Of considerably greater importance from my point of view, however, is a paper by Chambon and Ménard,² which recently appeared. In it these gentlemen relate their experience of the use of glycerinated vaccinal lymph when kept for a long time in capillary glass tubes previously sterilised and closed by the blowpipe. The results they obtained with lymph originally good were highly satisfactory, and even lymph which, in its fresh state, gave mediocre results, in the course of fifteen days produced a passable vesicle, and, after forty, fifty, or sixty days, a typical one. The improvement seemed due to the gradual extinction of parasitic microbes under the influence of glycerine and time.

Professor Straus made plate cultures with their glycerinated lymph, which showed that when fresh it gave rise to numerous colonies of various microbes, especially *staphylococcus pyogenes aureus* and *staphylococcus albus*, while the glycerine lymph fifty to sixty days old remained absolutely sterile, intermediate specimens presenting fewer and fewer microbes as they became older. These experiments were repeated many times, and invariably with similar results.

This evidence, so entirely corroborative of my own work, is all the more important as it appears certain, from a perusal of the original paper, that the authors were ignorant of the precisely similar results at which I had previously arrived, and which were published nearly twelve months before the appearance of their article.

There can thus, I venture to think, no longer be any doubt as to the superiority of the method of lymph storage which I advocate over the perhaps simpler method which has been so strenuously insisted on in England of late years; and I trust therefore that some authoritative pronouncement may before long be made on the matter, as it appears to me, at any rate, to be one which is of the utmost importance in relation to the present widespread objection to vaccination on the score of the possible dangers incidental to the operation.

THE TREATMENT OF PERFORATED GASTRIC ULCER, WITH REPORT OF SUCCESSFUL DRAINAGE IN A CASE.³

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THE following three cases show how variable may be the result of perforation of a gastric ulcer. In the first we have an example of the most acute kind, in the second there was a localised peritonitis, which at the end of a few days gave rise to general peritonitis, and in the third the extravasated stomach contents remained entirely localised, and never involved the general cavity of the peritoneum.

CASE I.—A girl, aged 22, was seized with severe pain in the abdomen when in the act of stooping, and became very faint. She was admitted to the General Hospital under the care of Dr. Simon, with whom I saw her. Six hours after the seizure the abdomen was a little distended, and rigid, it was tender on deep palpation, the pulse was rather hard, and there was vomiting and hiccough. There was no history of gastric ulcer. The abdomen was opened in the middle line below the umbilicus, and two to three pints of sero-purulent fluid were evacuated, but there was nothing to suggest any source of leakage, although a careful search was made. The abdomen was therefore washed out and drained. Death took place twenty-four hours after the operation. At the necropsy a perforating gastric ulcer was found on the anterior wall, in a position easily accessible for suturing.

CASE II.—A girl, aged 20, was admitted under Dr. Simon, with a history of possible perforation into the abdominal cavity two days earlier. Three years before she had been under treatment for gastric ulcer. Four days after admission the abdomen then being distended and tender, the pulse 150 and wiry, and vomiting being present, the abdomen was opened in the middle line above the umbilicus, and a collection of semi-purulent fluid was found between the liver and stomach. This was emptied and an ulcer found on the anterior wall of the stomach, from which a quantity of watery fluid was escaping. The opening, about half an inch in diameter, was closed with five points of Lambert's interrupted suture, and after washing out the abdomen, a tube was placed between the liver and stomach. Death took place thirty hours after the operation. At the necropsy well marked peritonitis was found, and about a pint of thin purulent fluid was found in the pelvis. The perforation was securely closed.

CASE III. *Leakage from a Gastric Ulcer: Abdominal Section Three Weeks after: Drainage: Recovery.*—I was asked to see this case by Dr. Hugh Snell, from whom I obtained most of the notes. A girl, aged 29, was on

May 8th, 1892, seized with severe abdominal pain, faintness, and vomiting. She had been previously suspected to be suffering from gastric ulcer, and on May 7th she had partaken of a heavy and indigestible meal, and on the morning of her seizure she had her ordinary breakfast. An hour later she felt "something give way inside her," and this was followed by acute pain and faintness, and she looked at first as though she were suffering from internal bleeding. The pain was general all over the abdomen, but was worst in the left hypochondrium; the abdominal walls were rigid and the belly was tender. A provisional diagnosis was made of perforation of a gastric ulcer. All feeding by the mouth was stopped and morphine was administered. Under this treatment the girl improved. A little food was allowed by the mouth owing to the irritable condition of the rectum, and the only complaint was of pain in the left lumbar region on sudden movement. On May 17th there was increased pain in this region and in the left hypochondrium, with tenderness, increased resistance, and some dullness. Two days later these signs had increased, and the temperature was 102° F. From this time to the 27th there was improvement, but on this day the breathing became hurried and the patient was restless.

On May 28th I saw the patient for the first time. Her pulse was 160; temperature 103°; respiration 40; in the left hypochondrium a mass could be felt, and it could be palpated bimanually, but without defining its limits exactly owing to the tenderness. The facial expression was very bad, and altogether the girl was so ill that I hesitated to attempt to relieve her by operation. The incision was directly over the swelling, about the left semilunar line, and on opening the abdomen the omentum was found adherent. After separating this a mass of hard granulation tissue was found, and the finger, breaking this down, passed backwards and upwards in a direction which would lead behind the stomach and almost to where it would be in contact with the spleen. At the bottom of this small cavity was found, containing not more than a couple of drachms of pus, of an offensive odour. A tube 5 inches long was placed in the cavity and the patient quickly put back in bed. Convalescence was very slow, and it was not until July 11th that the tube could be dispensed with. Recovery was delayed by an attack of phlebitis in each leg. At the present time (April, 1893) the girl is quite well.

The mortality after perforation is probably at least 95 per cent., so that each case recovering after operation may be looked upon as saved from almost certain death. Although the third case proved the most successful, it is clear that resort to operation at the earliest moment after perforation is recognised is most likely to prove serviceable in the large majority of cases. The diagnosis of perforation is as a rule not difficult, but in some cases there may be no evidence pointing to the stomach as the organ at fault; such was the case in the first patient.

From what has been said before, it is evident that the operative measures to be adopted are not always the same, but that they must vary with the condition which is suspected to exist. With the limited experience at present available it is not desirable to dogmatise as to the exact lines to be followed, but the following are the main outlines. The abdomen should be opened in the middle line, but not too near the costal arches. Positive evidence may at once be found in the presence of free gas or food. The area between the stomach and liver should be examined with care, so that any localised collection here should if possible be prevented from soiling the remainder of the cavity. Any extravasated matter having been removed, the perforation should be sought for on the anterior wall, especially towards the lesser curvature, where it will most commonly be found. If it be, the perforation should be sutured, and the most convenient method is by the continuous Lambert suture, the stomach being brought out of the wound if this be possible. If the edges of the perforation are too friable to hold the sutures, paring them to get a firmer tissue would only add to the time consumed, and the case would probably be better met by an extensive infolding of the margins, which could be done without much difficulty and without risk of kinking in the stomach. If the ulcer cannot be sutured, it may possibly be stitched to the lower angle of the incision. If the perforation be inaccessible for suturing, and cannot be brought to the incision, the only resource left to the surgeon is drainage, with a tube leading directly to the point of leakage. Though this falls short of the more complete proceeding, yet drainage has been found so efficient a protection against the extravasation of other fluids, as for instance bile, that one cannot but be hopeful of it in this condition.

Whether suturing be possible or not, it is of the greatest importance that the abdominal cavity should be washed out and thoroughly flushed with hot water. When the flushing has been done, the drain should be placed *in situ* close to the point of perforation, whether it has been sutured or not. It may also be well to introduce another tube through an incision in the lowest part of the abdominal wall, so as to drain the pelvic cavity. The want of this precaution I believe interfered with the well-doing of my second case, in which a

² *Gazette des Hôpitaux*, December 15th, 1892.

³ Abstract of paper read at the Birmingham and Midland Counties Branch of the British Medical Association.

considerable quantity of fluid had accumulated in the pelvis.

In the more chronic cases, such as the third, the treatment should be different. An incision directly on to any inflammatory mass would be the right procedure, and, in the event of pus or other fluid being found, this should be evacuated with the greatest care, to prevent fouling of the general peritoneal cavity. For this reason I should prefer to trust to sponging rather than to flushing for cleansing purposes, as the irrigation may carry infective particles to more distant parts whence they cannot escape again, but may set up fresh mischief. A drain to the bottom of the abscess cavity is then required, and all that can wisely be done has been done. To search for the perforation, with a view to closing it, would be useless and dangerous.

The third case here described is the most successful with which I am acquainted. Since this was written a successful case of suturing has been published by Kriege in the *Berl. klin. Woch.*, December, 1892, but there is every reason to look forward to better results in the future than in the past. It is most important that practitioners should recognise this accident of perforation at once, and that immediate operation should follow. Here hours are of as much importance as days in other conditions; in fact there is hardly any emergency more urgent in surgery.

NERVE INJURIES COMPLICATING FRACTURES OF THE UPPER EXTREMITY, WITH SIX CASES.

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THE subject of nerve injuries complicating fractures is one which receives little notice in any of the standard surgical textbooks. Hamilton, in his large work on fractures, completely ignores it. Weir-Mitchell in his *Injuries of Nerves*, gives a brief account of the subject, in which he remarks that "contusion or laceration of nerves from fracture of bones is most commonly encountered in such accidents as involve the humerus and the bony parts forming the elbow-joint," and he refers to two cases of this nature published by Erichsen in 1871, and to an essay by Ferrol Reuillet (Paris, 1869) on paralyses of the upper extremity connected with fractures of the humerus. He also discusses the question of compression by callus, and cites a case of this kind by Ollier. By far the most complete account of the subject which I have been able to find is given by Bowlby in his *Injuries and Diseases of Nerves*. This author remarks that fracture of the shaft of the humerus is more frequently the cause of nerve lesion than similar accidents in any part of the body. He cites, partly from Continental and partly from English sources, eleven cases of fracture of the humerus complicated with lesions of the musculo-spiral nerve, one with injury of the median and ulnar, and two with injury of the ulnar alone. With regard to fractures of the bones of the forearm, he remarks that "instances of nerve injury in cases of fracture of the bones of the forearm are certainly rare," and he cites two cases of injury of the median and of the ulnar nerves produced respectively by fractures of the radius and of the ulna. The cases cited by him are collected from sources dated from 1871 to 1882. It would thus appear that nerve injuries of this kind are of considerable rarity.

The following six cases have occurred at the General Hospital, Wolverhampton, during the past two and a-half years, and I cannot help thinking that nerve injuries of this kind are in reality of less rarity than might be supposed from the number of recorded cases. Many such cases are probably not detected, the symptoms being regarded as effects of disuse or confused with the stiffness of joints and muscles which commonly occurs after fractures. Cases, too, in which nerve lesions have been produced by undue pressure of splints are, for obvious reasons, little likely to be recorded.

Of the six cases now recorded, four are fractures of the humerus and two of the bones of the forearm. Of the four fractures of the humerus, three were complicated with para-

lysis of the musculo-spiral, and one with paralysis of the median and ulnar nerves, showing, as in the cases cited by Bowlby, the much greater frequency of lesions of the musculo-spiral. Of the two cases of fracture of the forearm, one was complicated with paralysis of the median, the other with paralysis of the posterior interosseous, a complication of which Bowlby remarks that he has been unable to find any recorded case.

As regards the mode of production of these nerve injuries, they fall into two classes: those in which the nerve is injured simultaneously with the fracture, and those in which it becomes involved at a later period. In the first case the nerve may be injured by the same form of direct violence as causes the fracture, or by the violent displacement of portions of the fractured bone at the time of the accident. The nerve may become involved at a later period in several ways. It may be stretched or slowly compressed through imperfect reduction or subsequent displacement of the fragments; or it may become involved in and compressed by the callus about the site of fracture; or, lastly, nerves in exposed positions may be slowly compressed by splints or other apparatus used to immobilise the fractured limb.

The six cases recorded below include examples of all these different modes of production. Of these, there is only one in which the symptoms can be attributed to injury of the nerve at the time of fracture through violent displacement of the fractured bone. This, however, appears to be the most probable explanation in Case I, in which a compound fracture of the upper part of the shaft of the humerus was complicated with paralysis of the median and ulnar nerves. In this case the symptoms of nerve injury appeared immediately after the accident, the hand being described by the patient as feeling "dead." The fracture was produced by direct violence applied to the outer side of the arm, and the broken ends were probably forced inwards against the nerve trunks on the inner side. The fact that the belly of the biceps muscle was also completely ruptured may, on the other hand, have allowed the whole limb and the nerves with it to be violently stretched.

CASE I.—Compound Fracture of Right Humerus; Paralysis of Median and Ulnar Nerves; Exploratory Operation.—J. C., aged 26, on September 25th, 1891, had his right arm severely crushed by a fall of earth in a coal mine. The humerus was broken in its upper third, and the fracture was rendered compound by two small wounds on the inner side of the arm. The belly of the biceps was completely torn across just above its middle. The following day the patient complained of great numbness in all the fingers, but especially in the middle and index. He was nevertheless able to localise a touch on all the fingers. He said that immediately after the accident the whole hand felt "dead," and remained so till the following morning, when feeling began to return. The wound ran an aseptic course. On October 20th, splints and dressings having been removed, the patient was found to be completely unable to flex the wrist or any of the fingers, and all the muscles on the front of the forearm failed to respond to the strongest faradic current. The voluntary power and electric reactions of the other muscles of the limb were normal. The hand still felt numb, but there was no definite loss of sensation. On November 7th, these symptoms continuing, the median and ulnar nerves were exposed and examined in the middle of the arm, but were not found involved in callus or in any way abnormal in their appearance and relations. On November 18th the patient had recovered slight power of flexing the little and ring fingers (ulnar nerve). On December 1st, contracture of the flexors had set in, and prevented extension of the wrist beyond the straight position. Under treatment by massage and the faradic current, power was rapidly recovered in the muscles supplied by the ulnar nerve, but in those supplied by the median recovery was slow. On January 19th, 1892, the arm presented the typical characters of isolated palsy of the median nerve, with wasting and loss of electric reaction in the affected muscles. On February 4th the flexor carpi radialis was found to contract on faradising the median nerve at the middle of the arm. On February 27th there was slight power of voluntary flexion of the last joint of the thumb. From this time he made a gradual but steady recovery, and when last seen on September 25th, 1892, nearly a year after the accident, he had a strong and useful arm and hand, and was able to oppose and flex the thumb perfectly. There still however remained slight numbness of the last joint of the index finger, and supination of the forearm and extension of the wrist were much limited by contracture of the muscles which had been paralysed.

Examples of nerve paralysis of later onset, due to slow compression by displaced fragments of bone, are probably furnished by the following cases:

CASE II. Separation of Lower Epiphysis of Left Humerus; Paralysis of Musculo-spiral Nerve.—B. H., aged 8 years. The accident, which was caused by a fall on February 18th, 1892, was recognised by the usual signs. After reduction the elbow was immobilised at a right angle by plaster-cast. When this was removed at the end of four weeks, there was much bony thickening about the lower end of the humerus and the elbow was very stiff. There was also complete paralysis of all the muscles supplied by the musculo-spiral below the elbow. These muscles gave no response to faradism, but responded to a smaller minimal galvanic stimulation than the corresponding muscles of the opposite side. No loss of sensa-