CASE VI.

Private K. Wounded November 6th, 1914, in the anterior aspect of the right thigh. Femur fractured. December 5th, on admission, there was a small depressed sinus in middle of thigh discharging foul pus. On December 9th the sinus was opened through wound in front of thigh, and a counter opening made. In thirty-six hours the thigh was much swollen and there was a discharge of thick serous fluid, which contained a large number of sporing bacilli and bubbles of gas. The wound was freely opened, and the muscles in the centre of the sinus were found blackened and semi-digested. A portion of this tissue was examined microscopically. The individual muscle bundles were burst, semi-digested, and large numbers of spore-forming organisms were seen tightly packed between the muscle bundles, and actually passing into and invading the muscle fibres themselves. Surrounding the larger collections of bacteria, the tissue was transparent and hardly took up the stain at all. Practically no pus cells were seen. The sporing organisms were isolated in pure culture and identified as the bacillus of malignant oedema. An organism of the *proteus* type was the only other organism isolated, although a few capsulated Gram-positive organisms were observed in the original films. Within three days of the operation the patient's haemoglobin had fallen to 40 per cent., and he was acutely ill, but finally made an excellent recovery. The wounds were treated throughout with hydrogen peroxide, covered by a thin layer of gauze soaked with peroxide, and oxygen constantly passed into the wounds. The limb was ultimately useful, though somewhat shortened.

In this case the bacillus of malignant oedema had apparently lain dormant for nearly five weeks, but was activated by the incision to provide adequate drainage. Bacteriologically this case suggests symbiotic activity between the bacillus of malignant oedema and the *B. proteus* or *B. perfringens*.

Another type of case, such, for instance, as Case IV and possibly Case V, owes its peculiar features to a process analogous to anaphylaxis; the tissues, having originally been subjected to constant doses of bacterial poison, are, after an interval, subjected to an anaphylactic dose of the original poison.

OBSERVATIONS ON
THE TREATMENT OF WOUNDS IN WAR.

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[Translated for the "British Medical Journal" by
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FROM the first I instituted the following treatment: The only dressing employed was the aseptic. The material for dressings—gauze and absorbent cotton—is autoclaved in special tin boxes of limited capacity, which are only opened when required. The ordinary cotton and carded peat for padding splints and the cloths for covering the field of operation are sterilized in the same way. The gauze compresses and cotton bandages are taken out of the boxes with sterilized forceps.

Instruments to be used at operations are sterilized in a Poupinel sterilizer, as are those for use in dressing wounds; the drainage tubes are boiled in a solution of borax. All antiseptic solutions are made with boiled water.

Before being dressed every wound is cleansed by washing with an antiseptic solution: dilute hydrogen peroxide, 1 in 1,000 solution of potassium permanganate, 50 per 1,000 solution of carbolic acid, or a 7 per 1,000 solution of salt. The neighbouring skin is freely painted with tincture of iodine (1 in 20).

It is now many years since I gave up using antiseptic dressings—carbolic or boric acid cotton, or iodoform, salolized or mercury perchloride gauze—on account of the drawbacks attending their use: painful erythema round the wounds, excoriations consequent upon outbreaks of medicinal eczema, iodoform poisoning, etc. Injurious to the animal cell, hindering the natural processes of healing and organic defence, antiseptics should only be employed within very narrow limits.

Rapid complete disinfection of the wounds, after free opening up, with antiseptic solutions and a dry aseptic dressing, has been my rule of conduct throughout.

Early and free laying open of all war wounds, more particularly those inflicted by fragments of shell, drainage with simple or perforated tubes, according to their length. In the neighbourhood of vessels as few dressings as possible—these also are rules that have been rigidly adhered to.

As soon as suppuration begins to diminish the drains are removed, and directly the sloughing tissues have been eliminated and the wound takes on a healthy aspect, washing with saline solution is substituted for antiseptic solutions.

Tetanus.

During the first few months of the war we had several cases of tetanus, but such cases have become excessively rare since injections of antitetanic serum have been systematically given at the front. I give a second injection eight days after the first.

Gaseous Gangrene.

I have pretty frequently met with cases of gaseous phlegmons which all had a favourable termination after free opening up, and the extraction of projectiles and debris of clothing.

The three following cases, which came from the front in the same train, are of interest in that they exemplify what may be termed the fulminating form of this infection, in contradistinction to the cases in which the decomposition of pus in partially closed cavities or pockets determines a variable amount of subcutaneous emphysema. To put it plainly, all cases of infection, or even gangrene associated with gas formation, are not cases of gaseous gangrene. The latter term should be reserved for instances of deep, rapidly spreading, rapidly fatal infection. Unfortunately the stress of work is such that it is hardly practicable to devote much attention to the bacteriological aspect of the question, but clinically there is every difference between the real cases of gaseous gangrene and the comparatively mild infections in which there may be some gas formation. My experience is that in the grave form no treatment is of any avail, since death follows in from six to twelve hours after the supervention of the earliest characteristic symptoms of the affection.

These three cases all came from the same corner in Champagne (Souain), and, as might be expected, the infection is particularly apt to occur in subjects who from force of circumstances have been left for many hours, or possibly days, on the ground without medical aid. It is not, however, confined to such cases, for there are instances of its occurrence in men whose wounds were attended to promptly.

CASE I.

A. G., a volunteer, received his wound in the grand offensive of September 29th, and was dressed two hours later at the *poste de secours*. He presented an enormous contused wound involving the left calf and popliteal space, in addition to a seton wound of the left shoulder by a fragment of shell. He received an injection of antitetanic serum on September 29th. He came under my care on October 2nd. On the evening of October 3rd the wound showed signs of gangrene. The tissues were swollen, of a dark colour, and on pressure the crackling of subcutaneous emphysema was felt. The limb was at once amputated through healthy tissue, but the disease rapidly spread, and he died on the following afternoon.

CASE II.

This man was a German soldier, wounded in the same fray on September 27th. He was admitted under my care on October 1st. He had a very extensive lacerated wound on the outer aspect of the right arm, with fracture of the humerus; also a contused wound of the left hand, entailing the loss of the index and middle fingers. A gutter had been ploughed in the region of the right olecranon. Resection of the elbow-joint was forthwith performed; within a few hours symptoms of gaseous gangrene set in, and, in spite of extensive incisions and the application of antiseptics, he died thirteen hours later.

CASE III.

C. C., wounded on September 28th, was admitted on October 2nd. As he had fallen in a spot which was constantly swept by the enemy's fire, it was not found possible to bring him in for forty-eight hours. He presented a seton wound by bullet of the left thigh, fracturing the femur, also a deep excoriation of the left heel. There was already some gaseous formation round about the wound, and amputation was performed high up the thigh, through apparently healthy tissue. The gangrene, however, spread upwards, distending the scrotum and penis, and proved fatal within a few hours.

It was noted that these patients, far from feeling depressed or ill, experience a curious impression of comfort and well-being which persists to the moment of death.

In two other cases amputation of the thigh in the first, extensive incisions and injections of hydrogen peroxide, etc., in the second, proved ineffectual. Both patients died in six or eight hours with abdominal distension, intestinal hæmorrhage, and the euphoria peculiar to this affection.

Sepsis and Septicaemia.

Although now and then we do meet with bullet wounds that remain aseptic, the fact remains that almost every wound is infected and that wounds by fragments of shell or bomb contaminated by debris of clothes or soil are the most septic. The practically constant infection of war wounds necessitates as prompt disinfection as possible of such wounds. The fact that nowadays we get vastly fewer cases of major sepsis than at the beginning is no doubt to be explained by the better organization and more rapid access to the surgical services.

Wounds of Joints.

Early arthrotomy, lavage with 50 per 1,000 carbolized water, followed by irrigation with saline solution and drainage, has been my rule, and its application has yielded me numerous successes, especially in penetrating wounds of the knee. The most rapid recoveries have been those in which the synovial sac was found to contain a rather turbid blood-stained fluid. In such cases we are justified in anticipating complete restoration of articular functions.

In presence of suppuration of the joint, especially of the elbow, resection of the articular surfaces is indispensable. The same remark applies to the shoulder and wrist. A properly performed resection under these conditions yields a better and more rapid result, with less risk for the patient, than the freest arthrotomy. Amputation is a last resource when the infective complications do not yield. I have been constrained to have recourse thereto several times for suppurating arthritis of the knee, and once in arthritis of the elbow.

Amputations and Disarticulations.

I have only performed a small number of amputations, in every instance on account of grave septic mischief or extensive lacerations. After ligation of the vessels I always employ copious lavage of the raw surfaces with a very hot solution of carbolic acid (50 per 1,000); then I drain and suture the stump.

I have had to deal with numerous cases of open stumps sent back from the front. It is difficult to express an opinion on this method, which was brought into practice by Verneuil some forty years ago. Verneuil used to keep the stump under carbolized spray. Rapidity of execution, the opening up of all suppurating pockets, and the rapid escape of fluid are the advantages of this method. The drawbacks, on the other hand, are: secondary resection of the stump is often rendered necessary by the projection of bone affected by proliferating osteitis, huge osteophytes, prolonged suppuration, painful cicatrices adherent to the bone, frequent ulceration, and so on. Here I should like to mention, apart from the secondary operations, the excellent results I have obtained by the aid of heliotherapy in hastening the healing of these extensive raw surfaces. It seems to me, moreover, that the scars following heliotherapy are softer and less painful.

As for "sausage amputation," judging from the few cases of the kind that have come under my notice, I hold that it is an unsurgical method, which ought to be abandoned.

Wounds of the Integuments of the Skull.

Every wound of the scalp in war surgery, whether complicated or not, should be incised down to the bone, and the latter must be carefully examined. When exploratory incision of the scalp proves negative the intervention is but trifling, one which, done under aseptic precautions, cannot possibly injure the patient. On the other hand, if we wait for cerebral symptoms to supervene before intervening, it is often too late. Here are a few instances in support of my contention:

CASE I.

L., wounded on July 16th at Eparges, admitted to the hospital on July 30th, after a sojourn in the Verdun Hospital. Apart from left facial paralysis, no cerebral symptom could be detected. His mind was quite clear. On examining the scalp I noticed a small scab in the left occipital region over an almost healed excoriation. An immediate exploratory incision was made. In the lower part of the left occipital bone I alighted upon a small cerebral hernia the size of a pea. There was no radiating fracture. I trephined and evacuated an abscess of the cerebellum, into which I was led by a small track opposite the orifice of entry, containing a teaspoonful of pus. We could not discover the bit of shell.

CASE II.

D., wounded on July 12th, at Eparges, in the left temporal region. When admitted to the hospital on July 16th he presented some incoherence of speech and mental confusion. I operated on July 17th. I came down on a fracture of the left temporal bone. After enlarging with the gouge forceps and removing splinters, and following up an intra-cerebral track running obliquely upwards and forwards, I removed three splinters embedded in the cerebral substance and evacuated a small abscess of the left temporal lobe. Radioscopic examination was negative.

CASE III.

S., wounded on July 13th at Eparges. Admitted to the hospital on July 16th, coming from the Verdun Hospital. Independently of other grave sounds, I noticed a small contused wound in the left frontal region unaccompanied by any cerebral symptom. I operated immediately. Underneath the temporal muscle I found a small cerebral hernia the size of a pea. The frontal bone in the upper part of the temporal fossa was perforated, the hole being about the size of a lentil, clean cut. Having removed a circle of bone with the trephine, I followed a small track into an abscess of the frontal lobe, from which escaped a teaspoonful of pus. Drainage to the depth of over an inch was necessary. Radioscopic examination revealed the presence of a small piece of shell situated in the right side of the frontal lobe near the longitudinal sinus.

CASE IV.

This man was wounded on June 28th in the trenches of Calonne, and admitted to hospital on July 7th. There was a contused wound of the left frontal region. After ablation with the gouge forceps of a circle the size of a halfpenny-piece, we found underneath it a tuft of hair squeezed under the inner table, and numerous splinters. An abscess the size of a walnut was opened in the middle of the frontal lobe, and a small fragment of shell found in the centre of the abscess cavity was extracted.

All these patients are in a fair way to recovery. Such instances might easily be multiplied, confirming the formal indication for deliberate exploration of every contused firearm wound of the cranium, whether or not there be cerebral symptoms.

Disruption of Muscles.

Not infrequently a simple seton wound masks extensive muscular disruption, entailing grave functional impotence. Among others, the following instance may serve to illustrate the type: In February a wounded soldier was brought to me presenting a seton wound in the right pectoral region. The aperture of entry was situated below the clavicle, and the aperture of exit at the margin of the pectoralis major. As there was a blood-stained, fairly copious oozing, I joined up the two orifices under anaesthesia, and, on evertting the margins, found the pectoralis major cut right through. It was the cut muscle that gave rise to the bleeding *en nappe*. I sutured the muscles, aponeuroses, and skin separately. Recovery rapidly took place, with perfect restoration of the shoulder movements. If suture of the divided muscles be not done, healing takes place with scar tissue and consequent functional impairment.

Secondary Union of Wounds.

More frequently than at the beginning we get wounded men presenting big gutters scored by bullets or by fragments of shell. When only the soft parts are involved, I consider it useful to unite these wounds by secondary union as soon as the sloughs have come away and the wound is looking clean and healthy. After freely reviving the edges I separate the aponeurosis from the skin; then I suture separately muscle, aponeurosis, and skin, leaving a small drain at each corner of the wound. More rapid recovery, a linear cicatrix, and less functional disturbance are the advantages of the method.

Damage of Nerves.

Damage of nerve trunks is of frequent occurrence during the present war. I have had quite a large number of such cases to deal with. Nerve trunks buried in scar tissue, embedded in the callus of a fracture, hypertrophies, often keloids of large size, notches or complete division, central haematoma, are some of the lesions I have met with. On two occasions I found the median nerve strongly adherent to the axillary artery in the armpit. In the first case the attempt to separate the two brought about a wound of the artery, which I was obliged to ligature, fortunately without causing any damage to the limb. In the second case I let the adhesion alone.

The nerve trunk most frequently involved was the radial, a fact which is explained by the frequency, especially during the first few months of the war, of fractures of the humerus.

Neurolysis is a protracted, delicate, tedious operation, lasting from an hour to an hour and a half. In order to discover the nerve it is better to tackle it in healthy tissue, following it up to the seat of damage. The anatomical relations have disappeared, the parts have changed aspect, and the search is often very difficult. I have invariably done my best to spare the smallest nerve fibre, and when the nerve is incompletely divided I join it up partially with every regard for the remaining fibres.

I only did complete suture in two cases of divided sciatic. The first was completely divided and the two ends, swollen and clublike, were 3 cm. apart. The second was three-quarters cut through, only a frail band remaining.

The results are usually long delayed, though they may be more rapid where the nerve is gripped by fibrous tissue; they are very long in becoming manifest when the nerve is completely divided.

Vascular Lesions.

Under the term "diffuse secondary aneurysmal haematoma" I described in the *Presse médicale* for February 11th of this year a special form of haematoma which only makes its appearance from three days to three months after the infliction of the wound. I have been called upon to operate in a fairly large number of these cases of haematoma, the clinical characters of which are: (1) delayed appearance; (2) sharp pain radiating throughout the limb, due to stretching of the nerve trunks; (3) anaemia varying according to the size of the haematoma; (4) apyrexia. The rule I follow is to open the pouch and tie the two ends of the damaged vessel after rapid removal of the clots. But in certain cases of large haematoma the anatomical relations are destroyed, while in others the ends of the vessels are shrivelled and undiscoverable, or, after removal of the clots, the cavity turns out to be very deep, so that it is impossible to apply the ligature. Under these conditions ligature of the artery above the lesion yields the best results.

Extraction of Foreign Bodies.

Among the numerous projectiles that I have been called upon to remove fragments of shell were the commonest, then rifle bullets and the round shrapnel balls. In one instance I removed from the calf a bit of wood 8 cm. long; in another, after opening up a very septic track in the buttock, I lighted upon a square-headed hobnail.

Shrapnel balls, and particularly fragments of shell, invariably cause septic wounds, because they always carry in bits of clothing. It is a common experience, when we are called upon to remove a splinter of shell a long time after the infliction of the wound—by which time the track of the missile has quite healed—to find it encysted in a pouch full of pus of very attenuated virulence. We must therefore proceed very cautiously when called upon to remove bits of shell or shrapnel balls lodged in or near a joint. The breaking down of the protecting adhesions in this case may determine suppuration of the part as a whole.

Bullets sometimes break up, especially when they strike a bone, or ricochet before entering the body. In such case we sometimes find the envelope of the bullet more or less torn open and fragments of lead disseminated in the tissues.

Among the interesting cases of projectiles which I have had to extract I may mention (1) a rifle bullet lodged behind the sternum opposite the third rib; one inside the hip-joint; two in the knee-joint; one in the elbow-joint; another in juxtaposition to the left axillary artery, under the pectoral muscle; (2) a bit of shell in the left pleura; a fragment of shell weighing 350 grams under the fractured left scapula, where it had lain twenty days; another between the two condyles of the femur in front; (3) a shrapnel ball implanted in the small trochanter, one in the knee, etc. I should like to call attention to the method of extracting projectiles under the radioscopic screen devised by Dr. Vulyamoz, which has been of the greatest service to me.

AUSCULTATION OF THE HEART OF THE RECRUIT.

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THE issue by the War Office of a memorandum on the significance of abnormal signs in the heart of the recruit, and the papers on that subject in the *BRITISH MEDICAL JOURNAL* of October 30th, 1915, suggest that possibly it may be of use to reproduce what I wrote thereon in an article on auscultation of the heart in *A Dictionary of Practical Medicine* in 1890.

I have made no alterations, but have omitted certain sections dealing with conditions unlikely to be met with in the recruit. The italics are in the original.

All murmurs should be timed by the carotid pulse, *not by their relation to the apex beat.*

Cardiac murmurs may be present without structural change in the valves or orifices, especially in anaemia and chlorosis, and when the action of the heart is excited.

Sounds closely resembling those resulting from organic disease of the valves, but really produced outside the heart, are of frequent occurrence, and are termed *false* or *cardio-pulmonary* murmurs.

The various conditions which may give rise to these murmurs may be classified thus:

1. Displacement of, or pressure upon, the heart, the result of disease of the (a) lung, (b) pleura, (c) thorax, or (d) abdomen.
2. Effusion into the pleural cavity.
3. Changes in the pleura of the praecordial area.
4. Changes in the lung overlying the heart.
5. Changes in the pericardium.

4. *Changes in the Lung overlying the Heart.*—... a systolic murmur about the apex of the heart which closely resembles the murmur of mitral regurgitation. The sound is caused by the impact of the heart upon the lung... producing an audible sound by displacement of the air in the bronchi. . . . It is almost always most distinct during expiration, is superficial, high pitched, and disappears when the breath is held after a deep inspiration, and often becomes inaudible when the patient lies down. This murmur may sometimes be heard in the axilla and at the angle of the left scapula.

5. *Changes in the Pericardium.*—False murmurs, when due to chronic changes in that membrane, are frequently heard at one particular spot—namely, the sixth left interspace and over the seventh rib close to the base of the ensiform cartilage. Here the right ventricle is in contact with the chest wall, and it is on its anterior surface that the "white patch" is most commonly found. The sound produced by the movement upon each other of the pericardial surfaces at this spot is systolic in time, usually short, sharp, localized, and superficial; it seldom acquires a blowing character. In fact, it often resembles more nearly a rough reduplication of the first sound than a murmur. It is, perhaps, doubtful whether the altered sound, which is so commonly heard at this spot, is in all cases due to the presence of a "white patch" on the pericardium. It is especially common in emphysema with downward displacement of the heart. The effect of change of position upon this murmur is variable. It may disappear entirely when the patient is in the recumbent position, as often happens with friction sounds audible elsewhere over the heart, whilst at times it is hardly at all affected by such a change. When the heart is not displaced, a murmur presenting similar characters may often be heard in the fifth left interspace close to the sternum. Thickening of the pericardium of the left auricular appendix occasionally produces a rough systolic murmur in the second left interspace.

The following precautions should be observed in the examination of all cases presenting murmurs. Assuming that the presence or absence of those consecutive changes in the heart, which are almost invariably associated with disease of any given valve, has been noted, if there is still room for doubt, the following points must be observed carefully:

1. The exact period in the cardiac cycle occupied by the murmur. False murmurs are often not exactly synchronous with the commencement of systole or diastole; they may precede or follow the one or the other.