

Of course these are a very small number of operations in three years, and they were treated in a country hospital, so that the result is not at all surprising; but when Dr. McVail attempts to draw extensive conclusions from them, and to show that the method of treatment adopted in these cases is better than the aseptic method, he is using a fallacious argument. All that can be said is that under the conditions in which these operations were performed, aseptic treatment was but little necessary, though even here we find that one out of 31 major amputations died of pyæmia. As we have seen, the best surgeons, Mr. Spence or Mr. Savory for instance, even with the use of the most scrupulous cleanliness, cannot reckon on anything like absence of infective diseases.

After all, these statistics are not nearly so good as the results obtained by Bardenheuer with aseptic treatment in the Cologne Infirmary in one year.<sup>1</sup> He had *no death* among 133 aseptic operations involving bones. These included, according to MacCormac—

- 41 amputations (17 of thigh) through bones.
- 10 „ at joints (1 at hip).
- 53 resections (15 of hip and 12 of knee).
- 23 cases of removal of wedge-shaped pieces of bone.
- 5 operations for badly united fracture.
- 1 case of trephining.

<sup>1</sup> MacCormac's *Antiseptic Surgery*, p. 29.

## CHAPTER XVIII.

RESULTS OF ANTISEPTIC SURGERY (*continued*).

General considerations. Wounds of, and operations on, healthy joints. Method of treatment adopted in these cases. Definition of the term 'Aseptic course.' Example. Wounds of healthy joints. Operations on healthy joints. Objections to the value of these cases: reply. Incisions into joints affected with synovitis. Incisions into joints affected with pulpy degeneration of the synovial membrane—*a* without suppuration, *b* with suppuration. Volkmann's results: Max Schede: Paul Barth: Saxtorph: Piéchaud: Nussbaum: Albert: Hueter: Létiévant: Kraske: Reyher: Bergmann. Comparison of Reyher's results with those obtained during the Crimean war, and with Heintzel's. Treatment by irrigation. Necessity for observing the minutest precautions as shown by Mr. Lister's case. Results of removing foreign bodies from joints without aseptic precautions: Larrey: Spence: Paget.

So far I have been dealing with general statements; and though these are often not of much use, yet I cannot think that there can be any doubt as to the great value of the facts which I have narrated. Thus, for example, we have had an opportunity of comparing Mr. Lister's results in Glasgow before and after the introduction of aseptic treatment. After he went to Edinburgh, we were able to trace a very marked improvement following the introduction of the aseptic method; and we also had the opportunity of contrasting the results of aseptic treatment with those of treatment by antiseptics in Mr. Lister's own hands. We were further able to point out that there was a great difference between these results and those obtained during the greater part of the same period, in the same hospital, and under more favourable hygienic conditions, by a surgeon who did not practise aseptic treatment.

We have further had most striking evidence from abroad showing that in infected hospitals the aseptic method has done what other methods, such as the open method, treatment by

irrigation or by antiseptics, could not do. It has not only diminished, but when properly employed, it has abolished infective disease. That this result has not been simply due to cleanliness, as has been suggested by some, is shown by numerous facts, such as those mentioned by Nussbaum (p. 394) and Volkmann, and also by the results of the use of thymol (p. 404).

Nor must I forget to mention the results obtained in ovariectomy, although these are not test cases. For the peritoneum has a wonderful power of destroying causes of putrefaction, or of rendering them inert by rapidly removing the fluid in which they might grow. Thus, dust-laden air has been injected into the healthy peritoneal cavity without bad results, though, if ascitic fluid were present, or if the peritoneum were unhealthy, there would almost certainly be fermentation, and probably, as a result of this, depending on the amount and nature of the irritating products formed, peritonitis. In the healthy peritoneum, which absorbs fluids with immense rapidity, there is no fluid for the organisms to develop in, and thus they are left in contact with active healthy living tissue, which, as we have seen from experiment, rapidly destroys them. Hence the case of ovariectomy is by no means a test.

There are certain cases, however, to which I must now allude, in which there is not the same tendency to destruction of organisms, but where there is opportunity for them to develop, and where the admission of septic dust is liable, as experience has shown, to be followed by very serious consequences. An example of such a case is where organisms are admitted into a healthy joint. Here fluid is present, in which they can develop, and here also all parts of the living surfaces are not in contact, and, therefore, organisms may be present in the fluid of the joint and yet not in contact with healthy living tissues. This is, then, a test case, for here organisms, if admitted, will as a rule grow. We must therefore inquire, how injuries which might involve the entrance of organisms into healthy joints behave under the various methods of treatment.

Then, again, in chronic abscesses we have similar conditions. Here the fluid is practically under the same conditions as if it were in a flask; the walls of the cavity are probably not even

healthy. How do such abscesses behave under various circumstances?

And lastly, although this is not such a test case, we know that compound fractures, whether made by the surgeon or by accident, are very dangerous, chiefly on account of their great liability to be followed by infective disease. In this instance the destroying action of the blood clot and of the living tissues can come into play, but nevertheless the movements to which the part is liable are apt to interfere with their action. Blood clot is only of use as a destroyer of bacteria if it be kept at rest.

#### *Wounds of, and Incisions into, Healthy Joints.*

I have already published the cases which have occurred in Mr. Lister's practice from the end of 1871 up to November 1879,<sup>1</sup> but I shall introduce these tables here in order to complete the subject. Before, however, discussing the results as a whole, I must mention how the cases have been treated, and what is the usual aseptic course.

Wounds of joints are treated on the principles described at page 113. If the case is seen very shortly after the accident (within a few hours) the joint is thoroughly washed out with 1-20 carbolic lotion by means of a syringe and catheter, the wound being enlarged if necessary; the surrounding skin is well washed with the same lotion, a drainage tube is introduced into the joint, a large gauze dressing is applied, and a splint is arranged so as to prevent movement. This treatment is carried out under a spray of carbolic acid. If the wound does not come under observation till after the lapse of twenty-four or thirty-six hours, a solution of carbolic acid in methylated spirit (1 part of carbolic acid to 5 of spirit) is used. If a still longer time has passed since the receipt of the injury, fermentation of the fluids in the joint has generally taken place, and there is but little hope of eradicating it. An attempt may, however, be made by the use of either of the lotions just mentioned, or of a solution of chloride of zinc (40 grs. to the ounce) or of iodoform suspended in alcohol and water.

In operating on healthy joints, the various precautions

<sup>1</sup> *British Medical Journal*, November, 1879

described in the chapters on aseptic surgery must be carefully carried out. As a rule the 1-20 carbolic lotion is used for all purposes. When the operation is concluded, a drainage tube or a horse-hair drain is introduced into the joint so as to provide free escape for the serum, which will probably, for a few hours, be of considerable amount, owing to the irritation of the synovial membrane by the manipulations and by the carbolic acid. The drain can generally be dispensed with in simple cases, such as after the removal of a loose cartilage, in from one to three days. As the result of these operations, the discharge becomes very slight after the first twenty-four hours. There is no pain nor swelling, in fact no local inflammatory disturbance whatever, and therefore, of course, no suppuration. Constitutionally the patient remains quite unaffected: he feels well, eats well, sleeps well, and in fact, thinks it a great hardship to be kept in bed for a few days. In the following cases, when I use the term 'aseptic course,' I mean this condition of absence of local or constitutional disturbance.

Let me take as an example a case of recent fracture of the patella, which was operated on with the view of obtaining bony union.

W. T. æt. 37 was admitted to King's College Hospital on Dec. 13, 1879, suffering from a recent simple transverse fracture of the patella. The accident had occurred on December 9.

*Condition on admission.*—The knee-joint was much swollen and contained a considerable quantity of fluid. The patella was fractured transversely and the fragments were about two inches apart. There was a good deal of pain in the joint.

*Operation.*—On December 13, chloroform having been administered, Mr. Lister made a longitudinal incision about 4 inches in length over the patella, the various aseptic precautions before described being employed. The knee-joint was of course at once opened. A quantity of coagulated blood and fibrous tissue filled up the space between the fragments, and this was removed. A pair of dressing forceps was then passed into the joint and projected against the skin at the most dependent part of the outer side of the joint. An incision was made on the projecting point, and by means of the forceps a horse-hair drain was drawn into the joint. The fragments were

then drilled obliquely, avoiding the cartilage, and, a piece of strong silver wire being passed along the drill-tracks, the fragments were firmly tied together. The two ends of the wire were then twisted together and left of sufficient length to project from the wound. A drainage tube was introduced into the incision superficial to the patella and brought out of the upper angle of the wound. The remainder of the line of incision was stitched. A large antiseptic dressing was applied enveloping the whole of the thigh, and the limb was placed on a posterior splint. The foot of the bed was raised on blocks so as to make the discharge flow upwards.

*After-progress.*—The after-progress of this case was typical. There was never the slightest pain or constitutional disturbance (see Fig. 77). On the following day (December 15) the dress-

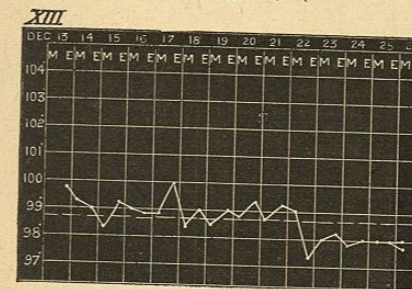


FIG. 77.—TEMPERATURE CHART FROM A CASE OF OPERATION FOR FRACTURE OF THE PATELLA. (No. 21, p. 434.)

ing was changed and a fresh dressing re-applied; there was no pain or swelling of the joint. On December 17, the dressing was again changed, and a portion of the drain was removed from the joint. On December 19, the superficial drain and part of the remaining drain for the joint were dispensed with; most of the stitches were taken out. At the next dressing, on December 24, the remainder of the drain and the rest of the stitches were removed. On December 31, the wound was again dressed, and was found to be quite healed, except a minute speck, where the drain for the joint had been. This was found to be quite healed on January 5, when passive motion was begun. The wire was removed on February 9, and bony union was found to have taken place. When the patient was discharged on February 15, the movements of the joint were perfect through an angle of 45°; patient could kick vigorously.

## I. WOUNDS OF JOINTS.

No.	Name and Age	Date of Admission, Operation, and Discharge; with Result	Injury	Treatment	Remarks
1	Frank K., 29	<i>Ad.</i> , Nov. 20, 1871. <i>Op.</i> , Nov. 20, " <i>Dis.</i> , Dec. 23, " <i>Result</i> , cured.	Little finger-joint fractured in various places. Skin over hand contused. Fourth metacarpal bone laid bare in the greater part of its extent. Fourth metacarpo-phalangeal joint opened.	Little finger amputated; other parts well syringed with 1-20 carbolic lotion.	Some sloughing and suppuration occurred among the contused parts in the hand, and an abscess formed in the forearm. Entirely healed December 23. Passive movements were begun in December, and could be easily performed.
2	George G., 60	<i>Ad.</i> , June 28, 1872. <i>Op.</i> , June 28, " <i>Dis.</i> , Oct. 1, " <i>Result</i> , cured.	Compound comminuted fracture of the humerus, caused by the wheel of a wagon passing over his arm. Humerus fractured in two places; the lower fracture communicating with the elbow-joint. Patient admitted about two hours and a half after the accident.	Wound injected with 1-20 carbolic lotion. Some loose pieces of bone were removed from the lower wound. (No portion of the articular end of the humerus was, however, removed.)	Putrefaction was avoided; typical aseptic course. The fracture had quite united on August 10. The wound was quite superficial on August 3, and boracic dressing was applied. On August 15, erysipelas attacked the wound. This passed off, and the wounds were quite healed on September 20. When dismissed, patient was able to flex his arm sufficiently to enable him to touch the shoulder of the other side.
3	Robert H., 30	<i>Ad.</i> , May 12, 1873. <i>Op.</i> , May 12, " <i>Dis.</i> , July 17, " <i>Result</i> , failed; amputation.	Compound fracture of the carpal bones of the left hand. Extensive laceration of the soft parts. Machinery accident. Patient admitted immediately after the accident.	Wound injected with a solution of carbolic acid in rectified spirit (1 in 5).	Putrefaction occurred in spite of the injection; and, as fever set in, Mr. Lister operated on May 16, removing the carpus and fingers, but leaving the trapezium and the thumb. The flaps were left gaping, and carbolic oiled lint (1-10) was introduced between them. Flaps brought together on May 24. Stump was quite healed on June 25.
4	Walter S., 42	<i>Ad.</i> , May 17, 1875. <i>Op.</i> , May 17, " <i>Dis.</i> , May 21, " <i>Result</i> , in process of cure.	Wound of metacarpo-phalangeal joint.	Washed out with 1-20 carbolic lotion.	Putrefaction was avoided. Treated as an out-patient. Wound followed an aseptic course.
5	Francis J., 48	<i>Ad.</i> , Oct. 4, 1875. <i>Op.</i> , Oct. 4, " <i>Dis.</i> , Dec. 4, " <i>Result</i> , cured.	Compound dislocation of the ankle; the articular surface of the tibia protruding through a large wound anteriorly. Both malleoli torn off.	The wound was injected with 1-20 carbolic lotion, and an attempt was then made to reduce the dislocation. This failing, the articular surface of the tibia, was sawn off, the astragalus being left untouched. Foot fixed at right angles to leg.	Aseptic course. The wound was almost absolutely healed when the patient was discharged. Joint strong and slightly movable. The temperature was on one occasion as high as 100 deg. F.
6	Henry W.	<i>Ad.</i> , June 8, 1876. <i>Op.</i> , June 8, " <i>Dis.</i> , June 13, " <i>Result</i> , cured.	Thumb and trapezium nearly torn off, and the carpal joints opened. Gunshot-wound.	The thumb, with its metacarpal bone, was removed; the trapezium was also dissected out. The wound and the carpal joints, as far as possible, were injected with 1-5 solution of carbolic acid in rectified spirit.	Aseptic course. Treated as an out-patient after June 13. On June 31, the wound had almost entirely healed.
7	David S., 13	<i>Ad.</i> , May 2, 1877. <i>Op.</i> , May 2, " <i>Dis.</i> , after Mr. Lister left Edinburgh. <i>Result</i> , cured.	Large lacerated wound of right knee. Large flap of skin thrown to one side. Mud was ground into the cartilaginous surface of the internal condyle of the femur. The accident resulted from a wheel of a heavy cart passing over patient's leg.	Shreds of tissue were clipped away, and the cartilage of the condyle was pared with a knife where the dirt was most ground in. The whole of the dirty wound was scrubbed with a nail-brush, and 1-20 carbolic lotion, and, in addition, 1-5 spirituous solution of carbolic acid were applied. No stitches were inserted. The limb was placed on a posterior splint.	The wound became filled with blood-clot, the deeper part of which became organised. On May 27, there was a large granulating surface. The wound was quite superficial on June 26, when boracic dressing was substituted for the carbolic acid. There was at that time very considerable movement of the knee-joint, without pain. In August 1878, 'patient visited the hospital, walking without any assistance, the two knees being equally useful, except that the injured one was still somewhat stiff.'

## I. WOUNDS

No.	Name and Age	Date of Admission, Operation, and Discharge; with Result	Injury
8	Ellen M., 12	<i>Ad.</i> , Nov. 6, 1877. <i>Op.</i> , Nov. 6, " <i>Dis.</i> , Nov. 17, " <i>Result</i> , cured.	Punctured wound of ankle-joint, caused by scissors. The accident happened twenty-one hours before admission. Glairy fluid escaped, and a probe passed into the joint. Foot red and swollen.
9	Jane D., 50	<i>Ad.</i> , Oct. 15, 1878. <i>Op.</i> , Oct 15, " <i>Dis.</i> , June 20, 1879. <i>Result</i> , wound of joint cured.	Compound fracture of the lower end of the femur, with splintering of the condyles into the joint. Patient was seen one hour and a half after the accident. (See compound fracture, No. 70.)
10	Maria L., 60	<i>Ad.</i> , Nov. 12, 1878. <i>Op.</i> , Nov. 12, " <i>Dis.</i> , April 19, 1879. <i>Result</i> , in process of cure.	Compound dislocation of the left ankle-joint, with comminuted fracture of the fibula and fracture of the internal malleolus. Skin in the neighbourhood of the wound much contused.
11	Henry B., 22	<i>Ad.</i> , April 20, 1879. <i>Op.</i> , April 21, " <i>Dis.</i> , May 30, to come as out-patient. <i>Result</i> , cured.	Patient jumped over Waterloo Bridge; in his descent, he struck his left elbow against the side of the parapet. The result was an oblique fracture into the elbow-joint, detaching the internal condyle. There was a small opening in the skin communicating with the fracture.
12	Samuel M., 54	<i>Ad.</i> , July 8, 1879. <i>Op.</i> , July 8, " <i>Dis.</i> , July 24, " <i>Result</i> , cured.	Punctured wound of the left knee-joint, just above the patella. The finger, when introduced into the wound, passed into the joint, and felt the under surface of the patella. Synovial fluid escaped. Great pain on movement of the joint. The wound was inflicted about fourteen hours before the patient came to the hospital.
13	Archibald R., 16	<i>Ad.</i> , Dec. 10, 1880. <i>Dis.</i> , Dec. 24, " <i>Result</i> , cured.	Incised wound of knee-joint. Incision one and a half inch long.
14	Ann P., 68	<i>Ad.</i> , Aug. 11, 1881. <i>Op.</i> , Aug. 12, " <i>Dis.</i> , Aug. 30, " <i>Result</i> , cured.	Compound fracture of the olecranon. The accident happened on August 10, and was immediately seen by the house surgeon.

OF JOINTS (*continued*).

Treatment	Remarks
Wound enlarged, and joint injected with a solution of carbolic acid in spirit (1-5).	The wound had quite healed on November 17. Aseptic course; dressed four times. When patient was discharged, the ankle was quite normal, with perfect movement. (See Chart I.)
The opening in the skin was enlarged. The projecting end of the femur was sawn off, and reduction was effected. The wound was washed out with 1 to 20 carbolic lotion. An incision was made into the knee-joint on the outer side, and a drainage-tube was inserted into it, to prevent accumulation of fluid.	Aseptic course. The drainage-tube was removed from the joint on October 28, and the wound of the joint had completely healed on November 24: the wound in the thigh healed on December 13. As the fracture remained ununited, Mr. Lister injected iodine between the ends of the fragments on February 14. Union not yet occurring, Mr. Lister cut off the ends of the bones and wired them together with thick silver wire. The femur is still ununited, but is under treatment. (See Chart II.)
The detached portions of bone were removed; wound syringed out with 1-20 carbolic lotion. Dislocation reduced. Drainage-tubes inserted. Dupuytren's splint.	Aseptic course. Some portions of the skin sloughed. When discharged, the wound was almost healed, but the ankle-joint was stiff.
Wound enlarged; some small fragments of bone removed, and the wound and joint syringed out with 1-20 carbolic lotion. Drainage-tubes inserted.	Aseptic course. Wound completely healed on June 30. The movements of the joint were then very good, and have since that time steadily improved. (See Chart III.)
Joint washed out with 1-20 carbolic lotion, and with a solution of carbolic acid in rectified spirit (1-5). Drainage-tube inserted; posterior splint applied.	Aseptic course. The pain on moving the knee ceased a few hours after it had been washed out. The wound was quite superficial when the patient was discharged, and the knee was quite movable. Healing was complete on July 31. The patient was again seen in October, the movements of the knee being then perfect.
Wound syringed out with an emulsion of eucalyptus oil containing iodoform. Surrounding parts washed with 1-20 carbolic lotion. Tube introduced into the joint.	Typical aseptic course. Tube removed on December 17. When discharged the wound had almost entirely healed, and healing was complete in a few days. Knee-joint perfectly movable and leg quite strong.
On the 10th the wound was thoroughly washed out with 1-20 lotion and treated aseptically. As there was no bed, patient could not be admitted till the following day. On the 12th the wound was again washed out, and, the opening being enlarged, the fragments were brought together by means of strong silver wire. Drainage-tube inserted, wound stitched, straight splint applied anteriorly.	Aseptic course. Some of the stitches were too tight and caused a little irritation, but this subsided as soon as they were cut. Incision healed and stitches removed on August 16. Drains entirely removed on August 19. The wound had quite healed when the patient was discharged. (The ends of the wire which brought the fragments together were cut short, and the cutaneous margins were brought together over them, so that the wire remains.) Seen in middle of September—extension perfect. Flexion beyond a right angle, and can be done perfectly by passive motion. Arm gaining strength.

## II.—OPERATIONS ON

No.	Name and Age	Date of Admission, Operation, and Discharge; with Result	Disease
1	John C., 46 .	<i>Ad.</i> , April 5, 1872. <i>Op.</i> , April 6, " <i>Dis.</i> , May 9, " <i>Result</i> , cured.	Caries of metacarpal bone and first phalanx of ring-finger.
2	David B., 39 .	<i>Ad.</i> , July 22, 1872. <i>Op.</i> , July 22, " <i>Dis.</i> , Aug. 5, " <i>Result</i> , cured.	Loose cartilage in knee-joint.
3	John McL., 34 .	<i>Ad.</i> , March 13, 1873. <i>Op.</i> , March 28, " <i>Dis.</i> , June 6, " <i>Result</i> , cured.	Ununited fracture of olecranon; fracture oblique; considerable separation of fragments. Patient unable to extend the arm. Accident occurred five months previously.
4	John H. 19 .	<i>Ad.</i> , May 6, 1873. <i>Op.</i> , May 31, " <i>Dis.</i> , Aug. 15, " <i>Result</i> , cured.	Dislocation of the lower end of the ulna backwards. The lower end of the radius was much thickened. Suppuration had occurred in the sheaths of the flexor tendons. The movements of the wrist-joint were painless, but limited, more especially as regards extension.
5	William T., 31.	<i>Ad.</i> , Nov. 19, 1873. <i>Op.</i> , Nov. 26, " <i>Dis.</i> , Jan. 8, 1874. <i>Result</i> , cured.	Loose cartilages in the elbow-joint. The movements of flexion and extension were impaired, more especially the former. Pain on attempting to complete these movements.
6	Frances G., 54 .	<i>Ad.</i> , Nov. 3, 1873. <i>Op.</i> , Feb. 8, 1874. <i>Dis.</i> , Sep. 14, " <i>Result</i> , improved.	Ununited fracture of neck of right femur. Accident happened 18 months before admission. Right limb, 29 $\frac{1}{2}$ in.; left limb, 31 $\frac{1}{2}$ in. Suffered great pain; could neither sit nor walk.

## HEALTHY JOINTS.

Treatment	Remarks
Removal of the finger and the whole of the metacarpal bone; the carpal articulations being of course opened.	On April 23, the wound had entirely healed except a small point at the distal end. Aseptic course.
Free incision into joint; cartilage removed.	Wound was completely healed on August 5. It had been dressed four times. Aseptic course. Knee freely movable.
Longitudinal incision over olecranon, the cartilaginous end of the humerus being at once freely exposed. Ends of fragments refreshed, drilled, and tied together by strong silver wire. Wound left open. Splint applied so as to keep the arm extended.	The wound had completely healed on May 2, except where the wire projected. Dressed ten times. Wire removed on May 19, when union was complete. Passive motion was commenced on April 8, and was performed at each dressing. Typical aseptic course. When dismissed, the movements of the arm were almost perfect. In a letter received from the patient some time afterwards, he stated that the one arm was as good as the other. The temperature in this case was irregularly taken but it was only once above 100° F., and then it was 100.6° F., an evening temperature.
Abscesses opened; end of ulna removed; drainage-tube introduced into the wrist-joint, which was healthy.	No local or constitutional disturbance followed the operation. When sent to the convalescent home on August 15, there was still a small sinus, but this soon healed. The movements of the wrist-joint were greatly improved.
Longitudinal incision over external condyle. Joint opened; loose bodies (about 200 in number) scooped out. Two drainage-tubes were inserted; wound stitched.	Healed on December 17. Dressed seven times. Aseptic course. Arm was paralysed at first, owing to the pressure of the tourniquet; but, under the use of galvanism, this was cured. When dismissed, the movements were much improved. (See paper by Mr. Sampson Gamgee in <i>Lancet</i> for January 10, 1874.) The temperature in this case was only taken once daily, and was only once above 99° F., viz. on the morning after the operation, when it was 99.7° F.
The limb having been drawn down to full length by pulleys, an incision was made over and above the trochanter, and the ends of the fragments were refreshed with the gouge and hammer, the joint being opened in the process. Drainage-tubes inserted into joint; no stitches; long splint and extension with weight and pulley applied. Length of right leg after operation, 30 $\frac{1}{2}$ in.	Healed on March 28; aseptic course. Extension was maintained till April 3; but when it was at length removed, it was discovered that the weight had been too heavy, and that the limb operated on was longer than the other. When the patient left the hospital, there was not osseous union, but she was able to walk fairly and sit, and the pain which she previously suffered had completely disappeared. (See Chart IV.)