REMARKS

ON

THE INSTRUMENTS DESIGNED FOR EXPLORING
GUN-SHOT WOUNDS,WITH A VIEW TO DETECT BULLETS OR OTHER FOREIGN
BODIES SUSPECTED TO BE LODGED IN THEM.

By T. LONGMORE, Esq., C.B.,

Professor of Military Surgery at the Army Medical School, Netley.

THERE are two distinct surgical operations which have to be adopted in proceeding to treat cases of suspected lodgment of foreign bodies in gun-shot wounds, as well recent as chronic wounds. The first is that of *exploration* of the wound, or the operation of determining with certainty that the supposed foreign body is lodged in it, as well as its exact situation; the second is that of *extraction*, or the operation of removal of the foreign body, after the fact and site of its lodgment have been established. The means of exploring for a foreign body, and of extracting it, are often combined in one and the same instrument. Nearly all bullet-extractors admit of being used for purposes of exploration; but, on the other hand, various instruments have been devised as explorators which do not answer the purposes of extractors. These latter instruments have been designed to meet the special requirements of particular cases.

Under ordinary circumstances, whenever a gun-shot wound is large enough to admit of the insertion of the surgeon's finger, this alone should be used for exploring purposes. No artificial instrument can give the same amount of information, or afford information so precise, with regard to the lodgment of foreign bodies and their nature, as the surgeon's finger can give. Should the opening of entrance of the projectile be too contracted to admit of its easy insertion, as will sometimes happen when the wound has been caused by a bullet of small diameter, such as the Chassepôt rifle-bullet or a pistol ball, the surgeon's finger should not be thrust in with undue force, which will be hurtful in many ways, but an incision to the necessary extent should be made at the margin of the wound, extending through the fascia, to facilitate its ingress. When, after insertion, the finger fails to reach sufficiently far, owing to the depth of the wound, the exploration is often assisted by pressing the soft parts, especially if the wound be in one of the extremities, from an opposite direction toward the finger-end.

In making the exploration, the finger should be inserted slowly and steadily towards the deepest part of the wound. During its passage, the surgeon should carefully observe whether any foreign body appears to be pushed before it, or to be lying by the side of the track of the bullet, and should note any other peculiarities of the wound. He should also ascertain whether the end of the track is reached; and, if this is found to have been arrived at, a careful circular sweep of the finger-end will then usually settle if any, and what, foreign bodies are lodged. The surgeon should not withdraw his finger until the course the projectile has taken, the injury it has done, the complications of the wound such as the presence of foreign bodies, and, in such a case, their kind and situation, have been decided by him; the exploration will then be completed by one operation, and a second insertion of the finger for the purpose, which is always irritating to a patient, will be avoided. Nothing can be simpler than the exploration of a gun-shot wound by the finger; yet, simple as it is, very different results may follow the operation according to the manner in which it is performed; if done carelessly and impulsively, it will be done roughly, will cause proportionate bruising, pain, and, after all, convey only imperfect information; if done thoughtfully, these hurtful effects will be avoided, while the knowledge conveyed by the manipulation to the surgeon will be definite, and generally of special utility in determining the proceedings to be afterwards adopted.

If the finger be not sufficiently long to reach the bottom of the wound, even when the soft parts have been approximated by pressure from an opposite direction, and when the lodgment of a projectile is still suspected, or some other point of doubt remains to be solved, such as the direction the projectile has taken in the latter part of its course, we are compelled to make a further exploration by other means. Generally, a long silver probe, that can be bent if required, and that can be guided into a definite direction at the will of the surgeon, will be found to be the best substitute for the finger. The probe should be used with great discretion, for, without care, it may readily be made to inflict injury on

vessels or on other structures which have escaped from direct contact with the ball, but have returned by their elasticity to the situations from which they had been pushed or drawn aside during its passage. It seems hardly necessary to observe that these directions for examining gun-shot wounds apply only to such as penetrate the extremities or extend superficially in other parts of the body; where a missile has entered any of the important cavities, such exploration would obviously be as useless as it would be mischievous.

In the majority of cases of gun-shot wounds there will be no difficulty in detecting the lodgment of foreign bodies, especially heavy ones, as bullets and fragments of shell, when the examination has been made early by the finger in the manner described. Sometimes, when the finger in the wound fails to find a lodged projectile, the particular spot in which it is lying may be detected simply by relaxing the muscular tissues, so as to give a loose and pendulous condition to the parts concerned, and then lightly tossing up the flesh at different points from below with the tips of the fingers. A bullet lodged among the soft parts will occasionally make its presence known, under such an action, by the impulse which its weight communicates to the top of one of the fingers when the parts which have been shaken upwards return to their previous position. Sometimes a gentle kneading pressure in the neighbourhood of the injury, assisted by information derived from the sensation of the patient, will lead to the detection of such a foreign body. Sometimes, as mentioned in the English official history of the Crimean war, when a lodged bullet could not otherwise be discovered, it was found by passing the flat palm of the hand down a limb. Its presence was occasionally detected in this way when the points of the fingers had utterly failed to feel it.

We come now to the cases in which the exploration by the surgeon's finger is altogether impracticable, and in which the use of the probe is attended with so many sources of doubt as to prevent any satisfactory conclusion in respect to the lodgment or absence of foreign bodies from being arrived at. These difficulties sometimes happen with wounds in situations where they might be least expected to be met with, but generally occur in such as have their terminations at or near some of the solid structures of the body. They are every now and then experienced in recent wounds, especially deep and narrow wounds made by small-bore rifle or pistol shot, but are more particularly so in chronic wounds in which foreign bodies are suspected to be lodged; wounds in which the original bullet-tracks have become contracted to narrow sinuses, and in which other changes have taken place rendering the directions of these sinuses tortuous or otherwise intricate. The finger may not be able to penetrate the small and constricted passage of such a wound; and the probe, even if it be enabled to traverse it, and happen to reach a hard substance, may fail to give the desired information as to its nature—whether it is striking against bone or the foreign body which is suspected to be lodged.

It may be readily ascertained by striking or rubbing a leaden bullet out of the body with a silver probe, and comparing the peculiar dull sensation conveyed to the fingers with the sensation experienced when a piece of bone is struck or rubbed, that one cannot under such circumstances be deceived with the eyes shut as to the respective differences between the two substances. But when the bullet or piece of bone is at the bottom of a wound, and the probe comes in contact with the side of the wound, especially if this side happen to be bone; or if the walls of the track be fleshy, and, while the probe is in contact with them, its extremity is pressed against bone which has become smooth and eburnated on the surface; or if any soft tissues intervene between the end of the probe and the object impinged upon it; it will be found such a complicated sensation is given to the fingers that the diagnosis is rendered exceedingly difficult and uncertain.

No more remarkable illustration of the difficulty of diagnosis just adverted to could be adduced, perhaps, than was afforded in the instance of the wound received at Mentana by General Garibaldi. In that case, the opening presented to the surgeon beneath the integument consisted of a fissure across the base of the inner malleolus. This fissure was not wide enough to admit a finger; and ordinary probes, when inserted, so failed to give satisfactory evidence on the important question of a foreign body being impacted in bone near the ankle-joint, that some of the ablest surgeons in Europe, after exploring with them, were led to declare that no bullet or foreign body had become lodged in the wound. And this occurred in a case where the opening made by the projectile was not much more, if any more, than an inch in depth, in which the track was not tortuous, nor among tissues of different kinds or of intricate arrangement, as frequently happens in doubtful cases.

M. Nélaton, after his visit to General Garibaldi, was led to think of various devices for determining whether the ball was lodged in the wound or not. His first idea was to obtain a steel probe cut like a file

at one extremity. He presumed that, by passing such an instrument down to the substance which was suspected by some to be the bullet, and by giving it a rotatory motion, sufficient would be brought away on the teeth of the file to determine its nature, whether bone or lead. At the same time that he was having this instrument made, he reverted to the idea of a chemical reagent, which had been tried before in similar cases of doubt, but without success. Acting on this notion, M. Nélaton applied to M. E. Rousseau, the chemist, to furnish him with some ample means of determining the presence of lead in a wound by chemical analysis. M. Rousseau then suggested the introduction of a body capable of bringing away a metallic impression, should metal be present, such as rough porcelain; thus making the metal capable of being recognised not only by chemical reaction, but by all its ordinary characteristic physical signs. This suggestion led to the construction of the instrument which, since its successful application in Garibaldi's case, has become known as Nélaton's probe.

Nélaton's probe consists of a slender rod of metal, five or six inches in length, terminated at one end by a small knob of white, unglazed, biscuit china. The other extremity of the probe is furnished with a small handle, grooved ridge-and-furrow fashion, in order that the finger and thumb may the more easily roll it between them, while the porcelain knob is being pressed at the bottom of the wound against the suspected foreign body. If it be a leaden bullet against which the porcelain is rubbed, a very distinct mark of lead is impressed on the latter, which is not easily obliterated. The bullet itself is thus caused to give ocular demonstration of its presence and place of lodgment. If the foreign body be iron, having a rusty surface, a stain of rust will be found on the china.

The round ball of china which is fitted to the Nélaton test-probes usually has a diameter of rather more than a quarter of an inch. This is often large enough to cause a difficulty in introducing it through the small fistulous tracks among fibrous tissues which are frequently met with as one of the chronic effects of gun-shot wounds. A sinus of this kind, unless connected with necrosed bone, usually leads to suspicion in the mind of the surgeon that it is prevented from becoming completely closed by the lodgment of some foreign body which passed along it at the time of the original wound. It is, therefore, just one of the cases in which such a test-probe offers itself as a valuable diagnostic aid to the surgeon, but where the size of the round china knob too often prevents the attainment of this object. A probe tipped with a piece of the biscuit china of less diameter, and more oval in form, is required for these narrow fistulous tracks. In a recent wound, the larger round ball is more convenient. It is not so likely to be impeded in its passage along the wound, and the impression made by the lead upon it is more obvious to observation.

The porcelain test-probe was much used during the war of the rebellion in the United States, and many favourable reports of the results of its employment have been published. A very ingenious modification of it, but one of doubtful practical utility, was manufactured during the war by the eminent surgical instrument-makers, Messrs. Tieman, of New York. In this instrument, the porcelain is placed at the extremity of a long flexible gum-elastic tube, which takes the place of the metallic stem in the ordinary probe. The length of the whole instrument is thirteen inches, the flexible part being nine inches long. By turning a screw at the handle in different directions, and by means of a mechanical contrivance concealed within the tube, the lower part of the instrument, at the end of which the porcelain is placed, can be caused to turn slowly round to the right or left, at the pleasure of the operator. It may be moved round so as to assume a considerable curve in either direction.

This instrument has obviously been designed with the purpose of applying the porcelain test in cases where the ordinary Nélaton probe cannot be used; more especially along deep and tortuous bullet tracks, whose ultimate direction is either uncertain or known to be turned from a straight course. The operator is supposed to cause the porcelain to search for the foreign body, as well as to identify it when found by bringing to light the usual evidence of its presence. I have only tried the instrument on the dead body, but the experiments have not been attended with favourable results. The chief sources of failure with it were found to be, firstly, the uncertainty concerning the direction taken by the end of the instrument when turned in search of the bullet among yielding tissues, at distances far removed from the aperture of entrance and from sight; and, secondly, the difficulty of applying sufficient force to get a metallic impression, even when the point of the instrument was directed against the foreign body, owing to the flexibility of the long tube at the end of which the button of china is placed. Another difficulty experienced was the following. If the china knob became entangled in the tissues at the end of a long track, or was prevented from moving freely by any cause, then the screw, not being able to act on

the extremity, caused the middle flexible portion of the instrument to become curved, so as to press on one side the soft tissues of the track of the wound, along which the probe had been passed. It was only through the displacement of the soft tissues being visible externally after it had occurred to some considerable extent, that a knowledge was gained of the fact that the porcelain end was not moving in obedience to the screw, but only that part of the probe lying in the track of the bullet.

It is evident, from the nature of the porcelain test-probes just described, that direct and firm contact between the porcelain and a bullet is essential, in order that the former may furnish the evidence which the surgeon requires. If it be merely a little blood, serum, or soft coagulum, in front of the bullet, pressure by Nélaton's probe will squeeze it away, and the leaden mark can be obtained; but if any resisting medium, however thin—the thinnest membrane, for example—happen to be placed between the surfaces of the metal and the china, no impression will be made on the latter. And there are various substances which are liable to be so interposed—such as muscular or cellular tissue pushed by the knob of porcelain itself before it; pieces of linen, cloth, paper, or other substances which have entered with the bullet; a piece or edge of bone projecting in front of it, and other such matters. The evil in such occurrences may not simply be the impediment to obtaining an impression from the lodged bullet; but possibly a surgeon may be led to an erroneous conclusion that he has obtained proof of no foreign body being lodged, because the usual evidence of its lodgment is absent from the porcelain. This may lead to delay in the healing process and protracted suffering to the patient, which might have been avoided had a more correct diagnosis been arrived at.

[To be continued.]

CASE OF FRACTURE OF THE ATLAS FROM GUNSHOT INJURY.

BY WILLIAM STOKES,
Surgeon to the Richmond Hospital, Dublin.

IN the following brief narrative of the case of the late Constable Talbot, I am indebted to Mr. Agmon Vesey and Mr. J. Walker for a record of many particulars connected with the case, which were noted by these gentlemen, who had the best opportunity of accurately recording them, in consequence of the unremitting attendance they bestowed on the patient, from the time of his admission into hospital up to the period of his death.

Thomas Talbot, aged 44, a large powerfully built muscular man, was admitted into the Richmond Hospital on Wednesday morning, July 12th, 1871, between 12 and 1.0 A.M., suffering from a gunshot-wound of the neck, which he had received about an hour previously to his admission. He was helped into the out-patient room of the hospital by Inspector Gorman and another constable, and immediately afterwards was seen by Mr. Vesey. The patient seemed weak; and, blankets being laid on the table, he was placed on it in the horizontal position. There had been some bleeding from the wound at the station-house in Green Street; but the amount of blood lost was inconsiderable, and at the time of his admission into hospital the hæmorrhage had completely ceased. The patient was perfectly conscious, spoke clearly and distinctly, but was greatly depressed in spirits, and even then despaired of his ultimate recovery. The temperature of the body was normal, with the exception of the feet, and to these a hot jar was applied. Immediately after this, at the patient's request, the surgeon who was on accident duty that day, Mr. Hamilton, was sent for; but as he happened not to be in town, Mr. Walker, who went for him, called for me. I accordingly went, and arrived at the hospital at 2.45 A.M. On my arrival, I found the room where the patient lay filled with people, chiefly police. On the room being to a certain extent cleared from the large and inconvenient crowd that had collected, I proceeded to examine the patient. He spoke slowly, but in a firm and distinct voice, and mentioned that he did not feel at that moment any violent or acute pain. On examining the wound, which I found behind the left ear, a little posterior to the mastoid portion of the temporal bone, I perceived a small round opening about the size of a fourpenny-piece, through which there was not at that time any sign of even an oozing of blood. His respiration was at this time tranquil, and the heart's action regular and strong. Under these circumstances, I considered it advisable to ascertain the position of the foreign body; and, having regard to the situation of the wound, if possible, to remove it. The