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NOTES

ON

ANTISEPTIC SURGERY

IN

WAR.

BY

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ROYAL HORSE GUARDS.

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PREFACE.

THE notes embodied in the following pages are the result of visits to Berlin, Dresden, St. Petersburgh, Moscow, Vienna, Munich, Paris, and other cities during my winter leave. The journey was undertaken to obtain information concerning foreign military hospitals, and to gather hints about Antiseptic Surgery as applied to service in the field.

I was most hospitably received and most kindly assisted in my object by everyone I had the pleasure to meet, and take this opportnnity to offer my sincere thanks, especially to the following gentlemen :—

The British Military Attachés at Berlin, St. Petersburgh, Vienna, and Paris.

To Surgeon-General Dr. Roth, 12th (Royal Saxon) Corps.

His Excellency von Koslov, Chief Medical Inspector-General of the Russian Army.

His Excellency von Ritter, in medical charge of the St. Petersburgh District.

Dr. Wywodzoff, Surgeon to the Imperial Russian Court.

Sanitätsrath Dr. Grimm, at St. Petersburgh.

Hofrath Dr. Unterberger, at St. Petersburgh.

Dr. Scott, at Moscow.

Oberstabsarzt Dr. Neudörfer, at Vienna.

Generalstabsarzt Dr. Ritter von Nussbaum, Munich.

Surgeon-General Dr. Lotzbeck, Munich.

Oberstabsarzt Dr. Port, Munich.

H. MELLADEW,
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LONDON, *9th March*, 1881.

NOTES ON ANTISEPTIC SURGERY IN WAR.

ARE wounds to be treated antiseptically in war, and, if so, how is the treatment to be carried out? are questions argued out in every possible form on paper, in lectures, and in conversation in nearly every country in Europe. This subject stands first for discussion in the Military Section of the International Medical Congress to be held in London in August next. Having, during the winter, visited many hospitals, both civil and military, in Paris, Germany, Russia, and Austria, perhaps it may not be out of place to put on paper some of the impressions I have brought away of what I have seen myself, of what I have heard in conversation with many of the first surgeons of the day, as also of what I have read on this most important subject. The matter is of the most vital importance, not only to the individual soldier, but also to the State. Such an urgent question has it become, talked of, experimented upon everywhere with a view to its final settlement, that its choice as one of the subjects at the Congress could hardly have been omitted, and its position as No. I. shows the importance which is attached to it.

The first part of the question may be got rid of at once; there seems to be but one answer everywhere, that Antisepsis in some form should certainly be the mode of treatment for wounds in war. After its brilliant results in civil hospitals, its steady triumphant progress from Glasgow and Edinburgh,

carrying blessings with it all over the world, there can be no doubt that the benefits it confers should also be extended to the unfortunate wounded on the battle-field. How well it has there already answered, under the most unfavourable circumstances, is shown by the numerous reports of the surgeons employed during the Russo-Turkish War, at the head of which stand those of Bergmann and Reyher. The wounds dressed antiseptically on the battlefield, on arrival at the hospitals, after a transport often of many days, over the worst possible roads, in the hottest weather and the thickest dust, were all healthy, some already healed, others nearly so. In the hospitals the necessary examinations could be made under spray without danger, fresh antiseptic dressings applied, and convalescence greatly hastened thereby. It has been my good fortune to meet many surgeons employed in the late wars in Bulgaria, Bosnia, and the Herzegovina, who all speak in the highest terms of antiseptic treatment. It was put in practice wherever possible, in as perfect a form as circumstances allowed; some attempt at it was made nearly everywhere. However small the means at disposal, and however defective consequently the practice, the results were always satisfactory as compared with those obtained before antiseptic treatment was heard of. There seems to be a general conviction that Antisepsis must be introduced on to the battle-field and into all war hospitals: ideas vary merely as to the necessity or not of spray, and in minor details; the best means of carrying it out remain only to be settled. Of course, strict Listerism is impossible on the battle-field, in consequence of the great disproportion between wounded and surgeons. One objection to its general introduction into military surgery is its cost. In the present enormous strength of armies, anything likely to add to the expense of equipment, except it be to increase its destructive power, is not easily sanctioned. Any extra cost to the State incurred

by fitting out each soldier and every hospital of war with the means of thoroughly carrying out antiseptic treatment, would most certainly be repaid many times over by the numbers of lives which would be saved, by the more rapid healing of wounds, and thereby hastened convalescence, which would enable men to rejoin the colours in a comparatively short time—men who, in former wars, would, if not succumbed under the various forms of blood-poisoning, at all events have been prevented by a much slower convalescence from again meeting their comrades in the ranks until after the end of the war: all the more would this be the case during the present quickly-fought campaigns. Antiseptic treatment, again, would save many a limb—and invalid pension afterwards—which, without it, would probably be lost; by it the work of the military surgeon would be greatly lightened, not only at the dressing stations, but also at the different war hospitals; many wounds, once closed with the antiseptic pad, would not require further attention for many days, and time be thus saved—time so urgently needed for those absolutely necessary operations at the dressing stations, as the arresting of severe hæmorrhage, the immobilising fractured limbs with splints or plaster-of-Paris, applied on strips of linen, bandages, or stockings, after antiseptic dressing had been applied to the wounds. It would confer another benefit, admitted by all army surgeons as of the first importance: it would permit rapid evacuation of the wounded from the front, the sending them away as far as possible and as soon as possible. Wounded men, as a rule, bear transport well, and in the better air and more cheerful society far from the battle-field, perhaps at or near their homes, they have undisturbed rest, are better fed, better nursed, and convalescence is much more rapid than if kept crowded together in the different hospitals near the theatre of war. Room so much needed is gained for others. The writings of Pirogoff and others show how enormously the rate

of mortality decreased whenever rapid evacuation could be carried out during the Russo-Turkish War. I add some statistics which speak for themselves :—

RUSSO-TURKISH WAR.

Surgeons.		Deaths.
Bergmann	Of 57 gunshot wounds of knee not treated antiseptically in the first instance ...	44·5 per cent.
,,	,, 15 ,, ,, knee-joint with fracture treated antiseptically primarily	6·6 ,,
Reyher ...	,, 78 ,, ,, ,, ,, ,, not in first instance ...	66·6 ,,
,, ...	,, 62 ,, ,, ,, ,, not treated antiseptically at all	77·4 ,,
,, ...	,, gunshot wounds of soft parts, treated primarily antiseptically	7·6 ,,
,, ...	,, ,, fractures, ,, ,, ,, ...	18·1 ,,
,, ...	,, ,, wounds of joints, ,, ,, ,, ...	13·1 ,,
,, ...	,, ,, ,, soft parts, not treated antiseptically in first instance ...	21·5 ,,
,, ...	,, ,, fractures ,, ,, ,, ,, ,, ...	35·5 ,,
,, ...	,, ,, wounds of joints ,, ,, ,, ,, ,, ...	61·5 ,,
Giess ...	,, 70 gunshot fractures { 34 treated strictly antiseptically	14·7 ,,
	{ 36 ,, not on strict antiseptic principles	13·8 ,,
,, ...	,, 66 ,, ,, into joints { 19 treated antiseptically in first instance ...	10·5 ,,
	{ 36 ,, ,, not ,, ,, ...	13·8 ,,
	{ 11 ,, not strictly on antiseptic principles	9 ,,
Kraske* ...	publishes a list of 23 gunshot wounds treated in Professor Volkmann's Klinik in Halle, treated on strictly antiseptic principles :—	
	Of 7 gunshot wounds of soft parts, 2 with injury to large vessels—none died.	
	,, 2 ,, fractures ... ... none died.	
	,, 4 ,, ,, of joints ... ... none died.	
	,, 3 perforating gunshot wounds of skull ... ... one died { Brain extensively lacerated.	
	,, 6 ,, ,, ,, of chest ... ... none died.	

* Langenbeck's Archiv., 24th volume.

Professor Esmarch places the "schwerpunct" (all-important point) of antiseptic treatment on the battle-field itself; although, as a rule, an "exact" antiseptic dressing there cannot be applied, the work of surgeons should be governed by the principle of Antisepsis. As experience teaches that even very severe gunshot wounds can, and do, heal aseptically under an occlusive dressing—that is, without inflammation and suppuration—if only they are not subsequently infected, it is very necessary that no examination on the battle-field with dirty fingers, probe, &c.,

take place, and that the protective dressing laid on the wound do not consist of poisonous material—as dirty charpie—but of an antiseptic preparation which forms with the blood in the wound a dry aseptic crust.*

Professor Dr. von Nussbaum, of Munich, puts the question in his book,† "Must this antiseptic treatment be carried out in war also?" and continues:—The fact "that the fate of a wounded man lies almost altogether in the hand of the surgeon who first dresses the wound," should necessitate the greatest efforts to be made to introduce Antisepsis, not only into the war hospitals, but also to render it possible on the battle-field itself. Septic wounds cannot always be made aseptic; it should therefore be the great aim of the surgeon at the help and dressing stations to prevent septic wounds being sent into the field hospitals.

Most of the wounds in battles of the present time are by rifle bullets; they bleed but little, and are especially fitted for at once closing with antiseptic pads. A firm, impermeable protection is given to the wound, which heals rapidly without any disagreeable symptom, if not previously infected by unclean fingers, probed, or afterwards by needless disturbance or examination, or by the shifting of the antiseptic dressing. The men of the Sanitäts detachment should, if possible, close the wound at once with the antiseptic pads proposed to be carried by each soldier. If not closed on the battle-field by the wounded themselves, or by the bearers, the wounds are to be dressed at the help and dressing stations. If the contents of the soldier's packet are not sufficient, they can be supplemented by those in the bearer's pouch or from the dead around. It may be that too much weight is put on this immediate closing of the wound, and that perhaps it

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* Langenbeck's Archives, volume 24, heft 2.

† "Guide to Antiseptic Treatment of Wounds," third edition, 1879.

would be better not to allow the bearers to lose too much time in dressing the slighter wounds on the battle-field, but to order them to make all haste to submit the wounded men to the surgeons at the first help and dressing stations. Wounds would thus escape one danger, that of infection by the bearer's hands, which cannot possibly be clean. However, there can be no doubt that the fewer slight wounds the surgeon is asked to attend to the better; the more thoroughly can he give his time to the more serious ones, and make them fit to be moved to field and other hospitals, to which the slighter cases, already dressed on the battle-field by the bearers or wounded themselves, at once pass on, unless circumstances should have arisen requiring further attention.

Professor v. Nussbaum recommends, should the wounds appear septic on future examination in the hospitals, their thorough syringing out with an eight per cent. solution of chloride of lime, and their further washing with a five per cent. carbolic acid solution. Should this treatment not suffice, should the wound remain septic after repeated washings and dressings even, "we stand again on the uncertain ground of former sad times;" all may go on well, but blood-poisoning in one of its many forms may result. The great importance, that the entire hospital staff should have a thorough knowledge of the practice of Antisepsis, is therefore evident: "The fate of the wounded man lies in the hands of the surgeon who attends him during the first few hours." Of course it is impossible to employ strict Listerism—dressing and spray—on the battle-field, and, fortunately, it is not required; Esmarch's advice to close every wound at once with an antiseptic pad being sufficient for the time; afterwards in a hospital it can be dressed at more leisure on stricter Listerian principles. Rather than apply to the wound the charpie of the packet which the soldiers of most armies still carry—a material made, perhaps, of dirty, infected linen by

unclean fingers—Professor Nussbaum advises, in the absence of the antiseptic pad, to leave the wound open, when the secretions will become thickened, form a scab, and thus prevent the development of bacteria. Charpie is not to be used on any account; it has to answer for the great mortality in former years from pyæmia, hospital gangrene, and erysipelas, &c., following wounds which under antiseptic treatment would have healed quickly and almost without fever. He recommends that every soldier should carry a pad of salicylic cotton-wool, enclosed in salicylic gauze and bandage. Oberstabsarzt Dr. Neudörfer, of the Austrian Army, one of the most experienced military surgeons of the day, recommends a similar treatment of wounds in war. After hæmorrhage has been arrested, the wound is to be cleaned and washed with some antiseptic solution and by position or drains the escape of any secretions ensured. A thin layer of salicylic acid in powder is next to be applied to the wound surface, protected by cotton-wool or organtin in eight or ten layers, and afterwards secured by a three-cornered bandage. This would apply to the first help and dressing stations and field hospitals. Such a dressing can, under favourable circumstances, remain undisturbed for three to four weeks. If to be changed, Dr. Neudörfer allows no water to be used. This dressing is very simple, requires little time, and would for that reason be well adapted for field and other hospitals. This surgeon differs from Professor Lister, in believing that "in the pus and in the albuminous secretions of the body a chemically acting ferment is formed as 'contact body,' which is slightly soluble in serum and other animal fluids, insoluble in alkohol, ether, and aromatic acids, but very soluble in water,"* and not that the poison enters wounds from the air. Under certain conditions this ferment can be absorbed in the

*"Behandlung der Wunden im Kriege."

wound by the fluids and blood of the body, and, there acting as a poison, produce the different forms of wound diseases. He therefore aims at—

First, to prevent the formation of this "contact body" in the secretions; and, secondly, if already formed, to arrest its absorption. Water consequently is not to be used, but some application which renders the poisonous ferment insoluble, and prevents its absorption into the system, such as carbolic acid, which forms with the albumen a "constant" compound. Dr. Neudörfer rests his convictions upon the good results obtained by him in the campaigns of 1848, '59, '64, and '66—before, of course, antiseptic treatment was known as such—and upon his experience since in hospital practice. The strict Listerian system was given a full and fair trial, but did not seem to possess any great advantages over the former mode of treatment, besides consisting of a great deal which is unnecessary; thanks to its complicity therefore and expense, it is not adapted for war, and luckily not necessary.

He, however, allows one great merit in Lister's treatment—the extreme cleanliness insisted upon—and lays down that hands and instruments should be scrupulously cleansed, not on account of bacteria, but to get rid of the smallest particle of dirt, which, by contact with the wound secretions, would cause their poisonous degeneration. Then the escape of blood, serum, &c., must be prevented, or, if this cannot be done, their decomposition not permitted. This, especially when the fluids cannot escape freely, is accompanied by their coagulation or precipitation by one of the many Antiseptica which prevent their decomposition, as carbolic, boracic, salicylic, and benzoic acids; creosote, thymol, alkohol, and camphor.

If we can do without spray, the carrying out of antiseptic treatment in war would be much simplified.

Spray diffusers are cumbersome to carry about, take up

much room in the waggons, and require each the whole attention and time of one man, whose hands are so urgently required elsewhere. When it is considered how many wounded the spray would be required for at the same time, and the number of diffusers therefore necessary, after a hard-fought action, it is easy to understand what a saving in material, space in the waggons and of hands, apart from the expense, its non-employment would cause. On the Continent spray seems to be gradually falling into disuse, some of the greatest surgeons having discontinued it. Professor Billroth, whose division at the General Hospital in Vienna can show a constant succession of the most serious and extensive operations, works without spray, and the results—to a casual observer—could not be more excellent or more satisfactory. Its use was discontinued about eight months ago, I believe, and although no statistics are at present published, the results now without spray compare satisfactorily with those formerly obtained under it. I have seen as many surgeons operate without it as with it, and if only that most important condition of Professor Lister's treatment—that of scrupulous cleanliness of hands, instruments, &c.—is faithfully carried out, the results obtained appear as good. Most thorough and frequent washing and rinsing-out of the wound by a stream of carbolic or any other disinfectant solution should, it would appear, more thoroughly get rid and kill any bacteria—if that theory be a true one—which have found their way into the wound from the air, than a very minutely-divided stream—which, after all, spray is—falling very gently and lightly, with insufficient force to remove anything adhering to the wound surface. Although conclusive statistics, with a long list of cases, are perhaps still wanting, thoroughly comparing the two methods—spray or no spray—it is, at all events, certain that the many great surgeons now operating without it after a previous thorough trial of spray would hardly continue to do

so were the results obtained not at least equally satisfactory.

It seems, therefore, probable that, given perfectly clean hands, instruments, antiseptic washings and dressings, and, above all, clean sponges — which are rarely sufficiently cleansed, and, therefore, become the agents frequently of poisonous changes in the wounds—we can be as successful in the treatment of wounds without spray as with it, which, if true really, would remove one of the greatest stumbling-blocks in the way of the practice of Antisepsis in war, and free a number of hands urgently wanted for work elsewhere. Whether spray would be beneficial in much-crowded hospitals, with older cases and septic wounds, is perhaps probable. As these, however, are generally far away from the front, in permanently established buildings or tents, the means to obtain spray would be comparatively easy.

We may divide Antiseptic treatment of wounds in war into that proposed for

1st. The battle-field itself, to be carried out by the men of the Army Hospital Corps and by the wounded themselves;

2nd. For the first help and dressing stations; and

3rd. For the field and other war hospitals.

It seems to be generally recognised that a wound received should as soon as possible be closed antiseptically, either by the wounded man himself, by a surgeon, or by a soldier of the Army Hospital Corps, with the dressing material carried on the man himself, which, if not sufficient, is to be supplemented by that from the bearer's pouch or from any dead at hand. As no water is likely to be found in the immediate vicinity of the wounded man, it is necessary that the antiseptic occlusive dressings should be used in a dry state. The greater majority of wounds is by bullets, and bleed little; they are as easily closed by an antiseptic as by

the old charpie pad. There should be no previous examination of the wound, except for most urgent reasons, by either finger or probe. Dressing stations are, if possible, to be established near water; as this, however, is not always to be had, it is very desirable that antiseptic dressing materials to be employed there should be dry also. Similar material would therefore be applicable to both battle-field, first help and dressing stations. At the latter place, also, examination of the wounds should, if possible, be avoided, bullets and splinters not be removed, nor any operation performed unless urgently required, such as the separation of a limb hanging but by a shred, or the necessary interference in extensive shell lacerations with tearing and crushing of the large blood-vessels, cutting off the blood supply to the parts below, &c. It is well to remember, though, that even the most extensive wounds heal when primarily closed with antiseptic pads. Surgery should be as conservative as possible.

Coloured cards should be carried in the pouches or havre-sacks of the bearers, as in those of the surgeons, employed at the theatre of war, of different colours with different meanings, say, for example :—

A red card, attached to the button of a wounded man's tunic, or hung round his neck, signifies :—

Slightly wounded, able to bear immediate transport, further attention unnecessary.

A blue card—unable to bear long transport, requires further examination, &c., at field hospital.

A green card—severely wounded, to remain at nearest hospital.

The German war medical regulations order white tickets for wounded requiring immediate hospital attention; red for those who are able to bear transport.

On these tickets the nature of the wounds is to be noted

as shortly as possible, such as Dr. Köcher, in "Sanitätswesen at Plevna," recommends :—

Fract. fem. d. $^1/_3$, meaning fractura femoris dextra in upper third ; $^2/_3$, middle ; $^3/_3$, lower third, &c. ; and more details as to dressing, operation, &c., as time would allow.

The Austrian "diagnosis" tickets carry the numbers one, two, three, each signifying different degrees of transportability ; the surgeon strikes out the two not applicable.

The slightest glance at a man on arrival at the dressing station or at the field hospital would show whether the wound requires further attention ; those men with red cards would at once pass on and give room to others requiring further surgical assistance ; while an immense amount of time would be gained for absolutely necessary operations, and for the putting up of fractures, &c., in plaster-of-Paris or in splints, so as to render them fit for transport.

Soldiers having had their wounds attended to at the first help and dressing stations, their fractured limbs put up, as Professor Esmarch recommends, before reaction has set in ; having been divided into groups by the coloured tickets according to the degree of their transportability, pass on to the field hospital, where the necessary operations are to be performed. Those with red tickets only pass through further to the hospitals in the rear. The forming of the wounded into easily distinguished groups prevents any confusion ; a great deal of time is gained, and no wound once dressed is disturbed unnecessarily. Watraszewski during the Russo-Turkish War employed carbolised rags, covered with ordinary cotton-wool, to the wounds with good results. Of oakum he speaks highly, as also of a five per cent. solution of carbolic acid as a hæmostatic agent.

Opinions vary greatly as to the material best adapted for antiseptic dressings in war, also as to the best way of carrying it there.

Very necessary conditions are, that the material chosen should be :—

1. Sufficiently antiseptic.
2. As lastingly so as possible.
3. Cheap.
4. Easily and rapidly prepared ; and
5. Easily carried.

An immense variety of dressing materials rendered antiseptic in a great many different ways has been proposed. It may be divided into two classes :—First, that intended to be carried by the soldier on his person, by the men of the Army Hospital Corps, and in the surgeons' pouches ; and, secondly, that to be placed in the hospital waggons for use in the different hospitals.

1. *The soldier's packet.* It is recommended to be carried in future sewn into the lining of the left breast of the tunic, instead of, as formerly, in the infantry at all events, loose in the left trouser pocket—a most objectionable place, for many reasons, one being that it is often lost by accident, or thrown away as taking up room which is considered by many more advantageously filled by tobacco or articles of food. The antiseptic agent which has most votes for this purpose is probably salicylic acid, but differences of opinion exist as to the best means of carrying it in the dressing packet.

To prepare material for antiseptic dressings in the quantities required to supply the present enormous armies at the last moment would be next to impossible ; it must be done in time of peace and stored in readiness for sudden war, at all events in sufficient quantity to provide the first outfit. Just as uniforms, articles of equipment, powder, cartridges, &c., are stored, and those longest in the magazine taken out and used, to be replaced by fresh, so can these dressing materials be prepared, collected, used, and the numbers again made complete, if, should any volatile material be used, means can

be devised to reduce that volatilisation to a minimum. Volatile agents have the advantage, if the infection from air theory is the true one, of keeping the surrounding atmosphere aseptic.

The problem of providing an envelope sufficiently protecting the antiseptic properties of the soldier's dressing packet has probably been solved by Oberstabsarzt Dr. Port, of the Bavarian Army. His packet, which he had the kindness to show me, is flat, about three inches by five, oblong, like a well-filled envelope. It contains either two little papers, each enclosing a small quantity of pure salicylic acid in powder, wrapped in layers of salicylic cotton-wool of equal size, or two pads made of a square piece of filtering-paper, covered with gauze and soaked in a solution of carbolate of lime, and afterwards dried. A short gauze bandage is folded round the two pads in each case, wrapped up again in parchment paper, and then enclosed in an envelope of tin. The metal is cut into a long strip, is folded across, the projecting edges of the one turning over the other and closing the case. This is finally wrapped up in paper soaked in a spirituous solution of asphalte, which, on drying, becomes perfectly air-tight. One of these little pads is intended for each wound, inlet and exit; the cotton-wool to keep, in the one case, the powder in its place; the parchment paper, torn in half, is applied over the pads again, and the bandage over all. The tin case spread out would be found useful as a makeshift splint, or a means of giving temporary support to the wounded limb.

Now this packet certainly has the one great advantage—that of enclosing the disinfectant in an air-tight envelope, which protects it from all rough usage; it, as a consequence, can be stored for a considerable time without serious deterioration or loss of quality; it is very flat; takes up but little room, and can be manufactured, I am assured by a most competent authority, very cheaply. There is every probability of its

being adopted in, at all events, one army. It does not contain a triangular bandage, which is a disadvantage perhaps; it seems to me also that the loose powder is very apt to get lost, upset by shaky fingers of the wounded, or blown away by the wind. Again, if struck by a bullet, particles of the tin envelope might be carried into the wound and become a possible serious complication. The hard tin case with sharp edges would perhaps become an annoyance during a long march, if pressed upon by straps, &c.

Professor Esmarch recommends for the soldier's packet:—

1. A three-cornered bandage, with safety-pin.
2. A starched gauze bandage about 2 yards long, 4½ inches wide, also with a safety-pin.
3. Two antiseptic pads of salicylic tow, wrapped up in salicylic gauze.

The whole, enclosed in strong parchment paper, will be 5 inches long, 3½ inches wide, and nearly 1 inch thick. This packet should, however, not be carried in the trouser pocket. Oberstabsarzt Dr. Münnich,* in an elaborate article on the various materials recommended for Antisepsis in war, gives his vote for chloride of zinc, with bleached tow or cotton-wool; this salt does not crystallise or dust-out, thanks to its hygroscopic qualities. Cotton-wool lies closer than ordinary tow, but has not many advantages over the bleached article. With a triangular bandage it is to be enclosed in parchment paper. The material is easily prepared; it is cheap, and does not lose much of its disinfectant property by rapid drying. If freshly made, and with a ten per cent. solution of chloride of zinc, as by Professor Bardeleben at the Charité in Berlin, it is too caustic and irritating to be long left in immediate opposition to the wound. Pro-

* "Deutsche Militärärztliche Zeitung," 2 heft, 1880.

tective silk is, therefore, placed between it and the wound surface. This, however, would probably be unnecessary in war, when the material has not been so recently prepared.

Professor Nussbaum recommends salicylic cotton-wool and gauze. He says* :—"In war, as in peace, a fresh wound must not be examined by either probe or finger without antiseptic precautions; it must be at once thoroughly closed with a pad—salicylic cotton-wool or tow wrapped in gauze." "Under such protection the wound heals like a subcutaneous one, or retains its aseptic condition for days, until time and opportunity allow of its further antiseptic treatment."

As we have already seen, Dr. Neudörfer, of the Austrian Army, also advises salicylic acid in powder, cotton-wool, and gauze. These are some of the chief materials recommended for the soldier's dressing packet. The necessary conditions are that it should be as small and as portable as possible, able to withstand plenty of rough usage, yet contain sufficient dressing material thoroughly to guard and protect the wound, this material to be antiseptic, and to be kept so as long as possible by some envelope impervious to damp or other hurtful influences.

Any loose powder, such as salicylic acid, would seem to be exposed to too many risks on the battle-field; but, being an excellent and stable disinfectant, it might be fixed by glycerine in cotton-wool, which itself is a perfect filter for anything contained in the air.

I have had a soldier's packet made which seems to me to answer all requirements. I hope still further to perfect it, and to make some experiments with it, before the Congress meets. Its contents at present are the following :—

Two pads of carbolised cotton-wool, thirty grains in weight,

* "Leitfaden," &c.; see above.

one for each wound, wrapped up in a piece of carbolised gauze one foot long and three inches wide.

A piece of gutta-percha tissue (or paraffin paper), folded round the above and closed air-tight by means of a solution of gutta-percha. This again lies in a triangular bandage, and the whole in a vulcanised india-rubber cloth envelope, itself thoroughly closed by the above solution. This packet is five inches long, 3 inches wide, and $\frac{1}{2}$ inch thick; weight, $1\frac{3}{4}$ to 2 ounces; price, if made wholesale in large quantities, $3\frac{1}{2}$ to 4 pence. The protection to the antiseptic material seems as perfect as can well be obtained; the packet, if sewn into the tunic lining in the hollow below the clavicle, would not be noticed much, and, by its softness, cause no pain or discomfort should belts pass over it. It contains everything needful for the dressing of wounds on the battle-field.

Boric acid cotton-wool would be cheaper, as, of course, also tow; but the former is not reliable, the acid not being equally diffused and apt to crystallise out in patches, while the other does not lie closely enough. Boric acid cotton cannot be applied directly to the wound, requiring an intermediate piece of protective material.

The material chosen for the soldier's packet would probably also be found best adapted for the surgeons' dressing pouches, as also for those of the men of the Army Hospital Corps; it is required mainly to supplement the former, to render the wound fit for carriage to the field hospital. The surgeons employed at the first help stations and the men of the bearer companies might, perhaps, be supplied, before the commencement of an action, with disinfectant dressing material, freshly made or "vivified" at the field hospitals by some means, such as solutions of carbolic acid or of other disinfectant agents, by Port's or Bruns' powder, &c., the composition and preparation of which are given further on.

Carbolised olive-oil on lint or cotton-wool I found a most excellent dressing for wounds requiring transport during the Franco-Prussian War; but whether this is sufficiently portable for general use on the battle-field and help stations is doubtful. At the dressing station, where the surgery and store waggons are to be drawn up, abundance of antiseptic dressing materials could easily be at hand.

Now come the questions, in what form is disinfectant dressing material to be supplied to the field and other hospitals in war, and how is it to be carried?—questions for which a great variety of answers has been suggested. Are simply ordinary cotton-wool, tow, gauze, &c., to be taken, as now, in the waggons, to be freshly-made antiseptic as required by solutions of carbolic acid, chloride of zinc, &c.; or are the materials to be prepared beforehand and packed in air-tight boxes in the waggons? The two surgery waggons of our bearer company contain 5 lbs. each of carbolised tow; but it is not stated whether it is to be freshly prepared on mobilisation.* Carbolised catgut is in the equipment, as also in the waggons of the Austrian and German Armies. The Sanitäts waggons of the bearer companies of the latter, besides, carry two spray diffusers; those of the field hospitals, two more; while at the reserve hospital depôt twenty-four are found.

The German War Sanitäts Regulations of 1878 hand over the antiseptic preparation of the various dressing materials carried in the waggons to the field hospitals; adding that, as at the chief dressing station the antiseptic treatment cannot be fully carried out as a rule, the Sanitäts detachment is provided with the necessary materials for it, beyond the dressings always carried, in order to have them at hand if desirable, and if time and circumstances permit, as also, in special cases, to allow the complete method to be carried out.

* It is made by Savory & Moore, by passing carbolic acid vapour through tow.

The first equipment of the field and other war hospitals would have to be drawn from stores of ready-made dressings; these, which probably will have been prepared some time before use, might be afterwards freshened up by solutions of the various disinfectants carried in a concentrated form in the surgery waggons. Subsequent supplies would be sent freshly made to the front by the contractors, or rendered antiseptic at the theatre of war by other contrivances.

Oberstabsarzt Dr. Port, of the Bavarian Army, proposes to carry carbolised tow and other disinfectant dressings in packages containing about $1\frac{3}{4}$ pounds, one hundred of which are to be stowed away in the waggons of a field hospital. The tow is prepared by being soaked in a solution of carbolate of lime, made with carbolic acid and quick-lime, a little glycerine to prevent hardness and roughness after drying, and to fix the salt, being afterwards added. This material can be quickly dried, losing only two per cent. of the acid in the process, much less than if it alone had been used. This tow, to the weight of $1\frac{3}{4}$ lbs., is pressed into square boxes, made entirely of iron wire covered, to prevent rust, with a coating of a spirituous solution of asphalte. The wire is woven loosely, in open meshes about half-an-inch apart, into long pieces about three inches wide; out of these strips lengths are cut as required to make the cases, and united by wire or pieces of tin or sheet iron, and, when filled with the tow, wrapped up in a thick paper soaked in the asphalte solutions and thereby made air-tight. Now, not only are the contents of these wire cases of use for the treatment of wounded in the field hospitals, but the cases themselves are of the greatest value in field surgery. At the garrison hospital at Munich I had the opportunity, thanks to the inventor, of seeing the variety of useful splints of most excellent quality which can be made with the wire strips of these cases with very little difficulty. The pieces are joined together in the

most ingenious way, strengthened by means of strips of sheet-iron or tin and a few nails, and the result is every conceivable splint of any length, firm, cheap, and adapted for any emergency. Pieces of tin are almost everywhere to be found, or, if not, preserve-tins would supply the needed material. A class of military surgeons at Munich undergoing a course of operative surgery employs its time, when bodies fail, as during my visit, in making these splints, and have attained a wonderful proficiency in their present work, as shown by the large number of splints, from the largest to the smallest, from the most complicated to the simplest, lying ready for use. Excellent splints are also made there of thick cardboard soaked in the above asphalte solution; they are roomy enough to take in not only the bandaged limb, but also the trousers, which, in default of other material which cannot always be carried about, constitute a very useful cushion.

Professor P. Bruns* very strongly recommends carbolised gauze. The gauze is soaked in an alkoholic solution of carbolic acid, to which is added colophonium and castor-oil; the first fixes the acid, the oil prevents the material becoming first sticky and then hard. The place of the oil can be taken by glycerine or stearine. Dr. Bruns has succeeded in making this mixture for impregnating the dressing materials into a very concentrated form, like an extract almost. It is easily soluble in alkohol, and could be readily carried in bottles, jars, or boxes in the waggons, taking up but little room. About 125 yards of gauze would only require $3\frac{1}{2}$ pints for thorough impregnation of the alkoholic solution. But to carry about the large quantity of alkohol might not be found very easy. This gauze can be prepared in half an hour and less, is much cheaper than Lister's gauze, and said to be more permanent. It adapts itself better to the inequalities of the body surface,

* Langenbeck's Archiv., volume 24, heft 2.

and causes no skin irritation; it also takes up less room than tow. Dr. Bruns has been able, under machine pressure, to pack into the same space double as much gauze, by weight, as tow. Then, again, with 2½ pounds of carbolised gauze, equal to 29 square yards, twelve amputations of the thigh can be dressed; with 2½ pounds of carbolised tow, only five.

The preparation of the concentrated mixture for war purposes is given as follows by Dr. Bruns:—

Take 400 grammes of colophonium in the finest powder, and add to it successively 100 grammes of spirit of wine and of carbolic acid, also 80 grammes of castor-oil (or 100 melted stearine). The mixture is to be stirred until it has acquired an even, powdery extract consistence, when it is at once placed in a vessel and closed air-tight. For use, this mixture is dissolved in 3½ pints of spirit by constant stirring. The gauze to be impregnated is spread out—2½ pounds—roughly, not in layers, in a large flat vessel; the mixture is poured over it and rapidly absorbed. In order thoroughly to soak the gauze, it is to be wrung out 2-3 times and replaced. Finally, the gauze is hung up to dry, but for as short a time as possible—that is, only so long that the spirit will have nearly evaporated—in summer and in the open air perhaps in 5, in winter and in a moderately warmed room in 10-15 minutes. The gauze is now ready for use; it is best stored in a closed tin box, where it will keep unchanged for months.

If the gauze is to be freshly used, the castor-oil or stearine may be replaced by an equal quantity of glycerine.

Dr. Münnich* has tested this gauze, prepared according to the above formula, with the following results.

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* "Deutsche Militärärztliche Zeitschrift," February, 1880.

Time of Testing.	Castor-Oil Gauze.		Glycerine Gauze.		Stearine Gauze.	
	Lying Free.	In Parchment Paper.	Lying Free.	In Parchment Paper.	Lying Free.	In Parchment Paper.
Immediately after Preparation	6·1 per Cent.		6·3 per Cent.		6·5 per Cent.	
After 3 days	4·4	5·8	4·3	5·9	5·1	6·4
,, 1 week	3·1	5·7	2·5	5·9	4·5	6·4
,, 2 weeks	2·2	5·6	1·9	5·6	3·0	6·2
,, 3 ,,	1·5	5·5	1·6	5·4	1·3	6·0
,, 4 ,,	1·4	5·1	1·1	5·0	0·8	5·2
,, 5 ,,	1·0	3·8	0·9	3·9	0·6	3·5
,, 6 ,,	0·7	3·1	1·0	3·1	0·3	2·6
,, 7 ,,	0·8	2·0	0·6	2·7	0·4	2·4
,, 8 ,,	0·5	1·4	0·3	1·6	0·2	1·9

These differently-prepared gauzes do not differ to any great degree; there is a rapid loss of carbolic acid after the fifth week in all those packed in parchment paper. Further experiments with these gauzes when exposed to the heat of the body applied to wounds speak highest for that made with stearine. The following tables show the loss of carbolic acid in three antiseptic dressing materials when stored, as also when applied to a wound (Dr. Münnich):—

Loss—Packed in Parchment Paper.

Period.	Fixed Carbolised Tow.	Simple Carbolised Tow.	Bruns' Castor-Oil Gauze.
After 2 weeks ...	0·2 per Cent.	4·1 per Cent.	0·5 per Cent.
,, 4 ,, ...	0·5 ,,	4·9 ,,	1·0 ,,
,, 6 ,, ...	0·6 ,,	5·0 ,,	3·0 ,,
,, 8 ,, ...	1·0 ,,	5·1 ,,	4·7 ,,

As Dressing on Wounds.

Period.	Fixed Carbolised Tow.	Simple Carbolised Tow.	Bruns' Castor-Oil Gauze.
After 4 days... ...	1·4 per Cent.	4·8 per Cent.	5 0 per Cent.
„ 7 „	3 9 „	5·8 „	5·4 „

This shows that the "fixed" tow has a decided advantage, not only when packed, but also when on wounds, over Bruns' gauze. This "fixed" tow is made by Dr. Münnich as follows:—

Tow	2½ lbs.
Colophonii	100 grammes.
Spiritus	1200 „
Acid Carbolic	100 „

The solution is poured over the tow and mixed with it as thoroughly as possible; the tow is then opened out for drying, and is ready for packing away in about half an hour. This dressing material is still further improved by using cleaned and bleached tow. It contains, after drying, eight per cent. of carbolic acid, and lost, packed in parchment paper, after a quarter of a year, only 2 per cent.; after half a year, only 4½ per cent.

The one objection to tow, especially to the ordinary, is that it does not lie close and is apt to loosen, and thus but imperfectly protect the wound. The above tow, however, is cheap, and was used with excellent results in General Zimmermann's corps during the Russo-Turkish War.

A "simple" carbolised tow is prepared by Dr. Münnich as follows:—One pound of the raw material is soaked in a mixture of 50 grs. of carbolic acid and 550 grs. of spirit, opened and spread out on a table; the drying is complete in half an hour to two hours, according to the season. Experiments as to its lasting antiseptic property follow.

Immediately after preparation the tow contained 8·7 per cent. of carbolic acid.

Periods.	Packed in			Lying Open.
	Tin Box.	Parchment Paper.	Writing Paper.	
After 3 days .	8·3 per Cent.	8·1 per Cent.	7·7 per Cent.	6·1 per Cent.
,, 1 week	8.0 ,,	7·6 ,,	7·3 ,,	4 2 ,,
,, 2 weeks	5·6 ,,	4·6 ,,	2 9 ,,	1·1 ,,
,, 3 ,,	4·6 ,,	4·2 ,,	2 1 ,,	0·8 ,,
,, 4 ,,	4·5 ,,	3·8 ,,	1·9 ,,	0·3 ,,
,, 5 ,,	4 3 ,,	3·8 ,,	1·7 ,,	—
,, 6 ,,	4·4 ,,	3·7 ,,	1·6 ,,	—
,, 7 ,,	4·4 ,,	3·7 ,,	1·1 ,,	—
,, 8 ,,	4·2 ,,	3·6 ,,	0·7 ,,	—

Simple carbolic tow, therefore, packed in parchment paper, remains fit for use for twelve days.

The preparations of tow have two properties which fit them particularly for use in war hospitals—their cheapness and easy and rapid mode of preparation. Packed in air-tight tin boxes, they would be especially adapted to form part of the first equipment of the surgery waggons proceeding on service.

Salicylic cotton-wool as a dressing material for war hospitals would probably be too expensive, and cannot be altogether depended upon.

Dr. Münnich closes his interesting article with the following recommendations :—

1. For the soldier's packet, for the regimental surgeons, and for the bearer companies, chloride of zinc, cotton-wool or bleached tow.

2. For the chief dressing station he advises "fixed" carbolic tow, which is especially adapted, covered with gauze bandages, soaked in carbolic acid, for wounded to be sent away.

This tow is to be prepared during the days of mobilisation, and, after pressing, to be packed in parchment paper. Fresh supplies can be easily made during the first rest days. In addition, carbolised gauze would be very desirable. For field hospitals the "fixed" carbolic tow would seem best adapted as a first equipment, for permanent hospitals the same, or the "simple" carbolic tow, which might be prepared every eight days or so, supplemented by carbolic gauze. Dr. Laué,* in the German military medical journal, after an extensive trial of Münnich's carbolised tow, speaks very highly of it:— "It protects absolutely against pyæmia, septicæmia, and hospital gangrene, tends to prevent erysipelas, renders the healing process more rapid, decreases or prevents suppuration; its use is unattended by any secondary hurtful influence, and it equals in its action Lister's gauze." For war Dr. Laué considers Münnich's carbolised tow well adapted, being without difficulty prepared in twenty-four hours by hospital servants from the raw material; it is easily kept, cheap, and portable. Of twelve amputations, six of which of the thigh, one died from already existing pyæmia; of four joint resections, and as many compound fractures, none died treated with this carbolised tow.

Dotter,† on the other hand, prefers Bruns' carbolised gauze; complete dressings of a thigh amputation he states as only about a halfpenny dearer than if Münnich's tow is used; it is more rapidly prepared; an equal quantity of gauze takes up but a quarter of the room of the other. For field service he especially recommends Bruns' concentrated mixture, the preparation of which has already been described.

Instead of the crystallised, it would be better to carry the liquified form of carbolic acid, such as Calvert's (one of water

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* Dr. Roth, "Jahresbericht," 1880.

† Idem.

to nine of acid). If the bottles were marked in ounces on the outside, dilution of the contents could be more rapidly carried out afterwards.

The *St. Petersburgh Weekly Medical Journal* of 20th November, 1880, contains an article on the Neuber-Lister permanent (Dauer) dressing, by Dr. Unterberger, of the Russian Guards, who gave it a trial when in charge of the surgical division of the hospital at Krassnoje Selo during the last manœuvres of the Russian Guard Corps. The hospital, thanks to its proximity to the manœuvre ground, may be considered as a chief dressing station; and antiseptic treatment was thus, according to Esmarch's advice, pushed on to the battle-field. The surgical division, which contained a daily average of fifty-five patients, was in tents pitched in the hospital garden, with the operating-room in a hut. The strictest antisepticism was practised, and the opportunity not lost of trying the modified Lister dressing—the Neuber-Lister permanent dressing, in which the gutta-percha are replaced by decalcified bone drains. Dr. Unterberger thinks that there is a great future in military surgery for these bone drains, especially at the dressing station. If the bone drains are not able to displace altogether the older ones, there is a large field for their use; by making Lister's dressing into a permanent one, they would save much time and labour in war.

The great objection against them, their too rapid absorption often, may perhaps be got rid of by using drains made from chicken-bones, as recommended by Dr. Macewen in the *British Medical Journal* of February 5, 1881; but their price would, no doubt, prevent their general use in war.

Ordinary catgut is not always very reliable, which probably also applies to that carried in the surgery waggons of the English, German, and Austrian Armies. To avoid any

risk, therefore, it might be advantageous to provide in future only that prepared by Professor Lister's method, as given in the *British Medical Journal* of February 12, 1881, for which he claims such decided advantages over that treated on the older plan. He dissolves 1 part of chromic acid in 4000 parts of distilled water, and adds to the solution 200 parts of pure carbolic acid or absolute phenol; into it is put catgut equal in weight to the phenol. At the end of forty-eight hours the catgut is taken out of the solution and dried, and, when dry, placed in 1 to 5 carbolic oil; it is then fit for use.

The antiseptic dressing material would probably be most safely carried in the waggons, in air-tight tin cases holding one to two pounds each, or in Dr. Port's wire cases, which have so many advantages over all other contrivances. It is to be sincerely hoped that these will be exhibited during the International Congress.

The following axioms laid down by the great Russian military surgeon, Pirogoff, for the general treatment of wounds in war, are very interesting.

They are taken from Surgeon-General Dr. Roth's translation (German) of Pirogoff's work on the Russo-Turkish War.*

1. War is an epidemic of injuries.

2. The condition of wounds, the mortality, and recovery depend in the main on the kind of weapon used.

3. Not medical or surgical treatment, but administration, plays the chief part in assistance rendered to the wounded and sick at the theatre of war.

4. Not quickly-performed operations, but a properly organised and conservative treatment, is the chief object of surgical and administrative activity at the theatre of war.

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* Roth, "Jahresbericht," 1880.

5. A disorderly crowding together of wounded and sick at dressing stations and in hospitals is particularly to be avoided.

6. For the same reasons, the severely wounded are to be removed as far as possible from the theatre of war.

7. Separation of the wounded, thorough ventilation, and especially the divided, and as much as possible isolated, position of the sick, are the true means of avoiding the spread of traumatic infection diseases.

8. Well-organised grouping at the dressing station and in the hospitals is the best means of ensuring proper surgical assistance.

9. Immediate removal of bullets, and the performance of primary operations, are not as necessary in present battles as was formerly ruled, and are but rarely necessary if life is not in danger. Sieges are an exception to this rule.

10. The examination of fresh gunshot wounds with probe or finger, opening them further with instruments, and the removal of bone splinters are generally hurtful, and ought only, in exceptional cases, be undertaken under surgical supervision.

11. The application of immobilising dressings, &c., especially of those with plaster-of-Paris, takes the place, in the great majority of wounds, of primary operations (amputations and resections) at the dressing station. All wounded with gunshot fractures are only to be moved with properly-applied plaster-of-Paris splints.

12. Secondary resections are to be preferred to primary, especially if an expectative treatment in gunshot wounds of joints still gives hope of success.

13. As amputations of the thigh offer but slight chances of success, all attempts at conservative treatment in these gunshot fractures, as also in those of the knee-joint, are to be considered as a progress in military surgery.

14. Suppuration in external injuries easily causes infection, especially when severely wounded are crowded together under one roof; it then becomes a danger, not only to the wounded man himself, but also to his neighbours.

15. Puriform infection not only spreads by the air, which becomes a source of danger when large numbers of wounded are crowded together in closed rooms, but also by the surroundings of the wounded—linen, bedding, walls, floors, and above all by the attendants.

16. Good ventilation of the sick-rooms does not itself prevent puriform infection when severely wounded are collected together in great numbers. Only isolation, and as far as possible separation of the houses, are, with attention to cleanliness and antiseptic treatment, a safe remedy against the spread of the various forms of puriform infection.

17. In treating gunshot wounds, the main points are—rest to the injured part by immobilising dressings and suitable position, and also prevention of decomposition changes. Cold, antiphlogistics, and low diet suit in exceptional cases; all lowering treatment is hurtful to the soldier, especially towards the end of a long war.

18. The use of anæsthetics is important, not only for operations, but also for the application of dressings, and is only contra-indicated by shock.

19. Statistics of war surgery are not reliable, and do not offer the surgeon true indications. The only conclusion which can be drawn from them is, that every injury and every operation have a certain minimum mortality, which even the modern improvements in medical science cannot further reduce.

20. Voluntary nursing forms a very important independent assistance to the medical service in the field.

Lühe* lays down the following conditions as necessary for the carrying out of primary Antisepsis in war:—

* Lühe, "Primary Antisepsis in War."

1. Occlusion of the wound by an antiseptic dressing immediately after it has been received, without any probing by finger or instruments.

2. The same treatment to be pursued at the dressing station, if the skin wound is small (bullet), even when of a joint or with fracture, if the wound does not gape or contain septic material, pieces of clothing, &c., as shown on examination without probing.

3. Bullets and bone splinters are not to be extracted at the dressing station.

4. The limb is to be dressed with some antiseptic material, after cleansing the part surrounding the wound.

5. Immobilisation is to be secured in gunshot wounds of joints by the necessary contrivances, in wounds of the soft parts by simpler means, position, &c.; the splints, &c., to be secured from wound secretions by a layer of impermeable material.

6. In large skin wounds (shell, &c.), dressing at the dressing station according to Volkmann (dry); if necessary, primary resection or amputation, with—

7. Immobilisation over the antiseptic dressing.

8. The best surgeons to be employed at the dressing station.

9. The wounded to remain as long as possible in the hands of the same surgeon.

Lühe can only recommend two first dressings—1. Esmarch's antiseptic salicylic tow pad; 2. Port's powder—and prefers to combine the two, in dressing the wound covered with the powder, with an antiseptic pad and three-cornered bandage.

This powder is prepared as follows:—

200 parts of carbolic acid, 400 of colophonium, 250 of alkohol, and 150 of glycerine. The colophonium is dissolved in the alkohol, with the aid of slight heat; the carbolic acid and

glycerine added after cooling. The powder is made from this mixture by taking one part of it and adding eight of precipitated chalk and mixing it thoroughly in a mortar. Bruns recommends the dusting of this powder over the wound, covering it with a thin layer of tow, which is also dusted over, another layer of tow, and then a piece of paraffin paper—a gauze bandage to fix the whole. Every soldier is to carry on his person half an ounce of tow, a gauze bandage, and a piece of paraffin paper.

These are some of the chief antiseptic dressing materials recommended: only the next war will set the much-disputed question at rest, as to which are best adapted for a campaign, most suited there to meet all the varied requirements, best able to bear with the least loss in antiseptic quality the rough usage, exposure to heat, cold, and wet, be most easily carried, most quickly prepared, most efficient, without adding very considerably to the cost of equipment of the individual soldier, as also to that of the various war hospitals—an outlay, however, which would be repaid many times over by the many benefits the antiseptic system would confer on the soldier, as indirectly also on the State.

The following order from the German Army Medical Department, referring to antiseptic dressing material for Army purposes, has just been published (Berlin, 8th February, 1881):—

"In consequence of reports received concerning the use of dry carbolic-spirit tow, the Army Medical Department is convinced that it has proved itself a useful antiseptic dressing, not only for use in time of peace, but especially on field service.

"The reports agree as to its easy mode of preparation,

its softness, ready adaptability in dressings, also as to its being an antiseptic material which can be depended upon when freshly prepared. As disadvantages are mentioned—its instability with the present method of packing, its aptitude as a dressing to become loose and insufficiently protect the wound, and its not soaking up the discharges equally.

"In consequence of the favourable results obtained, and the yet unsettled question as to what antiseptic dressing is best adapted for the field, the Army Medical Department considers the further employment of carbolic-spirit tow desirable, particularly as it is so readily prepared in large quantities for war purposes.

"In order to do away with the above-named disadvantages, the material is to be used as freshly prepared as possible, the method of applying it to the wounds improved, and the attempt to be made, by the use of parchment paper or mackintosh, to ensure a more equable absorption of the wound secretions. It is to be more simply prepared in future, by pouring over a pressed cake of tow, 1 kilogramme (2⅓ lbs.), a solution of 2 ounces of spirit, and then wrapping it up in parchment paper. The cakes are thoroughly soaked through in ¼ to ½ hour, and ready for use.

"This method of preparation does not increase the bulk of the material, it requires but little time, the tow is thoroughly impregnated, the quantity of spirit used is small, and loss of carbolic acid by evaporation prevented, which are all points in favour of carbolic-spirit tow as a dressing in the field."

Further experiments are to be made with it, and reports sent in on 1st March, 1882.

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