A LECTURE
ON
SMALL-BORE RIFLE BULLET WOUNDS AND THE "HUMANITY" OF THE PRESENT WAR.

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WE are all, I suppose, a little prone to assume that what is new to us is necessarily new to everyone else; and that of what we have lately learned others must necessarily be ignorant. The mere fact that I mention such a truism may, however, be taken as a proof that I do not share in the belief. In this South African campaign—rather prematurely called in some quarters the Transvaal war—there are so many features of novelty that even the most cursory sketch of some may prove of interest. I do not, of course, lay claim to any profound knowledge or experience of gunshot wounds; and, in drawing comparison with the results of other wars, I have been compelled to resort to books and statistical reports. Fortunately, military medical statistics relating to losses in wars are uniformly reliable; and, indeed, are given with a merciless thoroughness. As far as regards the present campaign I have had a fortunate experience, for in the course of the past few months I have, I suppose, seen between 2,000 and 3,000 wounds—nearer the latter figure, I suspect, than the former. It is easy enough to waste time, for war provides endless distractions and excitement, but during my time I stuck closely to work throughout, disregarding even the fascinations of Capetown. Everywhere, as I most gratefully acknowledge, I received the utmost courtesy and the utmost attention from high civil officials, from staff officers, and from the medical officers of all ranks. To them my very warmest thanks are due. My experience was principally, if not almost entirely, limited to the base hospitals and the stationary hospitals. It is there, after all, as it appears to me, that the civilian is best placed. There one can judge deliberately of organisation as a whole or of medical details; and it is certainly there that, free from the hurry and rush which are absolutely inseparable from work nearer the front, one can best study gunshot wounds and best watch the effects and results of treatment. My mission was a twofold one: first, to study the whole army medical organisation as it was working on a large scale in this present war; and the other was to learn all I could about the effects of gunshot wounds inflicted with the most modern weapons.

ARMY MEDICAL ORGANISATION.

You will pardon me if, on the first of these matters, I preserve silence, beyond making the one remark that it appears to me to be premature at present either to endorse or to question the criticism that has been made in some quarters of the army medical organisation as a whole, or on the other hand to join in the somewhat fulsome, or at any rate full, stream of eulogy and praise which is in other quarters lavished on the entire department. Efficient it is—that much I will say; more efficient beyond all question than any army medical organisation that has ever been in any campaign of any magnitude yet. But I hope that that will not prevent us in the future from striving to make it much better.

THE "HUMANITY" OF MODERN WARFARE.

It is often said that this is a humane war. I am disposed to take the remark as a sort of text for my lecture, and to consider from a broad standpoint the question of the humanity of this war. That statement is chiefly founded on the fact that modern small-bore gunshot wounds display remarkable features; that wounds do well; that operations do well; and that many of the recoveries that have taken place are undoubtedly very remarkable.

Professor Bruns anticipated, as the result of a series of experimental observations made a few years ago, that the next war would be a humane one. The experiments were made on the dead bodies of men and horses. Bullets were fired into them at known ranges, and the effects were noted. The weapons used were small-bore rifles. On the other hand, theorists like M. Bloch, in that remarkable work of his, *Is War Now Impossible?* takes absolutely the opposite view. He thinks war will be so inhumane that it will be impossible. Here we have contrasted the prophetic views of the practical man and of the theorist. I suppose that, judging by experience of the present campaign, in the whole history of literature no theory has ever been more astonishingly wide of the fact than that of M. Bloch has proved itself to be. One is reminded of an old remark of Ambroise Paré at the end of his treatise on gunshot wounds, "See, gentlemen, how I learned to treat gunshot wounds—not by books." Ambroise Paré did not underrate his own superlative merits; but he was a great and a wise surgeon, and recognised that there was but one way of gaining real knowledge of this class of injuries. Indeed, while the theorist is hopelessly wrong, the experimenter has already been shown to be very frequently far from right in his views.

There are other factors of the first importance to be taken into account besides the effects of these small-bore bullets. To these factors I wish first to draw attention. But, before passing on, I may say at once that it has been abundantly proved in the present war that the view is a correct one that the great majority of wounds are inflicted by rifle bullets and do not result from shell fire; that is borne out beyond all question.

SEPTIC DISEASES.

My point, however, is that the humanity of a war is not to be gauged solely by the nature of the bullet wounds. From the broader and purely surgical point of view, a war is humane or not according to the answer to be returned to this question: Are there or are there not present the great class of septic disorders, such as pyæmia, erysipelas, septicæmia, "hospital" gangrene, tetanus, osteomyelitis, and the rest? We know that these diseases are really preventable. Have we succeeded in preventing them? If they are absent, from my present point of view it may be regarded as a humane war; if they are present, as an inhumane one. Hitherto—and I desire to emphasise the fact strongly—these diseases have been almost if not entirely absent in this war. I cannot recall having seen a case of pyæmia or tetanus, or "hospital" gangrene, or osteomyelitis. A satisfactory condition of affairs, you will think. Such it undoubtedly is; and yet I wish at once to touch a discordant note, and to state my decided impression that in some parts of the seat of war wounds are not now doing quite so well as they did at the outset. To this I will allude again later on. Meanwhile, I wish to draw your attention to the various factors that have contributed to the exceptional results that have hitherto been obtained. One is the condition of our men. The sea voyage to the Cape told all in their favour. Of the weak and weedy striplings who, I had been assured, formed the bulk of our army, I saw hardly any examples. If they were put on board the transports in England, they had been got rid of before the troops were landed at the Cape. I saw regiment after regiment disembark; almost uniformly the men seemed a vigorous and healthy lot. The regiment in particular that I went out with, the Second Lancashire Fusiliers, were a remarkably fine set of men for the work in hand. The troops had, as a rule, been well fed on board, and they have, to say the least, been adequately nourished on shore. The good feeding of an army is of enormous importance. We may have in this campaign ignored, to our loss, some of the Napoleonic maxims, but the authorities have realised to the full one of the utmost value, to the effect that "an army moves on its belly."

COMMISSARIAT AND TRANSPORT.

Now, if one department may be praised unreservedly in this campaign more than another, it is certainly the commissariat department. The way they have done their work is marvellous. It seems to me that such a department has its full share of blame when things go wrong, but that it does not get its fair meed of praise when things go right. And on this occasion things have gone right. To those who have been working in hospitals this has been abundantly clear. The progress of a case of sickness and the behaviour of a wound form a very delicate test of a man's condition. As an instance of the difference that it makes whether men are well or ill fed, take the case of the Ladysmith garrison. On January 30th, 1900, there were, out of the Ladysmith garrison, in Intombi

and in Ladysmith itself over 2,500 sick and wounded in hospital—say, one-sixth of the force disabled through sickness and wounds. This condition of affairs was largely owing to the short rations—and the rations were short and uncommonly bad; there is no harm in saying so now. All the more honour to the garrison who stood it all.

Diseases complicating wounds were not much in evidence. The diseases that the medical officers have chiefly had to contend with are, in the first place, enteric. But the enteric is of the most terrible type that I have ever seen. Probably not far short of 30 per cent. of its victims died. Then there was dysentery in its various forms, some of it very mild, much of it not dysentery at all. There was rheumatism to some extent, but comparatively little malaria, save amongst the soldiers who came from India or who had seen service in malarious districts elsewhere. There were probably far more cases of pneumonia on board the transports on the voyage out than in the hospitals in South Africa, where the disease was but seldom seen.

Another factor is the transport. If the transport is bad, or if the conditions under which the wounded soldiers are conveyed back to the field, stationary, or base hospital be unfavourable, the cases are likely to do badly. On the whole the transport has been good. Sometimes the conditions were very trying, as, for instance, after the Spion Kop action, where, after the men crossed back over the Tugela to Spearman's Camp, they had twenty-three miles of rough country to traverse in dhoolies or ambulance carts before they joined the railway line at Frere. There was the same trouble after the action at Vaal Kranz, and after that at Pieters Hill, when the final relief of Ladysmith was effected. Again the battle of Paardeberg was fought a long way from the railway line and the nearest stationary hospitals at Kimberley. In all these instances the difficulties of the return journey and the difficulties of transport were very great. The condition of the wounded soldiers on arrival was proportionately bad. At the extreme front the conditions were good. Never, I suppose, have more efficient and courageous stretcher-bearer companies been organised than in this war. It may be gathered that they were not easily kept in order. Many of them were refugees from Johannesburg and such-like places. All agree that the way they would go out under fire to fetch in the wounded men and the rapidity with which they would get them back to the hospital were deserving of the very highest praise. It would be very seldom that the ordinary stretcher-bearer companies could be got to show the courage under fire that these men did on many occasions; so the wounded were got back from the field quickly. The ambulance trains did their share of the work well. The Cape Government Railway officials worked with a will. On the Natal side that extraordinary organiser, Mr. David Hunter, the general manager of the Natal Government Railways, worked the transport with astonishing smoothness. Consequently the wounded were given every chance to do well.

The Climate.

The climate was absolutely the strongest point in our favour. Consider, in Natal alone, the heights at which the hospitals were. Maritzburg, where the great central base hospitals are placed, is at a height of 2,200 feet above the sea. Ladysmith itself is 2,300, Estcourt 3,000; and one of the best hospitals in South Africa, that at Mooi River, which is No. 4 General Hospital, the altitude is 4,500 feet. In the matter of climate no more perfect place for a hospital than Mooi River could well be imagined. The climate, whether in Natal or in Cape Colony, appears to be surgically almost sterile, a point of the very first importance. The same holds in Cape Colony; the hospitals stand high. From a few hours after leaving Wynberg the railway mounts up by a steep incline, and on to the high veld, a huge tableland which stretches away over the Karoo for hundreds of miles, until the slope begins to fall again towards the Zambesi. You therefore have a huge, elevated, dry plateau, the veld, at a height of 4,000 and 5,000 feet. In this warm, dry climate—sometimes very hot in the middle of the day, and very cold at night, but dry and with a sandy soil—the open-air method of treatment can be practised to an extent that I confess at first staggered me. One saw patients lying in the hospitals in the marquee tents with the door flaps open, and the tent looped up all round, with the windows open and the dust, if there was any wind—and there generally is wind—blowing through, but nothing bad ever came of it. The patients could be dressed, or undressed, or operated on for that matter, practically in the open air, and yet, if due precautions were taken against unnecessary chilling, no harm followed.

The Hospitals.

If one thing was proved more conclusively than another in the Crimean war it was the necessity for air space and light in hospitals, and the experience of this campaign has borne it out. The chief medical authorities have taken this lesson, at least, fully to heart, and their wisdom in so doing has been proved to the hilt. Whenever the climatic conditions permit I should give the preference to tents, of whatever pattern they be, rather than to huts even in base hospitals. Huts are necessarily more close. Public buildings, churches, schools, and the rest are far less suitable.

The wide distribution of the hospitals was another highly advantageous factor. In Natal the hospitals are spread over 180 miles, and between Cape Colony and Bloemfontein the line of communications, dotted over with hospitals, is 750 miles long. In South Africa good sites for hospitals can be found everywhere. Contrast with that the condition of things in the Crimea, where it was hardly possible to find a suitable place to pitch a hospital in the whole peninsula.

Another feature of the campaign itself, from the military point of view, has been in favour of the medical men at the hospitals. At no time has there been any severe strain on the hospitals. There have been a series of sharp engagements, it is true; but these were fought for the most part at distinct intervals and over a large tract of country. The strain was thrown equally on two separate hospital systems, one in Natal, the other in Cape Colony. Lord Methuen's battles at Belmont, Graspan, Modder River, and Magersfontein followed, it is true, quickly one after another. When I first went out, there were some 1,100 wounded in the base hospitals at Capetown, practically all of them coming from the Modder River district. But, though this aggregate was fairly large, the patients had not been all at once thrown on the hands of the medical officers. There had been opportunities of partially clearing the hospitals in front and the wounded had been sent down in batches. In Natal I question whether at one time a strain such as was anticipated could have been adequately met. There is no harm in saying so now, when the fighting in Natal is obviously over. A request had been sent down to get ready at least 5,000 beds when the advance was first made on Ladysmith. However, as it turned out, there were a series of engagements fought, and so the hospitals were never overcrowded.

Antiseptic Treatment.

With regard to antiseptics, this is really the very first war of any magnitude in which the antiseptic system has been used on a large scale. In the Russo-Turkish war it was employed on a small scale, but with the most admirable results, by some German surgeons. The results are even better in this war. There has been an abundance of surgical materials, and the organisation has been well managed, so that all the materials of one kind are not crowded into one place and all those of another kind into another place. The various packages have been intelligently made up, so that, for example, the whole of the chloroform has not been sent into Natal while all the cyanide gauze was sent to Cape Colony. Preposterous mistakes of the sort have before now occurred in war, even with English officials at the head of affairs. Dressings were lavishly supplied, and were lavishly, not to say extravagantly, used. Still, I take it, the British taxpayer will not mind that. In certain details, on the other hand, needless economy seemed to be observed. While the amount of dressings used in the hospitals was perfectly astounding, there appeared to me, to take a single instance, to be a most singular parsimony with regard to the issue of nailbrushes, apparently insignificant but yet really most important articles in a surgical ward or operating theatre. The medical men had often to provide their own. Those who know something of the peculiarities of military methods are aware that it will take you quite as much trouble and possibly quite as long to get a nailbrush as, say, 500 extra bedsteads. All the

men were supplied with field dressings; of the value of these I cannot say much, but I have no doubt they did some good. The dressings in the field hospitals were always abundant, but necessarily in the field hospitals the minute details of the antiseptic system cannot be very thoroughly practised.

With regard to the practice of the antiseptic system throughout this campaign I hardly know what to say; perhaps it will be best at present to say no more than this: that it is abundantly clear that the elaboration of detail which is found absolutely necessary in a London civil hospital may be, and perhaps is, pretty often dispensed with out there. Under less favourable conditions of climate and of the other surroundings I have mentioned they certainly could not have been disregarded with equal impunity. Yet it must not be supposed that all wounds heal by first intention there, and that everything goes on in the best possible way in the best of all possible climates. Suppuration was common enough almost from the first, and it became more abundant as time went on. Many cases of compound fracture came down to the base hospitals suppurating very freely. It is not likely that the behaviour of wounds will improve. Indeed, I think it is getting rather worse; it is worst on the Natal side, where the climate is not quite so good, and some of the hospitals are getting somewhat worn from use. Of course the progress of a fracture depends very greatly on the amount of disturbance of the parts rendered inevitable by transport. But I saw nothing beyond suppuration, with high temperature, when pus was locked up in a wound, or when sloughs were separating from a wound. So soon as the offending part was dealt with—amputated, if necessary—the temperature sank and the case did well. Of pyæmia and septicæmia one saw nothing, and of tetanus nothing whatever; I do not believe there has been a case yet.

With regard to erysipelas, until yesterday I would have said that there had not been a case of erysipelas; but only yesterday I received information of the death of a young officer whom I saw in Natal, from whom a bullet had been extracted, and who died, I regret to say, according to report, from erysipelas. The circumstances I do not yet know, but I must say it seems to me that even if it be a single isolated case it is still of very grave import. I only heard of this long after I had thought upon the subject, and ventured to predict that the cases were not doing so well, and that the staff must keep a sharp look-out for graver septic complications. In some of these the cases are very septic; the septicity was not matter for much surprise. For example, there were some Boers who had been wounded at Paardeberg in the Kimberley Hospital—an admirable hospital—who were not received until a fortnight after the action. Two of them had compound comminuted fractures of the arm involving the elbow. So far as I could learn the only dressings they had applied had been tobacco juice, with tobacco leaves over the wound. They preserved their limbs, but whether in consequence of the tobacco juice I cannot tell you. Indeed I believe they preserved their limbs chiefly by declining altogether to part with them. Ultimately, although at one time the cases did not look at all hopeful, they were on the mend.

The Proportion of Wounded to Killed.

Professor Billroth, writing only a few years ago about the next great war, was convinced that there would be an increase in the number of wounded owing to the adoption of small-bore rifles. He thought too that the proportion of severely wounded would be very greatly increased. That anticipation has not been borne out. The proportion of killed to wounded up to the present in this campaign is about the usual one—about one killed to four wounded. It has often been much higher than that. In the Russo-Turkish war the proportion of killed to wounded on the Russian side during the assault of Plevna was 1 to 2.1. There, as you will remember, the attack was made on an enemy in very strong position, the condition of affairs that has obtained in most of our engagements.

Deaths from Wounds.

The number of the deaths from wounds is, however, much more to the point. On this topic I must say a word, even at the risk of wearying you with figures, for on the "deaths from wounds" the health of the troops in the campaign may be determined, the efficiency of the hospital system estimated, and, from my point of view, the humanity of the war gauged. It is not merely by the severity of the wound that a particular bullet inflicts, or by the amount of laceration that it entails, that we should judge. We must first take into account wounds which are necessarily mortal, but in which it is possible to transport the patient to hospital. These are comparatively few. In this war, as in others, those who are not killed at once by some such injury as smashing up of the skull or injury to the spinal cord high up, die, if they die in the field, of hæmorrhage. Of the wounds which are likely to be returned as "mortal" we may take some, but very few, to be of the head. Either the man is killed at once or there is a likelihood of recovery. A large proportion of abdominal wounds prove fatal, perhaps 40 or 50 per cent. The same may be said of injuries of the spinal cord, but after a distinct lapse of time, after they get into the hospital. Wounds of the bladder have shown bad results in this campaign; and necessarily also bad compound fracture of the femur high up. But with regard to all the rest, if a man can get into the hospital wounded he has a chance of recovery unless he dies of one of those septic disorders. That is abundantly proved by the returns officially furnished. It is a curious fact that up to a certain date in March we had 4,934 wounded, taking non-commissioned officers and men alone. Now, in the Franco-German war, the Fourteenth German Army Corps up to a particular date had 4,344 wounded. The numbers are very similar. Of these 4,344 Germans, 617 died; and of our 4,934, 239 died. Put into percentages it comes roughly to this: a mortality of "deaths from wounds" amounting to 5 per cent. in our army, and in the Fourteenth Army Corps to 14 per cent. Of the 617 Germans who died, 304 died of pyæmia and septicæmia and 39 of tetanus. If we exclude, then, these preventable disorders, the mortality in the two armies is almost the same—namely, 5 per cent. in our army and 6 per cent. in the German army corps. This result is surely very striking and very instructive.

Shell and Shrapnel Wounds.

And now, with regard to the humanity of the wounds. I have nothing to say about shell wounds: they are very much as before. Comparatively few men are killed by them—at any rate it is a very costly way of destroying or attempting to destroy your enemies. More are killed by shrapnel. But it is abundantly clear on both sides that shell and shrapnel fire, and especially the missiles from quick-firing machine guns have a widespread demoralising effect on the troops.

Bullet Wounds.

Let us consider only the small-bore rifles. Of course, "small-bore" is only a relative term. The calibre of the Mauser is 7 mm., or 0.275 of an inch, and that of the Lee-Enfield 7.7 mm., or 0.303 of an inch. As regards efficiency, there seems very little to choose between the two rifles. It is of the bullet that I wish chiefly to speak. The core in both consists of hardened lead covered over with a mantle or envelope. The envelope in our bullet is made of copper nickel in the proportions of 80 per cent. of copper, and 20 per cent. of nickel. The diameter of the bullet is 0.311 inch. The diameter of the Mauser bullet is 0.284 inch. The bullets are therefore, so to speak, larger than the bore of the rifle barrel. As they are forced through by the explosion they "take the grooving" and the rifling of the barrel imparts the movement of rotation in the longitudinal axis of the bullet. I want you particularly to notice, as shown by the sections (Fig.) the relative thickness of the sheath or mantle. The sheath of the Mauser bullet is of steel nickelled over. Ours, as already stated, is of copper nickel.

There is no need to weary you with minute details. The main point is that in modern rifles there is an exceedingly high muzzle velocity. Roughly, the bullet leaves the muzzle of the Mauser rifle at a rate of about 1,500 miles an hour, which is pretty rapid going; at 1,300 yards the velocity works out at between 800 and 900 miles an hour. The muzzle velocity of our rifle is rather lower than that of the Mauser,

but the energy at 1,000 yards is greater. The trajectory is practically flat up to 500 yards—that is to say, if a man is in a trench and holds his rifle on the level close to the ground, the danger zone is 500 yards; in other words, the bullet will not rise more than 6 feet for the first 500 yards. The rifling is intensely sharp; there is a complete turn in 8.66 inches in the Mauser rifle and one in 10 inches in the Lee-Enfield, so that the rapidity of rotation communicated to the bullet is tremendous. The energy of the bullet also is enormous. The energy of a bullet, it is computed, depends on the mass of the bullet multiplied by the square of its velocity, so that a small bullet going with a high velocity may have as much energy as a large bullet going with a low velocity. The weight of the Mauser bullet varies from 172 to 175 grs., and that of our bullet is 215 grs.

Explosive and Expanding Bullets.

Much has been said about "explosive" bullets, and I think people abroad and at home have allowed their feelings to be carried away rather on the subject. No such thing as a truly explosive bullet has been used in this campaign by either side. Explosive bullets were forbidden altogether by the St. Petersburg Conference in 1868, to which England was a consenting party. I do not think the Transvaal authorities were consulted in the matter at that time, so possibly they might claim to be to a certain extent exempt. They have not taken advantage of the circumstance. An explosive bullet is defined to be one in which any missile under 400 grams (14 ozs.) is filled with any fulminating or detonating compound. No such missile has been employed on either side in the present war.

An "expanding" bullet is quite a different affair. There are many different forms. The hard mantle may be incomplete at the top of the bullet, allowing the lead core to show. There may be a cavity extending some way down the bullet and open at the top; or the steel or copper nickel envelope may be slit down the side of the bullet. A common form is the "soft-nosed" bullet. Here the mantle ceases a third of an inch or so from the point, and the lead core projects to that extent. There is no doubt that soft-nosed bullets have been occasionally—but I believe very rarely—used by the Boers. Here are specimens picked up in the Boer trenches at Magersfontein. Note, then, that an expanding bullet may be deliberately made as such, or that a properly covered bullet may with a little trouble be converted into an expanding bullet. For sporting purposes expanding bullets are used. Oddly enough, for big-game shooting expanding bullets are used because they are considered more humane. When used in war they are reckoned inhumane. The inconsistency, however, is only apparent. The sportsman's object is to kill his game and not to wound it. A wounded animal is likely to escape for the time, but to die after a long interval if disabled, for it cannot hold its own in the struggle for existence. A bullet, therefore, is required that has a "stopping" effect. Now, any kind of sporting bullet, such as the soft-nosed bullet, will, if it strikes anything hard, break up and deform, and sometimes if it meets with tough structures such as tendon, it will also "set up" in the same way. The projecting lead core of the soft-nosed bullet flattens out, and the bullet assumes more or less a mushroom shape. As the bullet is rotating while it inflicts the wound, the lead is commonly twisted in the longitudinal axis, and this increases the liability for fragments to break off. The mantle, too, strips up, sometimes becoming completely detached from the core. The torn edges of the hard sheath project. Obviously a bullet so deformed will lacerate more than when it is intact, and it injures the tissues over a wider area, and clearly, too, the liability to hæmorrhage is greatly increased. In soft tissues, therefore, the sporting bullet is very destructive, and the wounds inflicted are very serious.

Confusion arises from the fact that any form of high-velocity bullet may exert, under certain circumstances, an expanding or "explosive" effect. Thus, if a completely covered bullet strikes the shaft of a long bone it will exert an expanding action on the bone; but that is a very different thing from its being an explosive bullet, whether it be a soft-nosed or split bullet, or any one of the hundred kinds of sporting bullets. Again, if any form of high-velocity bullet be fired at short range into a skull, it will burst the skull more or less. These scattered fragments show the effect as obtained experimentally. The skull was filled with plaster, and a bullet was fired into it just as the plaster was beginning to set, and was of about the consistency of brain matter. On an empty skull no such effect will be produced. But the explosive action in the skull is not due to the explosive or expanding nature of the bullet. It is due to the high velocity and the extreme energy of the bullet, not to its particular form, a natural bullet is just as likely to produce this expanding effect as a soft-nosed bullet. Just the same character of effects is shown in the case of the long bones. I show some skiagraphs to illustrate the point. Here the bullet has struck the shaft of the humerus, pierced it, fissured and broken the bone in various directions, and spread the fragments asunder. On the long bones an expanding bullet is rather less likely than a normal bullet to produce this expanding effect. The sporting bullet may yet damage a bone more grievously, and it will inflict a far more lacerated wound. It has long been suspected that the results obtained by experiments on the dead subject would not be borne out in actual practice. Experience in this campaign has strongly proved the correctness of the surmise, and the specimens shown furnish evidence of the fact.

Broadly speaking the injuries caused in the living subject are less serious than would have been anticipated from experiments. In this respect, then, modern war is more humane than it was thought likely to be.

Skin Wounds.

Mauser bullets commonly make a clean hole or slit through the skin, and let in practically no air. Often, it appeared to me, though the view was questioned by some, the bullet knocks in a little flap of skin. Close examination of a scar often reveals a little crescentic mark different from the rest of the cicatrix. The bullet itself is sterile; attempts to get cultivations from it immediately after it has been fired have failed. It is very unlikely to carry any bits of clothing into the wound. The only shreds of clothing found in wounds that I have heard of are bits of the Highlanders' kilts, another argument against that inappropriate and indelicate form of clothing. Shreds of clothing are very likely to be highly septic. The Mauser bullet will go through the skin and soft parts so cleanly that you cannot tell the apertures of entrance from those of exit. At a long range the speed of rotation begins to diminish, and the bullet begins to wobble while still preserving a straight course as it goes through the air. It is less probable then that the aperture of exit will be identical in appearance with that of entrance, but in the bulk of cases you cannot tell one from the other. I can recall the case of one man who was hit by a cross-fire shot in that portion of his frame which, in the words of Ingoldsby, it is considered equally indecorous to turn to a friend or a foe; and where, if I remember right, one of the combatants in the famous triangular duel in *Mr. Midshipman Easy* also met with a similar injury. The patient had four wounds from a single bullet in the gluteal region. All four scars were absolutely identical. John Hunter noted that the orifice of exit of a round bullet very often healed before the orifice of entrance, but I could notice no such difference in the wounds I saw.

The question of exploding and expanding bullets is a very old one. It comes up at every war. At Waterloo the French were accused—and they, of course, accused us also—of using cut bullets, which broke up in the wounds, as you can read in Sir H. Maxwell's *Life of the Duke of Wellington*. The same recriminations went on in the Crimean war; and again in the Franco-German war. They have been used in this campaign; there is no question about that, for we have it on the most unimpeachable authority possible—Lord Roberts himself—who would never bring the charge unless satisfied by the most irrefragable evidence. But, I repeat, for I wish to emphasise the opinion, that such forbidden bullets have been very rarely used. Often, no doubt, at the outset of the campaign, extracted bullets were perfectly honestly supposed to be of the expanding form when they were merely normal bullets that had deformed in striking a bone, or were possibly ricochet shots. Nor have "express" and large-bore bullets been employed against us save in the rarest instances. I have seen two or three express bullets extracted from patients. There is this one enormous difficulty about their use: that an army on active service cannot have

half a dozen different kinds of rifle ammunition; unless there is uniformity of pattern there would be endless confusion. Such confusion there was in the Crimea, when half were armed with the Minié rifle (so-called, though Captain Minié did not invent the rifle but only the bullet fired from it) and half with the old brown Bess.

INJURIES OF LONG BONES: AMPUTATIONS.

Specimens of bullets which caused fractures and have been extracted show that the natural Mauser bullets may be deformed and resemble expanding bullets after having struck the bone.

Closely bearing on injuries of long bones comes the subject of amputations for those injuries. The figures of course are not yet to hand for this campaign, but I believe that the results of amputations in this war will be very remarkable indeed, and contrast in the most marked manner with those of former wars. In the Peninsular campaign the results were fairly good; in the Crimea they reached the lowest ebb I suppose that surgery will ever reach as regards results. Out of 1,666 amputations of the thigh done in the French army, 1,531 died; the mortality was 91.89 per cent. The mortality on our side was 65 per cent. In the American Civil war the mortality after amputations of all kinds was 64 per cent. We may, I think, safely anticipate that the mortality in the present campaign will at least be twice as low; so it is not only the bullet wounds that heal well, but also the wounds caused by operations. Here, much more markedly than in the case of punctured wounds due to bullets, the surgeon is favoured by those conditions to which I have already drawn attention, and of course by the fact that pyæmia, osteomyelitis, and so on, are conspicuously absent.

WOUNDS OF JOINTS.

I can only now allude to the subject of joint wounds, though these injuries are of vast interest. Speaking of the Crimean war, Surgeon-General Sir Thomas Longmore said that not a single patient with a wound of the knee-joint recovered with his life and his limb. If the limb was amputated, he had a better chance than if conservative treatment was adopted. But remember 65 per cent. of our cases died after amputation of the thigh. If the limb was not amputated, the man died of the knee-joint wound. In this war I do not think I have seen a single death after a knee-joint wound, and wounds in which the bullet has unquestionably traversed the knee-joint are common. The bullet nearly always pierces the patella cleanly, and it appears to me to make little or no difference whether the range is short or long. I have only seen one case in which it failed to drill a hole through the patella if it struck that bone. Hæmarthrosis usually follows the injury. Experiment shows that a Lee-Metford bullet can go clean through the knee-joint in the extended position without injuring any of the bones. The bullet in one case traversed the ligamentum patellæ. The specimen is of interest, for it has been denied that a bullet can traverse the joint without injuring bone save in the flexed position. There is the proof that it can. Case after case have I seen in which, beyond all shadow of question, the bullet has gone clean through the joint, and in which recovery has been complete, including perfect mobility.

In one extraordinary case a Highlander, wounded at Magersfontein, was shot through the knee-joint. There, I am bound to say, the kilt was a convenience to him. He fell down, saw a hole in his popliteal space, and saw the blood spurting out. His only cover was an ant heap. The moment he moved he was shot at, so he kept still. The bleeding had ceased spontaneously before he got an opportunity of applying his field dressing. He had to wait some twenty-eight hours before he was picked up. He was brought down to Wynberg, a journey of some twenty-eight hours, in the hospital train, followed by a drive up hill to the hospital. There the dressing was removed, and immediately blood spurted out very vigorously. It was found the popliteal artery was wounded. The man recovered.

Another case I saw where the knee-joint was wounded, probably by a shrapnel bullet, and suppuration followed. There was some necrosis about the head of the tibia, and the suppuration extended into the knee-joint through a small opening. In this case the knee-joint was laid freely open, and it was found that the whole of the synovial membrane was thickened and inflamed, looking as if the knee-joint was lined with a layer of thick crimson plush. I suggested to the surgeon in charge that it should be dissected out. My hint was taken, and I heard some time after that the man was making a perfectly good recovery. In the history of military surgery I do not think you will find many operations of the sort recorded. Great credit is due, therefore, to the civil surgeon who performed it. I am a little proud of having suggested the proceeding.

WOUNDS OF THE SPINAL COLUMN AND HEAD.

I did intend to make some remarks about the head cases, but my time has slipped away, and I must trust to be able in some future clinical lecture to draw attention to the subject. But I wish to show you an experimental specimen made by firing a bullet at very short range into the spinal column. The lumbar vertebra is extensively broken up. An exploding and expanding action has been exercised upon the bone by the bullet. The astonishing feature of the preparation is that it shows how a high-velocity bullet can pass between important structures without wounding them. Here the bullet has found its way between the aorta and the vena cava without wounding either. Without such evidence as this it would have been thought impossible that a bullet travelling at such high velocity could cross the track of important nerves or vessels without wounding them. Nerves, I may mention, will show the most profound effects and lose their functional power when a bullet has only passed close by them.

But into so large a subject I must not now enter, and I only allude to such injuries to show how much there is of interest in modern rifle bullet wounds. I hope to communicate some remarks on nerve injuries to the Royal Medical and Chirurgical Society in due course.

Of the head cases I will only say that the question seems to be settled altogether that trephining can be done with the utmost freedom and with the greatest advantage to the patient. Never, I believe, in military surgery, have so many trephinings been done, or with such admirable results, as in the present campaign. Yet trephining is an operation which so great an authority as Sir Thomas Longmore thought hardly justifiable in military surgery.

CONCLUSIONS.

I have given you a very cursory—I fear you will question the epithet if I say a brief—sketch of some of the features of surgical interest in this war. Possibly I have adopted too pessimistic a tone. I am conscious that I have not added my voice in any marked degree to the chorus of eulogy that has been almost unreservedly lavished on the Army Medical Department during the present campaign. I do not hint for a moment that such laudation is undeserved. It may be that I am somewhat of Sir Peter Teazle's advice when he remarked "Sir Oliver, Sir Oliver, this is a damned wicked world; and the fewer people we praise the better." But in all seriousness I dread lest the good surgical results be not ascribed fully enough to their proper cause. We know the fearful mortality brought about by overcrowding and by bad hygienic surroundings in the Crimean war, and, for that matter, in the Franco-German, Russo-Turkish, and other later wars. This campaign has already shown that these preventable disasters have been traced to their true source. Air, air, pure sunlight and air, have done more, much more, for our wounded in this war than seems generally to be acknowledged. I dread lest the Army Medical Department commended and patted on the back as it has been and is, may relax its efforts to improve further. If so a terrible awakening is in store for us when we next have to face the hideous horrors of war amidst unfavourable surroundings. But if we look on our present experience just as an indication that we are working in the right direction, then at least the medical profession may feel that it is doing—not that it has done—its best to contribute to the humanity of war.

Lest we forget.

WOMEN GRADUATES IN ITALY.—According to the *Riforma Medica* the number of women who have taken degrees in one or other of the faculties in Italian Universities from 1870 to 1897 is 129. Of these 64 graduated in arts, 15 in medicine and surgery, 15 in physical science, 14 in mathematics, 7 in philosophy, and 4 in law. Of the "sweet girl-graduates" in medicine, 3 obtained their degrees at Naples, 3 at Rome, 3 at Bologna, 2 at Turin, while Palermo, Pavia, Florence, and Pisa were each favoured by 1. In the academic year 1898-99 the number of women on the books of the various universities was 261. Of these 37 were registered as students of medicine, and 9 as students of pharmacy. Of the medical students, Florence and Turin had 7 and Rome and Genoa 5 each, Pavia 4, Naples and Catania 2 apiece, Parma 1, Messina 1, and Cagliari 1. Four women graduated in medicine in that year—2 at Turin, 1 at Florence, and 1 at Pavia.