TREATMENT OF EMPHYSEMATOUS GANGRENE DUE TO *BACILLUS AEROGENES CAPSULATUS*.

BY R. H. GILPATRICK, M.D., BOSTON.

THE fundamental principle of treatment of emphysematous gangrene caused by the gas bacillus (*B. aerogenes capsulatus*) is that of bringing about conditions least favorable for growth and activity of the organism. The problem is that of arresting the spread of infection before the destruction of tissue has been too great to permit of recovery from the resulting absorption of toxic substances. The condition is to all practical purposes a local one, for by the time it has become general the case is hopeless. Treatment to be successful must control the disease while it is still a localized process. Considering the prevalence of anaerobic bacilli which are known to produce gaseous gangrene, it seems remarkable that cases of infection are not more common. Cases are usually found in patients who have suffered crushing or mangle injuries, particularly street accidents in which dirt and grease have been forced into the wounds and the tissues devitalized. Infection also takes place in the perineum, scrotum and buttocks probably from the rectum.

The *B. aerogenes capsulatus* undoubtedly occurs in varied strains, as do the cocci and other pathogenic bacteria, for whereas the typical case of emphysematous gangrene starts suddenly and spreads with extreme rapidity, often to a fatal termination, yet occasionally an apparently mild case is encountered in which organisms are found which resemble in morphology, cultural and staining reactions those discovered in the severe cases. I remember one such case where the infection was discovered in a compound fracture of the humerus. Fortunately it was detected very early and remedial measures promptly instituted. The infection did not attain serious proportions and the wound was clean of bacilli in thirty-six hours. The spread of infection is by contiguity, chiefly in the loose subcutaneous tissue, and all parts invaded undergo gangrene with formation of gas. In the typical case the spread is extremely rapid. There is no definite line of demarcation to outline the still healthy tissue from the diseased. Crepitation of the tissue under the examining finger is the only guide, and this is only approximate, for there is a zone of involved tissue in advance of the crepitant line. By the time inflammatory reaction is evident, the infection has spread far beyond. Amputation of an extremity to arrest the process must, therefore, be done at a considerable distance above the crepitant line, leaving a zone of healthy tissue between. Surgeons have hesitated to sacrifice extremities in such a way, — for instance, to amputate near the shoulder or at the joint for infection which was evident to or slightly above the elbow, — and many amputations done close to the line of crepitation have been unsuccessful in heading off the disease. I have seen one case of infection in the forearm and extending about two inches above the elbow which was saved by amputation

at the shoulder-joint, and one case in which multiple amputations of the leg and thigh failed to arrest the process because each operation was done through already infected tissue.

Treatment by free incisions and oxydizing agents, with adjustment of dressings so as to permit free ventilation of the wounds and at the same time inhibit the spread of infection by constriction of the extremity above the involved area, has been in more or less general use since the pathology and bacteriology of the disease were understood. A case in which infection with the *B. aerogenes capsulatus* probably originated from the rectum and rapidly involved the left side of the perineum, scrotum, left inguinal region, anterior aspect of left thigh and much of the left side of the abdominal wall left me the use of free incisions and application of oxydizing solutions, but no opportunity for amputation or constriction. Through the courtesy of Dr. F. H. Lahey¹ I was acquainted at the time with the work he had done on this subject and the conclusion he had drawn that proximal subcutaneous injections of hydrogen peroxide were unjustifiable. It occurred to me that pure oxygen gas could be run into the wounds with perfect safety and that the presence of the gas would tend to inhibit the activity of the organisms. Description of the method used is given in the report of the following case:

Mr. L., thirty-five years, consulted me on Aug. 31, 1909. He had been in poor general health for some time. Previous history unimportant save for recurring attacks of protruding hemorrhoids. For the past two weeks he had been incapacitated by a severe gastro-enteric disturbance, and the diarrhea had resulted in an exacerbation of the rectal trouble. Two days ago he began to have pain in the left side of the perineum and now complains of the sensation of a closed fist in the rectum. General physical examination negative except for general debilitated condition. Left ischio-rectal region shows typical signs of beginning abscess formation, which is probably secondary to an ulcerated hemorrhoid which could be seen opposite. Operation at 3.00 p.m., Sept. 1. Hemorrhoids removed by clamp and cautery. Incision over the ischio-rectal tumor and about two ounces of pus and fecal material evacuated. There was no evidence of gas bacillus infection at this time. Rubber tube drainage was established and hot moist dressings ordered every four hours. He was much relieved by the operation and was comfortable for twenty-four hours. Condition was satisfactory on the evening of Sept. 2, but during the night he began to complain of pain along the left inguinal canal. When I saw him the following morning at 11.00 the scrotum was reddened all over and there was a small bluish spot on the under side. Inflammatory reaction was evident over the left side of the perineum and upward along the inguinal canal and on to the thigh. There was crepitation over these areas and beyond them in all directions. Gas could be expressed from the edges of the perineal incision, and the characteristic odor of emphysematous gangrene was marked. Preparations for operation were made and Dr. D. D. Scannell very kindly saw the case with me and advised free incisions. Under primary ether I made some eighteen or twenty

¹Lahey, F. H.: Treatment of *Bacillus Aerogenes Capsulatus* Infections by Proximal Injections of Hydrogen Peroxide. *Boston Med. and Surg. Jour.*, Dec. 16, 1909.

incisions all over the crepitant area and cultures were taken. Those from the perineum showed mixed infection, while those from the abdominal wall showed pure *B. aerogenes capsulatus*. The incisions were made so that the tendency would be to gape widely. They were washed out with chlorinated soda and dressed with the same. Several soft rubber catheters, about 18 F., were boiled and their tips adjusted into the incisions nearest the edges of healthy tissue. The catheters were connected up by Y-tubes to an oxygen generator and a constant stream of pure oxygen gas run into the incisions under the dressings. These were readjusted every four hours and the catheters placed in different incisions. The following morning it was evident that the spread of infection was under control. Several more incisions had been necessary where crepitation was felt, but the crepitation rapidly disappeared after the catheters were adjusted to the new incisions. The oxygen was kept up for another day. The temperature had come to normal and pulse to 100. The problem of the case had changed to that of combating toxic absorption and regenerating a large amount of gangrenous tissue.

Treatment from this time on consisted in removal of sloughing tissue as fast as a line of demarcation appeared and sustaining the patient's strength. Destruction of tissue had been so great and the resulting toxemia was so profound that he was gradually overcome, and on Sept. 13, which was the tenth surgical day since the second operation, it was evident that the end was not far. Practically all the gangrenous tissue had separated and been removed, but there had been little formation of granulation tissue, probably due to lowered powers of regeneration. A direct transfusion of blood was determined upon after fully explaining the dangers to the donor, who was anxious to take any chance for his friend. On the evening of Sept. 13 connection was made between the radial artery of the donor and the median basilic vein of the recipient. I used the Ellsberg cannula and found it much more efficient than the Crile cannulae. Flow was rapidly established and allowed to continue for thirty-five minutes. The donor showed practically no ill-effect and his wound healed by first intention. The result for the recipient was most encouraging. Before the flow was started he had become moribund. At the finish his pulse was of fairly good quality and he soon regained consciousness and took nourishment. This improvement continued for thirty-six hours, when he suffered a rapid sinking spell. He rallied under stimulation and an intravenous infusion of saline, but twelve hours later he began to fail rapidly and did not respond to further stimulation and another intravenous infusion. Death about midnight of Sept. 15.

Here was a case of gas bacillus infection spreading with whirlwind rapidity. Spread of the infection was arrested almost at once, and although no definite conclusions can be drawn from a single case, I am convinced the effect was due to the oxygen, through the multiple incisions opening all infected tissue to or even beyond the line of crepitation. At least the treatment is rational and harmless. It is simple, easily applied and not very expensive.

THE medical department of Tulane University recently inaugurated the custom of holding an "Alumni Week," at which clinics and demonstrations were held for the benefit of graduates of the school and other medical men. — *Med. Record*.

New Instrument.

A NEW URETERAL CATHETER.

BY EDGAR GARCEAU, M.D., BOSTON.

This instrument is a modification of Albarran's ureteral catheter for collecting all the urine from one kidney. Albarran first introduces a flexible bougie of small size into the ureter with the aid of an ordinary cystoscope. Over this, as a guide, he slips, in succession, open end ureteral catheters of different sizes until one is introduced which fits so snugly that no urine escapes around it when it is in place.

The present instrument is 50 cm. in length. It has a caliber of No. 14 French at one end, and this caliber is maintained as far as the middle of the instrument. From this point it tapers gradually and evenly to the opposite end, at which the caliber is only No. 7 French. This end is open, and just below it on either side of the catheter is an additional opening through which urine may enter.

The technic is simple. A flexible bougie is first introduced into the ureter; over it as a guide the catheter is introduced and is pushed into the ureter until a sense of resistance is felt. This is occasioned by the grasping of the instrument by the ureteral wall, and is analogous to that felt when a bougie is grasped by a stricture in the urethra. The short distance between the internal sphincter and the ureteral opening plus the resistance offered by the bougie will serve to prevent bucking.

The advantages of the instrument are: (1) Assurance that all the urine will be collected, the catheter fitting into the ureteral canal exactly as a conical cork does into the neck of a bottle; (2) the ease of manipulation, the small tip always entering even a small canal, — with the Albarran catheters it will be found that the large blunt ends will not always readily enter the ureteral opening; (3) the saving of time, one maneuver being all that is required.

Clinical Department.

PROSTATECTOMY FOR RECURRING PROSTATIC INFLAMMATION.*

BY WILLIAM C. QUINBY, M.D., BOSTON.

I WISH to report a case of prostatectomy (partial in this instance) for recurring prostatic inflammation and abscess after the manner advised by Dr. Samuel Alexander, of New York, in his paper before this society at its meeting of May 12, 1908.

The patient, a mechanical engineer of twenty-seven years, contracted a gonorrhea in 1899, since which date until the time that I saw him, on the third of Novem-

* Reported before the New England Branch of the American Urological Association on March 8, 1910.