

degrees. She had a slight limp. Roentgen-ray examination, September 15, showed effusion of the left ankle; no decalcification or thinning of joint space. The Pirquet reaction to both human and bovine tuberculin was positive. The Wassermann reaction was negative. The gonorrheal complement fixation was negative. White blood cells were 9,200; polymorphonuclears, 58 per cent. The ankle was strapped and treated as arthritis. By November, there was no improvement. Muscle spasm and limitation of motion became more pronounced. Roentgen-ray examination, November 3, showed effusion still present. The joint space was thin; there was no decalcification. An infectious arthritis, probably syphilitic, possibly tuberculous, was indicated. December 5, the tuberculin test with 0.15 mg. was given with no reaction, general or focal. An exploratory operation, December 11, revealed that the appearance of the joint was typical of tuberculosis. The fluid was injected into a guinea-pig; the guinea-pig died in two weeks with no evidence of tuberculosis. The tissue report was tuberculosis. Acid-fast bacilli were found in the tissue. The wound healed by primary union.

CASE 8.—R. F., a girl, aged 6 years, admitted, Jan. 5, 1922, with a first diagnosis of chronic synovitis of the left knee, about two weeks before admission had an "abscess" on the outer side of the left knee. The joint had been painful and swollen. The left knee was 1½ inches larger in circumference than the right, and the patella floated. Motion was limited in all directions. There was a small sinus on the outer side from which a drop of pus could be expressed. Plaster was applied. Roentgen-ray examination, the day of admission, showed marked swelling about the left knee; the joint space slightly thinned; marked distention of the capsule by exudate; no decalcification, and no definite evidence of tuberculosis. A brace was applied, and worn intermittently with a period of improvement. The Wassermann reaction was negative. White blood cells were 10,400; polymorphonuclears, 45 per cent. Roentgen-ray examination, Jan. 9, 1923, showed no noteworthy change, but continued absence of productive reaction increased the probability of the fundamental lesion being tuberculosis. Exploratory operation, February 26, revealed an appearance typical of tuberculosis. The tissue report stated that there were fairly definite miliary tubercles, although no giant cells were seen. Tissue from the joint was implanted in a guinea-pig, with a positive result. The wound healed by primary union.

CASE 19.—I. L., a woman, aged 44, admitted, Aug. 22, 1923, with a diagnosis of tuberculosis of the left knee, had a gradual onset of pain in the left knee in December, 1922, which recurred intermittently through the winter. She injured the knee in a fall in May, 1923. Two weeks later, it began to swell and became stiff and painful. Symptoms had been continuous and progressive since. Five weeks before admission, a cast was applied for ten days. It completely relieved the pain, which returned after its removal. The patient appeared worn and fatigued. The left knee was flexed at 160 degrees. There was painful motion of 10 degrees, with muscle spasm. The knee was swollen. There was atrophy of the thigh and calf. Roentgen-ray examination, the day of admission, showed a moderate, dense, well defined effusion of plastic type; thinning of the joint space, but no definite bone involvement. The appearance was consistent with tuberculosis. White blood cells were 8,100; polymorphonuclears, 74 per cent. The Wassermann reaction was negative. The Pirquet reaction to human tuberculin was negative. The tuberculin test, with 0.2 mg., caused a temperature rise of 0.6 degree. There was no focal reaction. Following two succeeding injections of 1 mg., there was no general or focal reaction. After 3 mg., there was a temperature rise to 101.6 F., with headache and distinct increase in pain in the knee. Exploratory operation, September 12, revealed the synovia and fat pads to be infiltrated and edematous, and in places there were numerous small white nodules, apparently miliary tubercles. The operator considered the condition undoubtedly tuberculosis. The tissue report stated that there was very cellular granulation tissue closely packed with lymphocytes and plasma cells. There was some perivascular edema and infiltration. The diagnosis was chronic synovitis. There was evidence of tuberculosis. The wound healed by primary union.

## ABSTRACT OF DISCUSSION

DR. EDWARD J. LEWIS, Chicago: How many cases of knee-joint infection were proved to be tuberculous after puncture of the joint and the injection of the fluid into a guinea-pig was negative? I wish that Dr. Smith would describe his technic exactly, where he makes the incision and how much tissue he removes, and whether it is necessary to remove considerable of the synovia in order to find this.

DR. ALAN DE F. SMITH, New York: My technic has been to make a fairly long incision to the inner side of the patella. We have not gone to the extent of making a midpatellar incision. That has afforded us an opportunity to take a good look at the joint. We take out several small pieces of tissue in order to get a good picture of the pathologic changes in various parts of the joint. This, however, does not amount to a synovectomy. I think we have the figures about the guinea-pig test in my paper, although I did not read them. The guinea-pig inoculation was resorted to in twenty-four cases. Two pigs were lost and two died at the end of two weeks. This left fourteen tests in proved cases. Ten of these were positive and four negative. One has about that chance of getting a positive result in a case that is tuberculous.

## SECONDARY CLOSURE OF TUBERCULOUS NEPHRECTOMY WOUNDS\*

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The secondary suture of wounds assumed great prominence during the war, and in the literature between 1914 and 1919, one finds many articles devoted to this subject. In civil practice this procedure is rarely necessary, as most surgical wounds are closed by primary suture, and in infected wounds, drainage is so instituted that secondary suture is seldom necessary. One exception to this, however, is in those cases of tuberculous nephrectomy wounds which break down completely in spite of every preventive precaution.

That this not an uncommon complication is shown by the fact that in eighty-nine cases of nephrectomy for renal tuberculosis studied in this series, in sixteen cases there was complete dissolution of the wound following operation.

The first consideration of interest is the underlying cause of the failure to heal, and to this end these cases have been analyzed and compared with the cases in which the wound healed by primary union. The average age of these sixteen patients is 40 years, the youngest being 21 and the oldest 48. This differs in no respect from the general average age of patients with renal tuberculosis, as this disease is commonest between 20 and 40. The duration of symptoms of these cases before operation has been two years, while the total average in the eighty-nine cases is three years. This may be of some significance, as the infection after three years may have become less acute than at the end of two years. It is interesting to note that in these sixteen cases only two presented symptoms more than two years. One of these gave a history of symptoms for ten years, and the other for five years. In five cases, 33 per cent., the onset of symptoms was less than one year before admission to the hospital.

Cystoscopic examination showed ulcers in the bladder in six of these sixteen cases, or 37 per cent., while in the eighty-nine cases there was ulceration in twenty-four cases, or 27 per cent. Tubercle bacilli were found

\* From the James Buchanan Brady Urological Institute, Johns Hopkins Hospital.

in sixty of the eighty-nine cases, or 77 per cent., and in fifteen of the sixteen cases in which there was breaking down of the wound. Examination of the histories reveals no evidence to indicate that the actual number of tubercle bacilli found in the urine is of any prognostic value so far as the severity and acuteness of the renal infection is concerned. One would expect this, because the number of bacilli in the urine represents those originating in a focus that drains into the tubules or renal pelvis. Thus, a small ulcerated lesion in the pelvis or at the tip of a papilla would eject more tubercle bacilli into the urine than a large abscess or cavity in either pole not directly communicating with the pelvis. Therefore, the abundance of bacilli found is no criterion of the extent of the kidney lesion. Since this is true, and because ulceration of the bladder in tuberculosis is directly proportional to the amount of infection descending from the kidney, it follows that the amount of vesical involvement in any case is no indication of the extent of the renal lesion.

Separate kidney function, as determined by the phenolsulphonaphthalein and comparative urea determinations, gives no clue as to the acuteness of the renal lesion, as these are measurements of the amount of kidney tissue that is nonfunctioning, and there would be greater diminution of function in a chronic fibrous or caseous tuberculosis that had destroyed a large amount of kidney substance than there would be in a kidney with a small abscess, or in a tuberculous pyelitis. Therefore, one is unable to prognosticate the acuteness of the kidney lesion on the basis of the usual preoperative procedures used in arriving at a diagnosis.

The operative technic in all the eighty-nine cases has been essentially the same. The usual lumbar incision was made and extraperitoneal exposure of the kidney obtained. The pedicle was then ligated or transfixed and divided, and the kidney removed. The stump of the ureter has been treated in various ways, as will be discussed below.

For suture material, No. 3 chromic catgut has been used for the muscles and fascia, the only variation being the type of stitch employed. For the most part, interrupted sutures, either single or mattress or figure-of-eight, have been placed. In some, a single continuous suture has been placed in such a fashion that the muscles are approximated in two layers. This is obtained by starting the suture at the posterior angle and running it anteriorly, catching the lumbar fascia and transversalis in the first layer. The same suture is then continued posteriorly, the cut ends of the internal and external oblique muscles being sewed. It is unlikely that the type of stitch used could have a great influence in the healing of the wound, because, in the cases that have broken down, the separation has occurred only after two or three weeks in all cases, which would indicate that as long as the suture holds, the wound edges stay approximated; but after the suture material weakens, if there has been no coalescence of the edges of the wound, separation results. Both interrupted and continuous sutures will hold for this length of time, and if the healing process has not taken place at the end of two or three weeks, it is unlikely that a difference of a few days, which there might be in the length of time an interrupted or a continuous suture would hold, could materially affect the ultimate result.

It is obvious that the underlying cause of the failure of the wound to heal is infection. That this may occur in the fatty capsule before operation is indicated by the

frequency with which marked adhesions are found surrounding the kidney. However, tubercles or caseation in the perirenal fat, and tuberculous perinephritic abscesses, are very rare, which would indicate that if there is any infection, it is usually mild. However, on this assumption it has been advocated that the perirenal fat be removed at operation. This was done in none of the eighty-nine cases studied, and therefore it is impossible to judge the efficacy of it.

Infection of the wound with the tubercle bacillus may be caused by the operator inadvertently spilling tuberculous material during the removal of the kidney, or, as is commonly held, it is due to contamination from the stump of the ureter. The latter is probably the most universal conception, and many procedures have been practiced to avoid this, such as division with a cautery to sterilize the cut ends, phenol (carbolic acid) injections into the lumen, ureterectomy, suture of the stump inside a tube which is brought to the surface, and suture of the cut end into the muscles at the lower angle of the wound. In the sixteen cases referred to here, the following methods were employed: phenolization of the cut end, five cases; phenol injection of the lumen of the ureter, four cases; simple ligation and division, three cases; accidentally broken off, one case; Paquelin cautery division, one case; the ureter was brought up into a tube in one case; ureterectomy in one case. It will be seen, therefore, that failure to heal has occurred in cases in which the ureter has been treated in divers ways, which suggests very strongly that the treatment of the stump of the ureter is not the predominating factor concerned in the breaking down of the wound, although it cannot be said that it has no influence.

There is, however, one factor which is constant and which apparently has a very definite influence on the subsequent behavior of the wound. This is the type of lesion in the kidney. Tuberculosis of the kidney may be considered as divided into acute and chronic types of infection. In the former may be placed acute tuberculous nephritis and pyelonephritis, tuberculous abscess, single and multiple, and, if there is ureteral obstruction, tuberculous pyonephrosis. In the more chronic types of infection, one most often sees solitary and miliary tubercles, caseation, cavitation and chronic fibrous tuberculosis. So far as the treatment is concerned, the division of renal tuberculosis into pathologic types is only of academic interest, because in all types nephrectomy is indicated; but it can be said with assurance that the healing of the wound is closely related to the pathologic anatomy, and, in the acute types of infection, the wound is much more liable to dissolution. This has been recognized for some time, and it has been deemed wise by some to advise patients in whose urine multitudes of bacilli and extensively ulcerated bladders have been found to defer the nephrectomy until these symptoms should improve. This is, however, fallacious, because, as shown above, these are not accurate indexes of the acuteness of the kidney infection.

In the sixteen cases under consideration, eight presented multiple abscesses, three were pyonephrosis, three showed cavitation, and in the operative note it was said that some necrotic material accidentally was spilled into the wound. One case showed acute tuberculous nephritis, and in one case there was the cavernous type of kidney with no note as to whether or not any material was spilled at operation.

In the entire group of eighty-nine cases, every one in which there was a pyonephrosis has broken down

completely; and, if one considers the kidneys containing multiple abscesses as representing an early stage of pyonephrosis, these two types form eleven of the sixteen cases, or 68 per cent., of those which have failed to heal. Therefore, while it cannot be held that the wounds in all the pathologic types break down, it can be said that of all the cases which break down, these form a considerable part. Likewise, it is significant that none of the more chronic types of pathologic kidneys, when removed, have been followed by failure of the operative wound to heal.

The postoperative course of these cases is very similar. For the first week after operation, the wound appears healthy, and apparently is healing by primary union. After a fortnight or two weeks, one first notices slight induration and redness around the skin edges, which by this time are apparently healed. This induration increases until it surrounds the entire wound edges and is about 2 cm. wide on both sides of the wound. Then one sees developing along the line of incision several small areas of softening, usually beginning as very small spots a few millimeters long, and gradually extending along the line of incision until they are 1.5 or 2 cm. long, and are covered by an unhealthy, bluish film of skin. The most frequent sites are at the anterior angle and at the middle of the wound. If these are not opened, they will rupture in a few days and discharge thin, brownish, seropurulent material; and, after rupture, multiple sinuses develop along the wound edge, which increase in size until they unite and the entire wound is laid bare.

The depth to which this separation occurs varies. In four cases, not included in the sixteen under consideration, the nonunion has been confined to the skin and subcutaneous tissues, the muscle layers healing. Two of these cases were successfully followed. The wound in one case healed in two years, and in the other healing was complete after eighteen months.

In the sixteen cases that are studied here, there has been disunion of both the muscles and skin, occurring usually in the second or third week after operation in the manner described above. After separation of the wound edges, and destruction of the fatty capsule by the infection, there results a large granulating cavity, about 10 to 15 cm. in depth, from 8 to 10 cm. wide, and from 25 to 30 cm. long, which is lined by unhealthy, tuberculous granulation tissue. The orifice of the cavity is bounded by the retracted cut ends of the oblique muscles, and any possibility of approximation of these is precluded by their attachment to the ribs above and the crest of the ilium below, both of which are fixed points. It is therefore readily comprehensible why these wounds take several years to heal, since there is no tendency for the wound edges to fall together, as is usual in wounds of the soft parts.

The treatment of these wounds falls logically into two categories: (1) antiseptic, to combat infection; and (2) stimulative, to promote the growth of granulation tissue. The antiseptics that have been used are surgical solution of chlorinated soda (Dakin's solution), mercurochrome-220 soluble, meroxyl, potassium permanganate, hydrogen peroxid, gentian violet, acriflavine, phenol, silver nitrate and balsam of Peru. In each of the cases many of these have been tried and the results, so far as keeping the surface of the wound clean is concerned, have been good. It is not difficult to keep the cavity almost sterile with any of these drugs, but it is not the pyogenic infection that prevents

healing, because in nontuberculous wounds granulations grow rapidly under treatment with these antiseptics.

The failure of tuberculous cavities such as these to heal has long been recognized to be due to the fact that, as the granulation tissue grows, tubercles develop in it, and there is a generalized lymphocytic infiltration with endarteritis. This diminishes the blood supply, so that the more superficial granulations tend to slough, resulting in extreme slowness in the obliteration of the cavity. Therefore, many methods have been employed to stimulate the granulations, but none with any great success in hastening closure. Radium was used in one case without apparent effect, as the wound was still open when the patient was last heard from, nine months after operation. Ultraviolet rays from the Kromayer lamp were used in four cases. In two of these the patients were not heard from after discharge, but the wounds were still open four months after operation, when the patients left the hospital. Hypotonic salt solution was tried in one case, and Beck's paste in one. None of these procedures had any noticeable accelerating influence on the growth of the granulation tissue. In two cases, the cavity was thoroughly curetted several months after operation, and in each case, closure occurred within six months, while in the remaining cases that it has been possible to follow, none have closed within this time. It has been possible to follow seven cases, and an approximate estimate of the time that elapsed before the wounds closed spontaneously can be obtained from these. One case closed, except for two sinuses, in seven months. In two cases, the wound was still unhealed when the patient was last heard from, nine months after operation; one case, after ten months; in three cases, at the end of one year. The remaining cases were not successfully followed.

It is obvious that these patients will be completely incapacitated in the presence of a large gaping wound such as occurs in these cases, and that this incapacitation is months, sometimes years, in duration. Therefore, any procedure that will restore them to activity without endangering their lives is of great value.

With this object in view, the last two cases have been closed by secondary suture, with most gratifying results.

#### REPORT OF CASES

CASE 1.—A man, aged 30, who entered the hospital, June 20, 1923, complaining of frequency of urination, had had no urologic disease, and with the exception of the usual diseases of childhood, the systems of the body had been entirely normal. The onset of the symptoms dated back six months before admission, beginning with burning, nycturia and frequency. These had gradually increased until the patient, when admitted, voided about every half hour during the day and night, with considerable burning and urgency.

General physical examination showed no evidence of tuberculosis in any part of the body, other than that found on urologic examination. Urologic examination revealed no involvement of the genital tract. The urine voided was cloudy in three glasses and contained much pus, but no acid-fast bacilli were found in the first examination. Cystoscopic examination revealed a bladder capacity of 100 c.c. The bladder mucosa was congested everywhere, and cystoscopy was painful. There were several irregular, typical, tuberculous ulcers in the base of the bladder, particularly on the trigon in the region of the left ureteral orifice. The ureters were catheterized and specimens taken for examination. Comparative urea determinations on each side showed the right side was 0.056 and the left side 0.044 gm. per liter. Bacteriologic examination of the separated urines showed the right side to be sterile after twenty-four hours. The

left side showed streptococci and acid-fast bacilli in the smear.

The patient was operated on, July 6, a left nephrectomy being done through the usual lumbar route. The ureter was sutured inside a rubber tube, which was brought out of the posterior angle of the wound. Two cigaret drains were inserted, and the muscles closed with interrupted figure-of-eight No. 3 chromic catgut.

The kidney removed was greatly enlarged, and scattered over the surface were many small tubercles varying in size from 2 to 1 cm. in diameter. On palpation, it was soft and fluctuant. On section, the medulla had been completely destroyed, and there was a pyonephrosis with about 200 c.c. of tuberculous pus in the cavity. The operative note mentions the fact that a small amount of pus escaped into the wound which, however, was washed out with meroxyl and salt solution.

Following the operation, the patient had an uneventful convalescence, and the daily postoperative notes described the wound as being healthy and healing nicely until July 28, three weeks after operation. It is interesting to note that, following operation, a large amount of urine was drained through the wound owing to regurgitation into the left ureter. This was first noticed, July 22, sixteen days after the operation, and probably followed sloughing of the ligated end of the ureter. It continued until August 27, at which time it ceased. July 28, the first indication of separation of the wound edges was evident, and the wound was vigorously treated with mercurochrome-220 soluble and gentian violet, and the edges were strapped to prevent dissolution. Also, the patient was treated with the Kromayer light. The wound slowly broke down and by August 8 the edges had completely separated. During August, the patient received general hygienic treatment with antiseptics applied to the wound to keep it clean, and under this treatment gradually improved in health. This continued through September, with no particular change in the appearance of the wound. Although it was quite clean, it failed to granulate because, as the granulations grew they sloughed, and it was evident that many months would elapse before a repair would occur. October 25, a small bit of granulation tissue was excised from the wound and microscopically showed no definite tuberculosis. Smear from the wound at this time showed only one or two gram-positive cocci to a field, with less than one gram-negative bacillus. No acid-fast bacilli could be found. It was decided to close the wound by secondary sutures, and this was done, November 15, four months after nephrectomy. At operation, there was a large granulating cavity, which was lined medially by peritoneum covered by granulation tissue, and which extended upward under the ribs for about 6 cm. and downward almost to the brim of the pelvis. The cut edge of the muscles had retracted upward until the edge of the wound was about two finger breadths below the twelfth rib, and the lower edge had retracted downward about the same distance from the crest of the ilium.

The operation carried out was as follows: An incision was made surrounding the wound and about 1 cm. from the edge. This was carried down through the skin, subcutaneous tissue and muscle, and all scar tissue and granulation tissue was excised. Excision was not possible in the depths of the cavity, so this was well curetted out, all unhealthy looking tissue being removed. Three small iodoform gauze packs were then placed in the depth of the wound to stop the oozing that occurred, and the muscles and skin were closed by silver wire sutures placed as far from the cut edge as possible and drawn sufficiently tight to insure good approximation of the muscles and skin, care being taken, however, not to draw them tight enough to cause cutting. No buried sutures were inserted.

Pathologic report of the material removed at this operation showed definite tuberculous granulation tissue.

Following the operation, the patient's temperature rose for two days to 101 F., and there was reddening and induration around the edge of the wound so that some apprehension was felt as to whether or not it would heal. During this time the cavity was irrigated with meroxyl, 1:500, twice a day, and the patient received the usual hygienic treatment for

tuberculosis. This continued for a week following operation, at which time there was marked improvement in the appearance of the wound.

The first silver-wire suture, which was at the lower angle of the wound and was the least important, was removed at the end of ten days. The second suture was removed in two weeks, at which time there was no induration or redness in the wound and the skin had healed by primary union and the muscle layers were healed and no subcutaneous separation of them could be made. The cavity, which before operation had a capacity of about 150 c.c., had reduced in size until only about 15 c.c. could be introduced for irrigation. The final silver-wire sutures were removed three weeks after operation, at which time the wound had healed along its entire length with the exception of a small area about 2 cm. long at the posterior angle, where the iodoform gauze packs had been inserted, and at the anterior angle of the wound a small sinus about 2 cm. long had developed, through which a slight amount of serous drainage emerged. It was noticed at this time that the anterior sinus showed very little tendency to heal, but the sinus at the posterior angle drained very little and was therefore allowed to heal up.

The patient was discharged from the hospital, Jan. 17, 1924, the wound entirely healed with the exception of a small sinus 1 cm. long and 0.25 cm. wide in the anterior angle of the wound, which drained a very slight amount of serous material. The phenolsulphonephthalein output on discharge was 50 per cent., the urine showed no tubercle bacilli and the urinary symptoms were greatly improved.

CASE 2.—A man, aged 40, admitted, May 7, 1923, complained of frequency of urination and hematuria. The past history was essentially negative, except for two attacks of gonorrhoea in 1916 and 1918, and syphilis in 1918. The present illness began two and a half years previous with burning and frequency. This gradually increased until, on admission, the patient voided every half hour during the day and night. Since the first onset of symptoms, there had been several attacks of hematuria with the frequency. There was moderate burning and slight urgency.

General physical examination was essentially negative. There was no evidence of tuberculosis anywhere in the body except that which was demonstrated on urologic examination. The Wassermann reaction was negative.

Urologic examination showed a scar in the coronal sulcus of the penis. There was no urethral discharge, and no ulcers or tumors; the right testis, epididymis, cord and vas were normal; the left epididymis, cord and vas were normal.

Rectal examination showed a prostate of normal size. The right lobe was irregular, and firmer than normal, especially at the apex; there were slight periprostatic adhesions. The left lobe was similar to the right. The seminal vesicles were corded and thickened at their bases. The prostatic secretion showed a moderate excess of pus cells.

The urine was cloudy in three glasses, and no tubercle bacilli were found on repeated examination, but the urine contained pus and a small amount of blood. The phenolsulphonephthalein output was 90 per cent. in two hours.

Cystoscopic examination revealed a bladder capacity of 140 c.c. The bladder was quite irritable. Study of the prostatic orifice showed no hypertrophy or irregularity, but the orifice was quite red and edematous. The trigon was hyperemic and edematous. The right ureteral orifice was normal in appearance; the left ureteral orifice gaped widely and was surrounded by several small ulcerations covered with adherent mucus. The bladder mucosa was red everywhere, but more marked on the left. Ureteral catheters entered both ureters easily and ascended to the kidneys without meeting any obstruction. Specimens were collected, and tubercle bacilli were demonstrated coming from the left kidney.

The patient deferred operation until Jan. 7, 1924, when he was readmitted to the hospital and was operated on, January 9, nephrectomy being done. At operation the ureter was found to be greatly thickened and dilated until the lumen was about 1 cm. in diameter. It was quite irregular and definitely tuberculous. Therefore, as much as possible of it was removed after dissecting down retrovesically almost as far as the seminal vesicles.

The kidney removed showed early pyonephrosis with destruction of the papillae, and multiple tubercles scattered through the parenchyma of the cortex.

Following the operation, the patient had a marked febrile reaction, the temperature rose to 103 F., January 10, but on January 12, it was normal, and the patient's condition was quite satisfactory; and the wound had apparently healed nicely. January 25, sixteen days after operation, there was the first evidence of separation. The wound became indurated and red. Within two days several areas had broken down, and these enlarged in both directions until they united, and by February 9, the entire wound had broken down and a large granulation cavity, similar to that found in the first case, was present. This was treated with irrigations of mercurochrome-220 soluble, hydrogen peroxid and surgical solution of chlorinated soda from the time it broke down until February 28, at which time the smear showed only one or two gram-positive staphylococci to a field.

The situation at this time was identical with that present in the first case. There was a large cavity lined by tuberculous granulation tissue, which communicated with the exterior through the gaping lumbar wound, the edges of which had retracted so that the wound was about 2.5 cm. wide.

February 28, a bit of granulation tissue was removed from the wound and showed a tuberculous infection. It was decided, however, in spite of this, to attempt to close the wound. This was done, February 29. The operation consisted of excision of the wound edges, a margin of about 1 cm. being left. The skin, subcutaneous tissue and muscles were excised, and all unhealthy tissue was removed. The muscles were then closed with interrupted mattress sutures of No. 3 chromic catgut to the fascia of the internal and external oblique and transversalis. Each suture penetrated all three muscles, which were loosely brought together and tied. Silver wire stay sutures were then inserted at a distance of about 2 cm. from the edge of the wound, and traversing the entire muscle layer. The skin was closed with skin clips. The wound was not drained.

Pathologic report from the material removed showed tuberculous granulation tissue.

Following the operation, the patient had a slight reaction. The temperature rose, March 1, to 102 F. The posterior angle of the wound was found to be raised above the surface, and, when opened, about 10 cm. of serosanguineous fluid was evacuated. Dakin's tubes were inserted, and a dry dressing was applied. From March 2 until March 12 irrigations of surgical solution of chlorinated soda were instituted and, as in the previous case, the wound became somewhat red and indurated around the edges; but by March 14 this showed marked improvement, and by March 16 the edges were quite soft and not red or inflamed. March 20, it was first noted that the anterior angle of the wound was beginning to appear unhealthy, and therefore it was opened for drainage. Following this, the sinus at the anterior and posterior angles of the wound drained a moderate amount of seropurulent material, and irrigation of the cavity showed that it was becoming gradually smaller and smaller. The patient continued in this condition until April 22, when he was discharged from the hospital, fifty-five days after the closure of the wound and seventy-five days after nephrectomy. There was a small drainage tract at each angle, but the wound had healed completely with the exception of these, and there is little doubt that much time had been saved.

#### COMMENT

It will be noticed that in both of these cases the material removed at operation was tuberculous and, in spite of this, the wounds healed, except for small sinus tracts, which could drain the cavity. It would, of course, be highly desirable to obliterate this cavity at operation and in not so doing one is violating the cardinal principle in surgery of always obliterating any dead space; but this was technically impossible on account of its size and irregularity in shape. However, in these two cases the cavities had rapidly diminished

in size, and on the discharge of the patients had almost disappeared.

Another observation of interest is that in both cases the anterior angle of the wound spontaneously established a drainage tract, and the posterior angle showed great tendency to heal. This would indicate that the anterior angle is the proper site of drainage. The results in these cases have more than vindicated the operation. By this procedure a large, gaping, indolent wound that incapacitated the patient has been converted into a healed wound except for two small sinus tracts, which were becoming progressively smaller during the last days of the patient's stay in the hospital.

The prognosis in regard to healing of the granulating wound without operation is ultimately good, but months would elapse before it would be complete, and by this procedure one is able to save the patient a long, tedious convalescence with the care and worry of a large granulating wound, which is always itself a menace to his health.

## THE SURGICAL TREATMENT OF ACUTE PULMONARY ABSCESS AND CHRONIC PULMONARY SUPPURATION

WITH ESPECIAL REFERENCE TO THE POST-TONSILLECTOMY TYPE \*

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Pulmonary infection is a fairly common postoperative complication, and the accompanying pathologic changes vary according to the avenue of infection, the amount, distribution and virulence of the infective organism, the relative resistance of the patient, the length of time the infection has been present, and the treatment. If abscesses result, they vary greatly in size and location. They may be simple, multiple or multilocular. They are usually surrounded by a peripheral zone of pneumonia, which may be circumscribed or extensive, and in various stages of resolution or liquefaction. In the more chronic stages, purulent bronchitis or bronchiectasis usually develops. Long continued infection results in thickening of the walls of the abscess, of the adjacent pleura, and fibrosis of the lung. For such a variety of pathologic lesions there can be no single descriptive term, but "chronic pulmonary suppuration" seems the most comprehensive and adequate.

In a series of 692 cases of acute abscess or chronic pulmonary suppuration observed at the Mayo Clinic, 146 (21 per cent.) followed operation. Of the postoperative cases, 31 per cent. followed tonsillectomy performed elsewhere; fourteen (9.5 per cent.), extraction of teeth, and thirty-eight (26 per cent.), laparotomy. With a few exceptions, these operations were performed under general anesthesia.

Abscess in the acute stage following tonsillectomy is typically localized to a circumscribed area of the lung, but may be widely distributed from the onset. In the chronic stages, all the foregoing lesions have been observed. A chronic diffuse bronchiectasis may result in cases in which the abscess heals. In 1911, I observed a case of abscess following tonsillectomy at the Massachusetts General Hospital that came to necropsy. The

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\* Read before the Section on Laryngology, Otology and Rhinology at the Seventy-Fifth Annual Session of the American Medical Association, Chicago, June, 1924.