Certainly it is very gratifying, particularly at this season of the year, that comparatively few cases have occurred. Among 2,000 German, English, and Belgian troops who have been, or are at present, in the base hospital at Oxford there have only been five cases of typhoid fever; and this, I believe, to be the experience in other large hospitals throughout the country. It will be a great triumph to go through this war without a devastating experience of typhoid fever. In the fighting line it is not possible always to ask the soldier to carry out sanitary precautions, and in a very infected country, even with the best of intentions, he cannot avoid exposure. Here we may expect to find the protective value of inoculation, and it is very satisfactory that the value of the measure has been so generally recognized by officers and men. An immense proportion of those who go with the Expeditionary Forces will have been protected—for a period at least. While with our present knowledge we cannot but regret that the inoculation has not been made compulsory, let us hope that a sufficient number have taken advantage of the procedure to make impossible a repetition of the enteric catastrophe in South Africa.

In the midst of this great struggle we stand aghast at the carnage—at the sacrifice of so many lives in their prime—

The many men so beautiful,
And they all dead did lie.

The bitterness of it comes home every morning as we read in the Roll of Honour the names of the much loved sons of dear friends. Strange that man who so dominates Nature has so departed from Nature as to be the only animal to wage relentless war on his own species. But there are wars and wars, and let our thought to-night be of the other army waging peaceful battles against our true foes. No one has so well contrasted the work of these two armies as the poet laureate of the profession, Oliver Wendell Holmes:

As Life's unending column pours,
Two marshalled hosts are seen—
Two armies on the trampled shores
That Death flows black between.

One marches to the drum-beat's roll,
The wide-mouth clarion's bray,
And bears upon a crimson scroll,
"Our glory is to slay."

One moves in silence by the stream,
With sad yet watchful eyes,
Calm as the patient planet's gleam
That walks the clouded skies.

Along its front no sabres shine,
No blood-red pennons wave;
Its banner bears the single line,
"Our duty is to save."

We shudder at the needless slaughter of the brave young fellows— allies and foes alike—but think of the slaughter which goes on in our homes, just as cruel as, often more cruel than, that of the battlefield! Tuberculosis alone will kill ten times as many this year in Great Britain than will die abroad for their country. Comparing the death-rate in England to-day with that of fifty years ago we may say that, as a result of the work of the other army, more will be saved from death by enteric fever in 1914 than will be killed this year in the war. Eberth's *Bacillus typhosus* will kill in 1914 in the United States more than will German shrapnel and bullets in France and Russia. Moving in silence, the great army of sanitation, with a general staff and leaders of all lands and languages, claims allegiance only to Humanity. In war it has not often fought winning campaigns, but the new knowledge is full of such promise that even the vanquished may be victors.

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- ⁴ *Journ. Amer. Med. Assoc.*, May 2nd, 1914. ⁵ *Ibid.*, June 13th, 1914.
- ⁶ *Ibid.*, 1912, vol. i, p. 112. ⁷ *Lancet*, 1913, ii. ⁸ *Journ. Amer. Med. Assoc.*, June 13th, 1914. ⁹ See paper by Dr. Stallybrass, *Public Health*, September, 1913. ¹⁰ *Transactions of the Epidemiological Society*, vol. xxv.

THE following members of the medical profession have been elected Fellows of the Royal Sanitary Institute: Dr. Andrew Balfour, C.M.G., Dr. Ralph H. Crowley, Dr. John W. S. McCullough (Chief Health Officer for the Province of Ontario), Dr. E. W. Rees-Jones (M.O.H. Blackpool), and Dr. Nadirshah H. E. Sukhia (Bombay).

A REPORT ON GAS GANGRENE.

BY

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AND

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IN CHARGE OF MOBILE FIELD LABORATORY.

(From the Field Laboratory G.H.Q. November 11th, 1914.)

It seems advisable to briefly record the conclusions at which we have so far arrived on the spreading gangrene which has occurred amongst the wounded of all the armies now in France.

One of us (S. R.) has examined the condition bacteriologically, and this examination was carried out in the Mobile Field Laboratory. In a typical case affecting the hand, a bacillus was found which was isolated for examination. A culture of this, when inoculated into a guinea-pig, caused its death in eighteen hours. *Post mortem* there was found a gangrenous cellulitis from which the inoculated organism was recovered. A second guinea-pig inoculated from this culture was sent to the Lister Institute. It arrived safely and died within a few hours of its arrival, thus affording abundance of fresh material for a more detailed examination than was possible under field conditions. An examination of the culture was meanwhile made in the field laboratory, and the conclusion arrived at was that it was probably the specific organism of malignant oedema. Further examination made at the Lister Institute by Dr. C. J. Martin, F.R.S., and Dr. Arkwright inclined these observers to the view that the organism in question was identical with one that for some time was confused with that of malignant oedema, known as the bacillus of Ghon and Sach. This organism was originally obtained from a case of gangrene in the human subject. There are some ten different organisms that have been isolated from cases of gas gangrene in man, all of which are closely allied, and have the common characteristic of being anaerobic spore bearers. From other cases in the clearing hospitals at the front several more organisms of this group have been isolated, and have been sent to the Lister Institute for confirmatory diagnosis.

A sample of earth from a trench was also examined. The inoculation of a few drops of water, in which this earth had been shaken up, into a guinea-pig, killed the animal in eighteen hours. *Post mortem*, a similar gangrenous cellulitis was found. The animal was also found, like the guinea-pig inoculated from the gangrenous hand culture, to be infected throughout with a spore-bearing anaerobic organism belonging to the same group. It is reasonable to conclude, therefore, that the gangrene found amongst our wounded soldiers is directly due to infection introduced at the time of the wound, and this is especially likely to occur if muddy clothing has been carried in by the projectile or if earth has been carried in by the explosion. We are therefore of the opinion that the gangrene that occurs amongst the wounded is a traumatic infection and dates from the moment of the injury. It is solely due to infection from the soil, and is in no way related to sloughing phagedaena, or so called hospital gangrene.

Clinical Picture of Gas Gangrene.

In the cases we have seen the gangrene has always occurred in connexion with wounds of the extremities. We have not seen it in the head, neck, thorax, or abdomen.

Nature of Projectile.

We have seen it in wounds from rifle, shrapnel, and fragments of shell.

Nature of Wound.

We have seen it in both slight and very serious wounds, but a larger proportion of the serious wounds are affected by it, especially when large bones have been shattered and muscles extensively torn and extruded. We have seen it with and without fractures, and in a relatively large number of fractures of the femur.

Period of Onset.

It is most noticeable that it always shows itself within the first few days, or even hours, following the infliction of the

injury. In two cases we have seen it well marked within thirty-six hours, and in several others already extensive on the third and fourth day.

Several patients have died of it on the third day following that of the injury, and in other patients it has progressed so far that amputation has been performed on the third day.

Onset.

This is characterized by swelling of the injured part, and the gangrene seems especially liable to occur in connexion with that swelling of a limb which is due to extravasation of blood in the subcutaneous tissues and intermuscular planes. It seems to us that interference with the circulation either by extravasation of blood or by tight bandages has a marked influence.

In the early stages the patient complains of severe pain which is perhaps due to tension, the result of the swelling, but in the later stages the affected area becomes completely numbed and insensitive. The edges of the wound are generally ragged and sloughy, and a considerable quantity of blood-stained serum constantly exudes and soaks the dressings. This discharge emits a characteristic and most offensive odour which is so marked as to be almost diagnostic. The skin, if not previously discoloured by extravasated blood, assumes a dark purplish or slate-coloured hue.

In the vicinity of the wound it changes subsequently to a more green colour. The swelling extends coincidently with the change of colour, and a few hours later the skin becomes nearly black, and finally forms a black, leathery slough. Beyond the area of discoloration the limb is swollen with gas and fluid exudation, and an emphysematous crackling can be elicited on pressure with the hand. This may spread to a distance of as much as a foot above and below the actually gangrenous area, and so rapid is the extension of the gangrene that we have seen the whole of the lower extremity completely mortified before the end of the third day after the infliction of the wound.

Condition of Patient.

Temperature is not materially affected in many cases, and high fever is rare. A temperature of 99° to 100° is usual. Respiration is not materially quickened; headache is not complained of. The mind is perfectly clear till near the end. The pulse is not greatly quickened but rapidly loses power, so that several of the patients we have seen have had no perceptible radial pulse. The heart's action is greatly weakened so that its beat is quite difficult to feel.

Vomiting is common and in many cases is frequent; diarrhoea is rare; sweating is not generally present, and before death the skin is cold; the tongue is usually covered with a dirty fur, but the mouth is not exceptionally dry. Death appears to be due to cardiac failure, and we have been struck by the extraordinary clearness of the mind of a patient, almost pulseless, and within an hour or two of his death. In the worst cases the gangrene may spread with such rapidity that the whole limb may be cold, of a purple or black colour, immensely swollen and quite devoid of all sense of touch and power of motion within thirty-six hours of the onset of the gangrene. The smell of such a limb is overpowering, and almost precludes a careful *post-mortem* examination. If incisions are made before or after death gas and sanious fluid bubble up. Pus is confined to the edges of the wound, and is very little in proportion to the sanious discharge.

Practical Conclusions.

The practical conclusions we would draw from these observations are as follows:

1. All tight bandages and especially those applied at the first field dressing should be avoided. Shell wounds are so often followed by so much interstitial haemorrhage that the part swells and the bandage rapidly becomes tighter and interferes with the circulation. Consequently many bandages require to be cut within a few hours of their application.

2. In many cases the tension requires to be relieved by incisions and drainage, and the opportunity should be taken to wash the wounds thoroughly with an antiseptic. Hydrogen peroxide is one of the best. Great care should be taken to remove portions of clothing; as these

contain the infective agent. Shattered fragments of bone and pieces of shell or gravel should be taken out.

3. Amputation may often be successfully performed through tissues made emphysematous by gas but not yet gangrenous.

4. The group of anaerobes causing gangrene are spore-bearers, and spores (especially of this group of anaerobes) are especially difficult to kill by any antiseptic solution or even by boiling. Consequently, in order to sterilize instruments and other things that have been infected, other measures are required.

(a) Destruction of blankets and clothing soaked by the discharge.

(b) Heating in an autoclave at a temperature of 120° Centigrade.

(c) Boiling for an hour in a solution of 1 in 20 carbolic acid or lysol (1 in 10).

It should be remembered that the mud on the clothes of wounded soldiers is almost certainly infected, and care should be exercised to see that the area in which operations or dressing of wounds are performed should be kept free from possible contamination from such a source.

5. Where possible, it is advisable to isolate patients under treatment in hospitals, and this is all the more necessary on account of the bad smell which is inseparable from the condition.

The above is a copy of a report sent to the Director of Medical Services on November 9th, and is mainly the result of work done at the clearing hospitals at the front to which patients are taken within a few hours of being wounded. Many of the conclusions and practical recommendations, however, have been conveyed to the hospitals verbally or by official communication and attempts are being made at the Lister Institute to provide an antitoxin.

INJURIES TO THE BOWEL FROM SHELL AND BULLET WOUNDS.*

BY

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INJURIES to the rectum or pelvic colon, which occur in war, whether from bullet or shell wounds, must of necessity be very serious; and as a fact the statistics of previous wars show that injuries of this nature are attended by a higher mortality than injuries to other parts of the alimentary canal. Many of these cases must be fatal owing to concomitant injuries of the large vessels in the pelvis, or to resulting peritonitis. In the Boer war the mortality from wounds of the rectum was 30.7 per cent. of those so wounded, death being due to peritonitis, internal haemorrhage, or septicaemia. We have as yet no means of ascertaining the percentage of mortality from such wounds in the present war; but already there must have been a number of cases of wounds involving the large bowel under treatment in our home hospitals. It is to be hoped that, as the result of increased knowledge and improved technique, we shall be able during the present war to bring the percentage of mortality for wounds of this nature down to a much lower figure than in previous wars.

As these wounds present some unusual difficulties and require special treatment, it does not seem out of place to discuss them at this early stage of the war, if by so doing we can give any assistance to ourselves and other surgeons who may have to deal with such cases during the continuance of the war. In my position as surgeon to King Edward VII's Hospital for Officers I have seen several of these cases during the last three months.

The injuries vary from clean bullet wounds to large septic lacerated wounds due to fragments of shell. There can be no doubt that a high velocity Mauser bullet may pass straight through the abdomen, or across the pelvis, penetrating the large and small bowel, without causing a fatal or even very serious result, always provided that certain conditions are present. Of these conditions the

* Read before the Subsection of Proctology of the Section of Surgery, Royal Society of Medicine, November 11th, 1914.