtained by prostatic massage. It was found to contain mucus, some pus cells, but no gonococci or other organisms.

Case 2.—(C. R.) This was a case of arthritis in which the application of diathermy to the joints alone had been unsuccessful. The patient then had ten treatments

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during five weeks to the prostate and vesicles. At the end of this time the arthritis had disappeared. After the fourth treatment the discharge was reduced to a small amount, and noticed only in the morning. After the tenth there was no discharge. The material obtained by prostatic massage contained mucus, some pus cells, and degenerated epithelial cells. No gonococci were found.

Case 3.—(J. S.) This patient had arthritis of knee and ankle, and a copious white discharge from the urethra. He had nine treatments during four weeks. He was then examined, and no gonococci were found. A week later no discharge could be obtained. A fortnight later the prostate was again massaged, but no discharge could be obtained. The pain in the joints had disappeared. Eight weeks later the patient was still free from pain and discharge.

Case 4.—(M. N.) This was a case of epididymitis accompanied by discharge from the urethra. Diathermy was applied to the prostate and penis. The pain and swelling disappeared after the second application, and after the fourth there was no discharge. The prostate was afterwards massaged, and the fluid obtained was found to contain epithelial cells, but no gonococci.