

cavity being merely filled with detonating powder, generally a mixture of chlorate of potash and sulphuret of antimony in equal parts, and closed with beeswax. This bullet used generally to burst after it had penetrated some distance into the animal's body and inflicted very deadly wounds, but frequently it either failed to explode or burst on impact, causing a large skin wound, but doing little serious damage at the moment; that is to say, it did not "stop" the charge of the tiger, though he might subsequently die of the wound. The second form was a most terrible projectile, and in my experience no soft-bodied animal fairly struck by it could do further mischief.

This bullet was cast in two parts, the base something like a thimble with a flat top, the apex conical, with a hollow leading down from the point. The base, or thimble-shaped end, was nearly filled with ordinary powder, then a piece of thin cloth was laid over the top, the apex was fitted in, and the two parts were then "swaged" together in a machine. There was thus formed a conical bullet, generally a 12 bore (that is, a bore that took a spherical bullet of 12 to the pound), with a charge of powder in the base, a thin diaphragm, and a hollow leading to it from the point. Down this hollow detonating powder was poured, and the hole closed with wax. This was a typical form of explosive bullet and most deadly in its effects. I shot a great deal of heavy game with it in India, and never lost an animal I knew I had struck. I have seen a stag 15 hands high hit behind the shoulder collapse on the spot as if its legs had turned into jelly. On one occasion I saved my life by killing a charging bear in dense jungle, dropping her within a few feet of me. In this case I observed smoke issuing not only from the wound, but also from the mouth and nostrils, and on opening the chest found the lungs and heart torn to pieces.

This was the true explosive bullet, and it was against it and similar inventions that the Geneva Convention legislated.

As I pointed out before, the Snider bullet, though not strictly an "explosive" bullet, became in its latter form equivalent to one, but it was never forbidden in warfare.

The next advance was the Martini-Henry rifle, with a hardened projectile of 0.450 diameter—the Snider was 0.577—with greatly increased velocity and penetration and a much lower trajectory. This bullet was complained of as not having stopping power—that is, it passed through the limbs or body without causing immediate collapse unless some vital part or important bone was struck. In European warfare this was of comparatively little consequence, as civilised man is much more susceptible to injury than savages. As a rule when a "white man" is wounded he has had enough, and is quite ready to drop out of the ranks and go to the rear; but the savage, like the tiger, is not so impressionable, and will go on fighting even when desperately wounded. The Martini-Henry was in use for many years, but was at length superseded by the Lee-Metford, the present military rifle of this country. This rifle has a bore of only 0.3 inch, the bullet being of lead surrounded by a jacket or covering of nickel, and, fired with smokeless powder, gives a very high velocity with a very low trajectory and immense penetration. As an instance of its extraordinary power I will detail an experiment I saw carried out at Enfield by Mr. Rigby, the then superintendent of the Government Small Arms Factory.

A strong wooden box, about 6 feet long and 1 foot wide and 1 foot deep, was constructed of 1 inch planks, screwed, and bound with hoops of iron. A sheet of india-rubber about a quarter of an inch thick was substituted for wood at one end. The box was filled with water, and a Lee-Metford bullet fired into it through the india-rubber. This was done to prevent the projectile from altering its shape. So tremendous was the energy that the bullet, in forcing its way through the water, displaced it so violently that it tore the box open, bursting the planks asunder and rending out the screws and nails.

It was also found that on firing into a dead animal the bones were frequently comminuted to an extraordinary degree, though on other occasions the bullet merely drilled a hole in passing through. This was the experience of our troops in India, and while in some cases terrible wounds were inflicted, in others little or no damage was done. There is the well-known instance of the "Chitrallee" who walked into one of our field hospitals to have his wounds dressed, when it was

found that no fewer than five Lee-Metford bullets had passed through various parts of his body.

The men felt that their weapons failed in "stopping" power, and that though they might hold straight and hit their adversary fairly, he was still able to charge home and perhaps cut them down.

Some experiments were then made at the Dum-Dum Ordnance Factory near Calcutta, when it was found that by leaving a small portion of the lead at the apex of the projectile uncovered, the bullet "set up" or mushroomed soon after impact and inflicted sufficient shock to stop the most determined Ghazi. This was effected either by removing part of the envelope or by putting merely a wrapper of nickel as far up the bullet as was necessary to enable it to take the rifling, leaving the lead bare at the conical portion.

In the last Soudan fight this was effected by filing off a small portion of the point or nose of the bullet, and leaving it flat and bare of envelope. In a similar way these bullets "set up" or mushroomed after impact, and gave the necessary stopping power.

It will be seen from the above that the Lee-Metford is in no sense an "explosive bullet," but merely a partially expanding one, and even now is not for a moment to be compared in its destructive powers to the Snider bullet, which was never objected to by the Geneva Convention or the Great Powers.

ACTION OF THE LEE-METFORD AT SHORT RANGES.

BY SURGEON-MAJOR C. M. THOMPSON, M.B., I.M.S.,
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IN your remarks in the BRITISH MEDICAL JOURNAL of March 19th, writing of injuries caused by the Martini-Henry and Snider rifles as compared with the new Lee-Metford, you say, "The more severe injuries produced by the latter, if indeed they prove to be more severe, depend solely on their much greater muzzle velocity."

I think it very questionable if wounds inflicted by the Lee-Metford and dum-dum bullet at short range are as severe as wounds inflicted by either the Martini-Henry or Snider rifles at similar range; my experience during the late Tirah expedition certainly goes to prove that they are not.

During the retirement from the Saran-Sar on November 9th a party of the 15th Sikhs, consisting of a British officer, a jemadar, and four sepoy, was fired into from a range of about 300 yards; of the whole party, the British officer only was not wounded. The wounds were undoubtedly inflicted by the Lee-Metford and dum-dum bullet. The jemadar was struck on the outside of the right thigh; the bullet passed through the muscles on the outside, but did not touch the bone. One sepoy was struck on the left side of the chest; the bullet entered a couple of inches above the nipple, and emerged between the scapula and the spinal column on the same level; another was struck in the fleshy part of the right buttock, the bullet passed through the muscles, but no bone was hit; another sepoy was struck in the lower part of the abdomen, and the hole of exit was through the left side of the sacrum. One sepoy was killed on the spot, and I had no opportunity of examining his body. In the case of the jemadar, and the sepoy wounded in the buttock and chest, the wounds of entrance and exit were all very small, about a quarter of an inch in diameter, or less; there was no sign of setting up of the bullet. All these cases recovered, and were sent down to the base hospital in a few days convalescent.

The wound of entrance was also small in the case of the sepoy hit in the abdomen, but in his case the wound of exit, through the sacrum, was about the size of half-a-crown.¹ Serious injury must have been inflicted on the abdominal or pelvic organs, as he only lived a few hours; the pelvic bones were smashed, but the fragments were not much displaced, and there was very little comminution; the bullet appears to have drilled a hole in the bone with radiating fractures.

These cases and others which came under my notice during the campaign lead me to believe that the dum-dum bullet at close range certainly does not set up, if only soft tissues are traversed; and that even if a massive bone be struck the

¹ The diameter of this coin is 3.2 cm.

resulting injury, though very serious, will compare not unfavourably as regards the possibility of recovery with similar wounds caused by the Martini-Henry or Snider rifles.

I have seen a good many penetrating wounds of the chest inflicted by Martini and Snider rifles, but I have never seen one recovery when the bullet passed through the lung. In all such cases that I have seen the patient either died within a few hours from shock or hæmorrhage, or subsequently from pneumonia or other complications. I attribute the recovery of the sepoy wounded in the chest, whose case I have quoted to the small calibre of the bullet and to the fact that there was no setting up. The small wound in the skin caused by the small bullet can be very effectually closed by the natural elasticity of the tissue and deep septic infection of the bullet track thereby prevented. The jemadar suffered so little from shock that he was able to walk into Camp Maidan, a distance of two miles; the sepoy wounded in the buttock had lost a good deal of blood before he was brought to hospital, and was suffering from shock, partly the result of that loss; the sepoy wounded in the chest was in a very precarious condition for some hours, suffering from profound shock.

I am inclined to believe that the high muzzle velocity of the Lee-Metford, associated with a bullet of small calibre, tends rather to drill a hole in even a massive bone than to smash it up into small fragments; and that at short range the dum-dum bullet does not set up, even if it impinges on a large bone.

THE ROENTGEN RAYS IN BULLET EXTRACTION.

By I. L. G. GILLANDERS, M.B., C.M.ABERD.

On February 11th I was asked to undertake a small operation. The patient, D. A., aged 14, whilst cleaning a pistol, accidentally shot himself (January 24th), the bullet lodging in



Fig. 1.

the palm of the right hand. The wounded hand had been subjected to the Roentgen rays on February 1st, the skia-

graph revealing the bullet lying in the second interosseous space close to the proximal ends of the first and second metacarpal bones (Fig. 1).

When I examined the patient (February 11th), I found the wound of entrance situated $\frac{1}{2}$ inch from the distal end of the third metacarpal bone on the palmar surface. The hand was œdematous, and the patient complained that he "was losing the power of his fingers."

The following day I operated, Dr. Tipper, Coldharbour Lane, acting as chloroformist. I made a free incision in the palm, carefully explored the first, second, and third interosseous spaces, but with a negative result. Then I controlled the chloroform, and Dr. Tipper operated. He also met with non-success. The operation was postponed, and next day the patient was taken to Mr. Glew's radiographic laboratory. I placed a strip of lead foil along the wound. Another skia-graph was taken which indicated the comparative relationship of my incision to the bullet (Fig. 2).

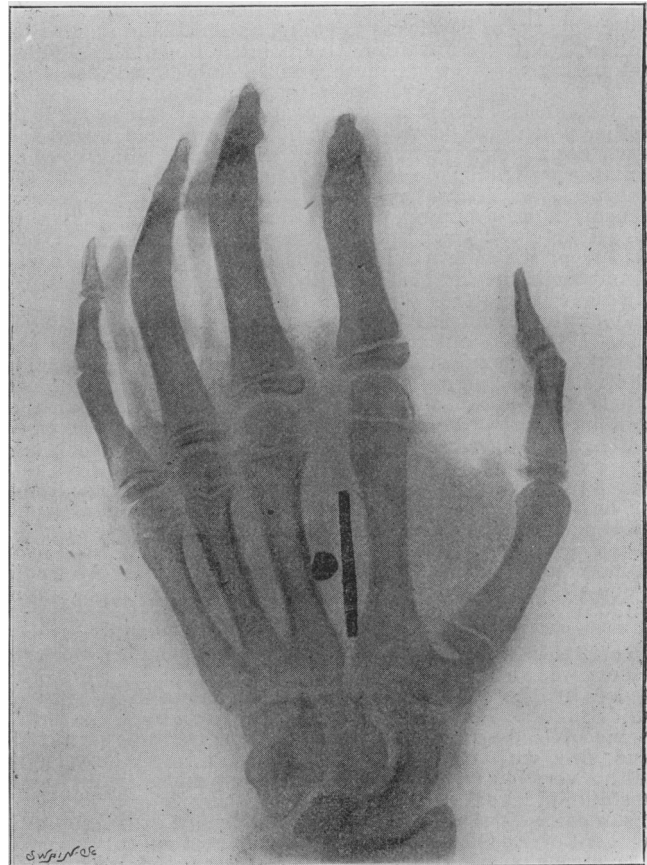


Fig. 2.

I then resolved to operate on the hand while the rays were actually passing through the tissues, and substituted the fluorescent screen for the sensitive plate. The strip of lead foil was removed, Dr. Tipper put the patient under chloroform, and the room was darkened. Mr. Glew controlled the Roentgen apparatus, and held the screen between me and the boy's hand. On introducing the bullet forceps into the wound a perceptible shadow of the instrument was thrown upon the screen, and my own hand appeared in skeleton outline. Removal of the piece of lead was a question of very few minutes. I was so struck by the success and rapidity of the operation that I venture to make the following suggestions with regard to the removal of foreign bodies.

First, that the direct use of the screen is preferable in many cases to operating by the aid of a fixed skiagraph, provided that the foreign body is lodged in the less dense tissues.

Secondly, that it is advisable to place over the skin a piece