mesocolon was oedematous. The gall bladder was atrophied to a fibrous cord and apparently contained some calculi. The peritoneal cavity contained a fair quantity of blood-stained fluid; so far as could be made out, the rest of the abdominal organs were normal. The whole condition looked hopeless, and, as the patient was seemingly at the point of death, I rapidly closed the wound in the endeavour to get her off the operation table alive.

She was removed to the ward, placed in the Fowler position, and rectal salines given. For about a week her condition was most distressing, the pain and abdominal distension being very acute; the restlessness and pain were so severe that I was compelled, against my almost invariable practice in abdominal cases, to keep her under morphine. The bowels, in consequence, did not act until the fourth day, in spite of the free administration of calomel, magnesium sulphate, and turpentine enemata; eserine was given with, I think, good results.

About the tenth day diarrhoea became troublesome; this was relieved by bismuth. After this her convalescence was uneventful, and she left the hospital on December 5th.

Owing to the urgency of the case and the necessity for immediate operation, a specimen of the urine was not obtained, but the urine passed immediately after operation contained a small quantity of sugar, which soon disappeared.

I saw the patient a few days ago, three months after operation, walking briskly in the street and looking the picture of health; she tells me that she feels quite well, but still has the dyspeptic symptoms, and the sour rising in the throat which she had previous to operation.

Though the diagnosis was incorrect and the operation consisted only of a rapid laparotomy and puncture of the stomach, the patient recovered; whether this was *post* or *propter hoc* one cannot say, but she certainly was the most ill patient, both before and after operation, that I have ever seen recover.

I have to thank Mrs. Somerville for her assistance at the operation and for the after-treatment, and Mr. Bradford for the notes on the case.

APPENDICITIS CONSEQUENT ON ACUTE PHARYNGITIS.

By CHARLES BENNETT, M.B.,

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THE case described below possesses features which, although not of a new type, are, in my opinion, noteworthy. Reliable statistics of appendicitis are not too numerous, and the need for them in order to trace the disease to its sources is undisputed. By the findings in this case, both at the operation and at the subsequent histological examination, I am convinced that it is an example of infection of the appendix from a distant infective condition, namely, acute inflammation of the fauces and pharynx, and that the infection was conveyed by the blood stream. Although this cause is recognized in general terms throughout the literature yet, judging from the number of detailed cases on record, instances of it are either uncommon or have for the most part escaped observation.

G. R., female, aged 25, who was admitted to the Western Infirmary, Glasgow, on January 3rd, 1917, gave the following history: On December 30th, 1916, she began to suffer from a catarrhal cold accompanied by "sore throat." On December 31st pain commenced in the abdomen. At first this was felt in the epigastrium, but that same evening it settled in the right iliac fossa, whence it occasionally radiated to the umbilicus. There was no vomiting. Her condition remained thus until her admission to hospital, when, in the absence of the visiting surgeon, Major Duncan Macartney, I was called to see her.

Her general appearance suggested more a thoracic than an abdominal condition. The face was deeply flushed, respirations were rapid, and there was considerable restlessness. Temperature was 102° F., and the pulse rate about 140. Examination of the chest proved negative. The tongue was white with pink spots, while the fauces and pharynx appeared intensely inflamed. The tonsils were not enlarged. There was marked rigidity of the right rectus muscle of the abdomen and tenderness was general over this cavity, but most complained of in the right iliac region.

I opened the abdomen by the gridiron method. The terminal twelve inches of ileum, the caecum, appendix, and a part of the ascending colon were of a deep red colour, while the bowel proximal and distal to these parts was normal in appearance. The redness seemed to map out exactly the distribution of the ileo-colic branch of the superior mesenteric artery. The pelvic organs were normal.

The appendix, which was only slightly swollen, and in which a good lumen could be felt, was removed, and the abdomen closed.

As I expected, the temperature did not immediately settle, but swung irregularly until the fourth day, and about this time also the throat condition subsided. She was dismissed well on January 17th.

As all the circumstances suggested to me that inflammation of the appendix had commenced in a plane nearer peritoneum than mucosa, the organ was sent to Dr. G. Haswell Wilson, acting clinical pathologist to the infirmary, for histological examination. In his report, after referring to evidence of previous inflammatory mischief, he says: "The serous covering and the meso-appendix are intensely inflamed, and show early purulent infiltration."

The formation of pus in this plane with comparatively normal coats nearer the lumen is significant.

Dr. Wilson states that in his opinion the histological evidence supports my view that the infection came from a distance, and the throat condition was a possible causative precursor.

Of course no general conclusion can be drawn from one or a very few cases; and despite the evidence of the source in this instance it seems to me improbable that more than a small proportion of cases can be due to a similar cause. On the other hand, the possibility of such a cause is already admitted by many, and a cause affecting even a small proportion is not to be set aside. Personally I believe that when the etiology of appendicitis has been determined we shall find no one universal cause, but rather that the cases resolve themselves into a number of groups with a definite cause for each.

I am aware that the possibility of appendicitis being caused by infection carried through the blood stream is denied by a few observers. Perhaps the most dogmatic of statements lately made on this head is by Klotz,[1] of Ottawa, who says:

> In recent years some authors have claimed that appendicitis is the outcome of a blood distribution of bacteria gaining entrance to the body tissues at some distance from the appendix. The tonsil has been spoken of as the portal of entry. A study of human appendicitis can give no support to this theory. It is rare to find a metastatic abscess of the appendix, and the character of this lesion is vastly different from clinical appendicitis.

Nevertheless, I am satisfied that my case was of metastatic nature. The signs and symptoms were precisely those of acute appendicitis. Even though there was also infection of the bowel in the immediate neighbourhood, the appendix was the focus of danger, and claimed principal attention.

REFERENCE.

[1] *Canadian Medical Association Journal*, December, 1916.

A NOTE ON THE USE OF B.I.P. AFTER BONE-GRAFTING.

By CAPTAIN H. S. BRANDER, R.A.M.C.

THE technique of the operation of bone-grafting rendered necessary by the character of wounds caused by modern projectiles requires careful consideration owing to the fact that the cicatricial tissue is often extensive and the blood supply consequently poor. As the scar tissue must be undermined in order to expose the end of the bone which is to be grafted, and the risk of relighting infection in a wound which has been healed for months avoided, I venture to record my experience with the use of "Bipp" following a bone-grafting operation. This I do because, in my opinion, the strictest aseptic precautions *alone* are not always sufficient.

Corpl. B. P., R.A.M.C., aged 26 years, wounded by shrapnel at the Lancashire landing, Gallipoli, on July 11th, 1915, was transferred to a military hospital in this country on July 27th, 1915. He had a compound fracture of the left radius. A skiagram showed that the bone was fractured in two places—about the junction of the middle and upper thirds and at the junction of the lower and middle thirds. From the history of the case it is evident that there had been much purulent discharge from the wound due to necrosed bone. The sequestrum was removed on October 13th, 1915, and the wound healed about eight weeks afterwards. The patient was discharged from the army on June 8th, 1916, as medically unfit.

As a Chelsea pensioner he applied for treatment at the War Hospital, Keighley, and was admitted under my care on November 13th, 1916. On the externo-anterior aspect of the left forearm there was a healed scar 4 in. by 2½ in., very

adherent to underlying structures. There was marked wrist-drop and apparently considerable loss of muscular tissue. The proximal and distal ends of the radial fracture could be readily felt at about a distance of two inches from each other. This was well seen also in the skiagram.

Employing strict aseptic precautions, I operated on November 26th. I took the graft from the tibia, and followed Albee's technique throughout, except that I used a Hey's saw instead of a motor-driven circular saw. A long curved incision was made on the front of the forearm, well away from the scar. This was completely undermined, and found to be adherent to the fractured ends of the radius, most of the muscular tissue in the proximity of the fracture having been destroyed either at the time of the wound or by subsequent sloughing. On completion of the operation the forearm was put up on a splint midway between pronation and supination.

At the end of a week I dressed the wound for the first time and found that, although the skin incision had healed by first intention, part of the original scar tissue about the size of a five shilling piece had sloughed, exposing about an inch of the graft. My first impression was that the operation was doomed to failure. Employing very strict technique, according to Rutherford Morison's method, however, I applied "Bipp"[1] to the sloughing surface, and renewed the "Bipp" every ten days, with the result that the skin wound had healed nine weeks after operation, and the union of the graft to radius was strong. The skiagram showed the graft in excellent position.

The use of "Bipp" after this bone-grafting operation was suggested to me by the excellent results I had by it in compound comminuted fractures, hernia cerebri, etc.

In this connexion I wish to take the opportunity of thanking Lieutenant-Colonel Sir Berkeley Moynihan for advising and encouraging me—on one of his official visits of inspection at this hospital—to persevere with "Bipp" in the treatment of troublesome comminuted fractures. Also Lieutenant-Colonel Robert Jones for the opportunity he gave me of seeing a bone-grafting operation at the Military Orthopaedic Hospital, London.

A CASE OF GAS GANGRENE ASSOCIATED WITH B. OEDEMATIENS.

By E. J. DALYELL, M.B.

[From the Bacteriological Laboratory, Hôpital Auxiliare 301 (Scottish Women's Hospital), France.]

THE following paper gives an account of a case of gas gangrene associated with *B. oedematiens* (Weinberg), some notes on anaërobic infections observed in routine examination of wounds.

J., a French soldier, aged 23, was wounded on September 14th, at 4.30 p.m., at Maurecourt, by shell fragment in the left thigh. The first dressing was applied soon afterwards, and the wound was dressed daily until admission to the Scottish Women's Hospital at 1 p.m. on September 17th, when the temperature was 100.4° and the pulse 90. The face showed a yellowish pallor but the general condition was good. High up on the inner side of the left thigh was a perforating subcutaneous wound, and the skin between the wounds of entrance and exit was gangrenous; a purulent discharge present was slightly offensive, and there was slight crepitation in the neighbourhood of the wound, and localized swelling of the thigh above the wound. The *x*-ray report was to the effect that there was no fracture of the femur and no foreign body in the limb. The bacteriological report was that films of the purulent discharge showed streptococcus, *B. perfringens*, and other sporing anaërobes.

First Operation.

On September 17th, at 7 p.m., under chloroform, the gangrenous skin between the wounds was excised, the muscles below were found to be gangrenous and crepitant, and portions of the sartorius and adductor longus muscles were cut away; a piece of *capote* was removed. The wound was dressed with chlorinated soda, and continuous irrigation with Carrel's solution arranged.

September 19th: Wound looking clean; temperature 101°, pulse good; patient still very yellow.

September 20th (evening): Patient sleepless and complaining of pain in leg; some swelling of muscles present in the wound; tissues above wound swollen, but no general swelling of thigh or of abdomen; pulse weak and rapid.

Second Operation.

On September 21st, at 9 a.m., the patient was very much collapsed, the wound offensive, the temperature 98°, and the pulse 120. Muscles gangrenous and gaseous; swelling extending up to Poupart's ligament due to firm gelatinous exudate in and between muscles. Slight amount of swelling present on abdominal wall. Leg amputated above wound. Artery normal, but gangrene noted in muscles superficial and internal to artery. The patient did not rally after operation and died at 1 p.m. The temperature throughout the illness was not higher than 101° F.

Bacteriological Examination.

A portion of gangrenous muscle, removed on September 21st, was firm, oedematous, and foul smelling. Fragments of muscle fibre and some serous exudate from the mass of muscle were inoculated into three broth tubes containing pieces of coagulated egg-white. The tubes, which were at a temperature of 100° C. when inoculated, were kept at 100° C. for one minute, three minutes, and five minutes respectively, and then rapidly cooled. From each heated broth tube a series of five deep agar tubes was inoculated by introducing five drops of heated emulsion into the first tube, mixing well and conveying five drops of the mixture to the second tube, then inoculating the third tube from the second, and so on.

In twenty-four hours the series of tubes inoculated from emulsions heated for one minute and three minutes showed aërobic organisms present and numerous colonies of anaërobes. These were not further investigated. The third series, inoculated with material heated for five minutes, showed in the first and second tubes a scanty growth of colonies of one type only, and the remaining tubes were sterile. The unfamiliar appearance of these colonies suggested further investigation, and in process of identifying them the following observations were made.

I. *Cultural Characters.*

Attempted subcultures from agar shake culture into *glucose broth* and *egg-white broth* failed altogether in the ordinary Bulloch jar anaërobic apparatus, but succeeded under conditions of more strict anaërobiosis (as described later) and showed peculiar appearances. In thirty-six hours growth was visible as clear fine flocculent masses throughout the liquid; in forty-eight hours the fluid had cleared and the culture had settled in a fine cloud at the bottom of the tube. The cloud diminished in size and became more opaque, and in four days was reduced to a fine granular deposit at the bottom of a tube of clear liquid. A faint fetid smell was present in broth cultures after thirty-six hours.

The corresponding microscopical examination showed that the growth in thirty-six hours consisted of auto-agglutinated masses of rather long, non-motile, Gram-positive rods, the majority of which were curved or bent, with few straight forms; later cultures showed loss of Gram-fast property in many of the organisms and the appearance of numerous spores, large, oval, and sub-terminal; still later the granular deposit at the bottom of the tubes consisted of spores detached from the rods which were present only as faintly staining fragments.

On *serum agar* a scanty surface growth was present of flat, clear colonies with finely lobulated borders. In *deep glucose agar* there appeared after thirty-six hours small white colonies with opaque centre and irregular clear border; under the low power of the microscope could be noted the varying opacity of the colony from centre to edge, and the finely filamentous margin. Gas formation was scanty or absent altogether.

Stained specimens from deep agar colonies showed Gram-positive bacilli, often with irregular Gram-negative patches in their length. Straight forms were rare, and individual bacilli were curved, bent, twisted, or coiled, irregular in outline and variable in length.

In *alkaline meat medium* (prepared according to M. Robertson's[1] formula) after five days' anaërobic incubation, there was abundant acid and gas production, without putrefactive change or digestion of the medium. *Spores* were readily produced in this medium and stained with great difficulty, after prolonged heating by the Ziehl-Neelson method.

These observations, and the character of the case from which it was obtained, suggested that the organism was identical with the *B. oedematiens* described by Weinberg and Séguin,[2] and isolated by them from similar cases in 1915.

II. *Inoculation Experiments.*

A serum test was therefore made with guinea-pigs, using for the purpose anti-*oedematiens* horse serum, prepared by Dr. Weinberg, and kindly supplied by him from the Pasteur Institute.

A thirty-six-hour unheated culture of the organism in bouillon was used, and the injections were made deeply into the thigh muscles of guinea-pigs A, B, C, and D. A received an injection of 2 c.cm. of culture; B an injection of 1 c.cm. of culture; C received an injection of 1 c.cm. of culture + ½ c.cm. of anti-*oedematiens* horse serum; D received 1 c.cm. of culture + ½ c.cm. "anti-*Vibrion septique*" horse serum (Weinberg).

[1] The formula given for "Bipp" by Mr Rutherford Morison (*Lancet*, 1916, vol. ii, p. 268) is bismuth subnitrate, 1 oz. by weight; iodoform, 2 oz. by weight; liquid paraffin sufficient to make a thick paste.