A Clinical Lecture

ON THE

VALUE OF RADIOGRAPHY IN THE DIAGNOSIS OF BULLET WOUNDS.

DELIVERED AT THE MIDDLESEX HOSPITAL.

BY

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The most mischievous instrument that can be used for the investigation of a bullet track is a probe. Mischievous, because the aperture of entrance—and of exit if the bullet has passed out of the body—soon becomes

Fig. 1.—(a) A Spitzgeschoss (natural size); it weighs 154 grains. (b) A Spitzgeschoss in section, showing the lead core and the nickel covering. (c) The nickel covering stripped from the bullet and twisted by impact against a hard body, such as a stone. This was removed from a soldier's hand.

very little was known of the injuries inflicted by the sharp-pointed bullet known as the "S" bullet, or Spitzgeschoss, used by the Germans. It is sharp-pointed, and has a much higher initial velocity than bullets of an older pattern. The Spitzgeschoss has a solid core of lead enclosed in a nickel case deficient at the base (Fig. 1). It is necessary to understand the structure of this bullet in order to appreciate some of the injuries it inflicts.

The utility of radiography in detecting metallic substances embedded in the body and in the diagnosis of broken bones is beyond all question. At the 3rd London General Hospital we have been fortunate in having such a skilful and indefatigable officer as Dr. F. H. Humphris to help us. In my wards the use of a probe for investigating bullet wounds is interdicted. A careful inspection of the injured region is made with the eyes, and if there is only an aperture of entrance a gentle digital examination of the skin on the opposite side of the body, limb, head, or neck is made. In many instances the missile can be felt under the skin. Bullet wounds of the chest should always be examined in this way. When a bullet pierces both walls of the chest it may lie near the skin. If a

bullet enters the chest and there is no aperture of exit, the surgeon should carefully palpate the opposite wall of the chest; if he comes upon a patch of emphysematous crackling it will be an assurance that both walls of the chest have been perforated, and it will enable the bullet to be localized and extracted. Some bullet wounds are curious in the way they traverse regions of the body where big vessels and nerves are crowded together and yet the important structures often escape injury. In the routine description of bullet wounds it is customary to state that a single bullet may make four wounds; for example, a bullet sometimes passes through both legs; in this way there are two apertures of entrance and two of exit. A hussar under my care had five wounds from one bullet. It passed through both buttocks, leaving four holes, and in passing across the interspace between the two buttocks it chipped a piece of skin off the posterior aspect of the scrotum. The soldier recovered. When a bullet lodges in soft tissue a small quantity of clear serous fluid accumulates around it. This is often a guide to the surgeon when he hunts for a bullet, either rifle or shrapnel; the sudden escape of some clear fluid into the wound indicates its lair.

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A troublesome and often painful wound is caused by the nickel covering of a bullet. When an "S" bullet hits a hard object, such as a stone, and glances off, it is "deformed," the nickel covering strips, and becomes twisted into fantastic shapes (Fig. 1, c). When such contorted pieces of nickel penetrate the body they produce unpleasant wounds. The extensive wounds caused by such deformed bullets are responsible for some of the injuries erroneously attributed to expanding bullets. I have seen examples in the hand, groin, and foot. Occasionally the leaden core of a glancing bullet will break up into minute fragments; pellets of this kind have destroyed many eyes. The case of a shrapnel shell is sometimes reduced by explosion almost to the fineness of sand. Small, irregular fragments of such metallic sand driven with violence are fearfully destructive to eyes. Bullets often convey more tangible things into wounds than micro-organisms. If a bullet strikes a man's pocket it will carry in fragments of the things contained therein—such as matches, a button, fragments of a pipe, or a piece of a tobacco pouch, beside pieces of cloth, leather, coins, etc.

In order to

convince you

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ing facts

will serve:

A soldier in

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like shadows, often misleading. For example, a soldier had an aperture of entrance over the internal condyle of the left femur. An x-ray examination revealed a bullet lying in relation with the condyle (Fig. 3); it required several plates to determine accurately whether the bullet was lying in front of or at the back of the bone. It was

Fig. 3.—A bullet lodged in the femur near the adductor tubercle. The bullet turned a somersault in its flight and entered the thigh base first. From the radiographs it could not be decided whether the bullet lay in contact with the femur or was embedded in it.

also conjectured that the bullet had turned a somersault before entering the limb. When the parts were exposed in the course of an operation the bullet was found firmly embedded in the condyle near the adductor tubercle, with the point looking towards the aperture of entrance. The bullet had turned a somersault in its flight before it struck the limb and entered the leg reversed, that is, base foremost. Fortunately the damage it inflicted was trifling, and the recovery quick as well as uneventful.

The evidence afforded by a skiagram of the nature of the foreign body is invaluable.

A soldier was admitted with a painful wound of the big toe caused by the bursting of a shrapnel shell. A skiagram showed an irregular-shaped piece of metal embedded in the head of the metatarsal bone of the big toe (Fig. 4). The man suffered intense pain until the fragment of metal was extracted.

The same batch of wounded included a soldier who had been injured in the fighting on the Aisne by the bursting of a shell. He had an elliptical hole in the middle of the calf over the most prominent part of the fibula. The wound had become septic and small pieces of bone protruded from it. The skiagram (Fig. 5) showed that the middle of the fibula had been reduced to small fragments and a piece of metal, 5 cm. square, could be easily seen 2 in. above the ankle-joint. The wound after being daily irrigated with hydrogen peroxide solution cleared up, and with the help of an anaesthetic I enlarged the wound and removed the fragments of the bone, but failed to find the piece of shell. The search was not unduly pressed for fear of widely infecting the tissues of the leg. The soldier appeared to be making a good recovery, but twenty-one days later I noticed some oedema above the external malleolus; the skin was incised, some pus escaped, and from a locus, near the malleolus, I removed a big fragment of copper. An ordnance officer, who examined it, expressed the opinion that it was a piece of the driving band of one of the shells ejected by the huge gun named by our soldiers "Black Maria."

In cases where there is clear evidence that a bullet

has traversed the whole thickness of the limb and left a clean punctured hole of entrance and of exit, a good radiograph gives us a picture of its track in relation to bone. The effects of bullets on bones vary enormously, and at present I am unable to satisfy myself on what these variations depend. For example, an officer was wounded in the thigh at Ypres; a round aperture of entrance was present on the front of the thigh 7 cm. above the patella. On careful palpation of the skin at the back of the popliteal space I could make out a tender spot. I suspected that the femur had been perforated by a bullet, and that the missile was probably lying under the skin on the opposite side of the limb. A skiagram of the limb proved the accuracy of this forecast. (Fig. 6.) A canal had been made by a shrapnel bullet completely through the shaft of the femur, and the bullet lay immediately beneath the skin. It was extracted a few days later.

The next bed was occupied by an officer who had received a bullet wound in the left shoulder. A round hole in the skin, immediately over the head of the bone, indicated the point at which the bullet entered, and a widely gaping elliptical opening, at a corresponding spot on the back of the shoulder, marked its exit. On admission, both wounds were septic, and a fragment of bone blocked the posterior opening. The whole limb was enormously swollen. A radiograph showed that the upper half of the humerus had been broken into a number of small fragments, and the lower half was split longitudinally. A week later I enlarged the openings made by the bullet, extracted more than thirty fragments of bone, and stuffed the cavity with lint soaked in iodine. The nerve trunks are uninjured and there is good reason to hope that this officer will obtain good, though restricted, use of the limb. Such an example of great comminution of bone is caused by a bullet that becomes "deformed" on striking a hard bone, then the leaden core breaks up and acts like a charge of shot.

A consideration of these two cases raises an important question—important because opposite opinions are expressed by surgeons in regard to the removal of missiles and fragments of bone. Some impacted missiles cause pain; others cause no pain. The soldier prefers to have the offending bullet in his pocket than in his body. This may be a matter of self-conceit. A wound or a scar must often be taken on trust; the exhibition of a bullet is something more than circumstantial evidence. The desire on the part

Fig. 4.—An irregular fragment of shell embedded in the head of the metatarsal bone of the big toe.

Fig. 5.—A fragment of the huge shell emitted by a "Black Maria." It has reduced to fragments the middle portion of the fibula. The pieces of bone and the square of copper were removed. The soldier recovered, but his foot was in the condition of talipes equinus.

of the patient to see the bullet sometimes leads the surgeon to take great pains to extract a bullet. I think it is good practice, in the majority of cases, to remove foreign bodies, but in this, as in surgery generally, no hard and fast rules can be laid down, experience and judgement should guide our actions. A foreign body in a wound often keeps up a discharge and maintains a fistula. The spontaneous escape of the foreign body, or its removal, is followed by rapid healing. This is equally true of a

compound comminuted fracture; free incisions and removal of minute fragments of bone are attended with relief of pain and promote healing.

In dealing with wounds caused by projectiles there are some facts that quickly impress themselves on the mind. The size of the skin wound that admits the missile is no indication of the amount of damage sustained by the tissues, hard and soft, in its track. No attempt should be made to ascertain the amount of damage by manipulation, by insertion of a finger into the wound, nor by a probe. An *x-ray* examination saves infection, pain, and much misery.

A bullet moving with a high velocity will traverse a limb and perforate a large bone like the femur and cause very little disturbance; or it may catch a nerve, an artery or a vein and produce instantly unmistakable signs. A man under my care received a bullet wound just below the angle of the left orbit, it emerged between the right styloid and mastoid processes, causing palsy of the right facial nerve. He soon became convalescent, but the facial paralysis persists. The small amount of injury that puts a soldier out of action has also impressed me. A bullet hits a man on the tip of the finger, carries off the nail, and splits the

terminal phalanx. We have had many injuries of this kind; they quickly become septic, and the soldier is invalided with a whitlow for several weeks. In these apparently trivial cases an *x-ray* examination is exceedingly useful.

Fig. 6.—The femur of an officer wounded at Ypres. A shrapnel bullet had entered the thigh, traversed the femur, and lay under the skin in the popliteal space.

Incidentally references have been made in the notes of the cases in this lecture to the modes of treating septic wounds so frequent in the soldiers wounded in this war. It is of course impossible to treat such wounds aseptically. The employment of antiseptic solutions is urgent, and it is remarkable how quickly the wounds clear up under solutions of carbolic acid, boracic fomentations, and especially hydrogen peroxide. Tincture of iodine has proved very useful, and especially a combination of carbolic acid solution (1 in 60) and tincture of iodine a drachm to the pint. The wise surgeon does not put his whole trust in any routine measure whether it be styled antiseptics or asepsis. He adapts his methods to the necessity of the case. It has been suggested that

the value of antiseptic methods is underrated by some surgeons and runs the risk of being forgotten, and, decades hence, some enterprising surgeon will rediscover it. The idea is unthinkable. Antiseptics cannot be rediscovered for it cannot be forgotten.

THE THRESHOLD OF DISEASE.

AN ADDRESS DELIVERED TO THE MEDICAL SECTION
OF THE ROYAL ACADEMY OF MEDICINE IN
IRELAND ON NOVEMBER 20TH, 1914.

BY

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MEDICAL science seems likely to advance in three directions—namely, first in gaining better knowledge of the causation of disease; secondly, in the acquisition of facilities for more prompt diagnosis; and, thirdly, in the discovery of improved methods of treatment. It is to the second of these topics that I propose to direct your attention to-night.

Early diagnosis of disease is, we are all agreed, a matter of vital moment. It is important mainly for two reasons—first, because the neglect or misinterpretation of early symptoms often turns a slight case into a serious one; and, secondly, because the efficacy of treatment is in many cases proportionate to the promptitude with which it is applied. Amongst the “calamities of medicine”—to use Paget's phrase—failures to make and act upon an early diagnosis take a prominent place. Time lost in the field of disease is seldom regained, and the loss is both one of safety to the patient and of credit to the physician.

Let us first glance at a few of the simplest and most obvious cases before we penetrate to the heart of our subject. Chronic dyspepsia is the blight of innumerable lives, but its first beginnings are simple enough and tractable enough. The dyspeptic, unlike the poet, *fit non nascitur*. He does not often owe much to heredity. Either he has incurred dietetic error, or he has prematurely used up his original stock of nerve force. He may have eaten and drunken not wisely but too well, or, on the other hand, insufficiently; or neglected those important aids to health which the dental art supplies; or

his nervous energies may have been dissipated too soon by work, worry, or pleasure. Whatever be the cause, his digestive efficiency does not fail suddenly. The machine creaks often before it refuses to move. But the admonitions are commonly neglected. A timely warning to such persons to regulate their diet, take care of their teeth, and conserve betimes their nervous energy would save them much suffering, and, incidentally, deprive the world of a good deal of the literature of pessimism. Gout, unlike dyspepsia, owes much to heredity. It often gives warning betimes of the coming disasters to joints, kidneys, and circulation—warnings too generally ignored until the hour of nocturnal torture strikes. The late Lord Dufferin once said that his ancestors had drunk so much wine that he was obliged to drink water. Not all the scions of a gouty ancestry show a like power of self-control. An early diagnosis of a gouty tendency and of incipient gouty manifestations, and suitable action thereon, will not always banish the enemy, but they may do something to keep him at bay. The chronic bronchitic has many warnings before his malady takes final hold. The victim of chronic rheumatism commonly makes light of his malady in the stages when treatment would be most efficacious. There are obvious cases which suggest their own moral. I pass on to consider some more difficult problems.

I wish to deal with a few cases where the failure to make an early diagnosis is due, not to the carelessness of either patient or doctor, but to the inherent difficulties of the case. I have selected four examples where an early diagnosis raises problems, always difficult, sometimes insoluble, and I have purposely selected them from widely different departments of medicine. The cases are as follows:

- (a) Endocarditis.
- (b) Cancer of the stomach.
- (c) Disseminated sclerosis.
- (d) Pulmonary tuberculosis.

I believe we may study with profit the problem of early diagnosis in these four diverse fields.