Address.

THE MEDICAL DEPARTMENT IN TIME OF WAR.[1]

BY LOUIS A. LA GARDE,
Captain and Assistant Surgeon, United States Army.

GENTLEMEN: — Upon the invitation of your surgeon-general I have prepared some notes which relate to the medical department of the United States army in the time of war. At a time when the State troops would be called to co-operate with the regular army your regulations would not differ from ours, and what I have to say in this instance will apply to us alike.

My remarks will relate (1) to the method of organizing the medical department on a war basis; (2) I shall take up the question of our present allowance of sanitary soldiers, medical officers, etc.; (3) I shall direct my remarks to the question of the necessity for an increase in the number of helpers to the wounded, which seems apparent with the use of the new military rifle.

(1) *Field Organization.* — In taking the field the medical officers and members of the hospital corps serving with troops in different parts of our country proceed with their respective commands, as a rule, to a point of rendezvous or base of operations. The medical officers are assigned by the chief surgeon, under the orders of the general commanding, to the various duties involved in the administrative and executive branches of the medical department.

The members of the hospital corps are likewise organized into two branches, namely, the one for duty in the field hospitals proper as cooks, nurses, clerks, apothecaries, etc., and the other as drivers to ambulances, as porters in collecting and removing the sick and wounded, and rendering first aid thereto.

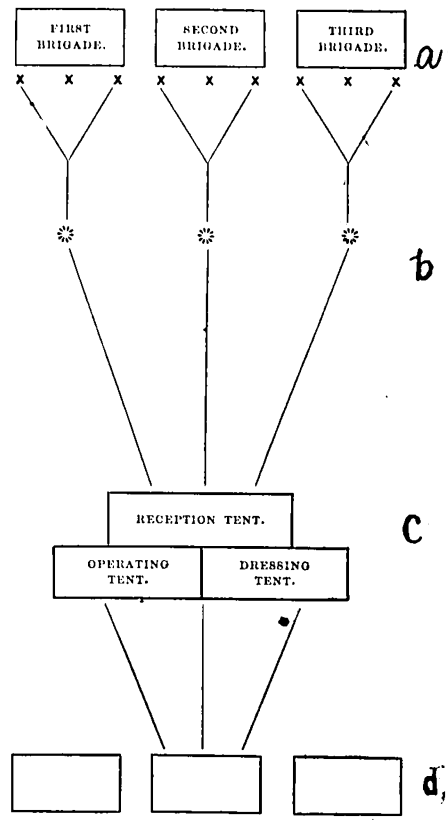
The necessary tentage, instruments and equipment are carried in part by the various detachments arriving at the base of operations, and they are furnished in part by timely requisitions on the medical-supply depots, of which we have three principal ones at present, namely, at New York, St. Louis and San Francisco.

We have no specially defined plan to be followed in case of hostilities; yet medical officers are pretty well agreed that a system could be evolved from our present regulations as soon as the troops were made to assemble. Our regulations are sufficiently exact to suggest, as it were, the remedy of such lapses as may be apparent with the occurrence of each emergency.

(2) *Present Allowance of Sanitary Soldiers and Medical Officers.* — Our regulations provide that in time of war the privates of the hospital corps shall form two per cent. of the strength of the command; and that one acting steward to every ten privates of the corps and one full steward to every thirty of the privates shall form the standard upon which to base the number of helpers to the sick and wounded. The number of medical officers with troops in the field is on an average of three to each regiment, although this number is by no means constant, and it is possible, at times, to get along with much less, while certain emergencies are likely to arise when two or three times that number might be required.

This being the allowance of medical officers and members of the hospital corps we see at once that when the troops are massed, the organization changes, with the arrival of the troops, to first, the regimental; second, the brigade; and third, the division hospital. In other words, the medical department, including the hospital corps, organizes *pari passu* with the organization of the troops.

In addition to this force of the hospital corps and medical officers, our regulations provide an auxiliary force among the privates of the fighting line. These



DIAGRAMMATIC DRAWING, SHOWING THE SEVERAL LINES OF MEDICAL AID ON THE FIELD.

(*a*) *Line of Battle.*— Regimental surgeons, orderlies, dressing cases, company bearers, first aid packages, stretchers, immediately in rear of fighting line.

(*b*) *First Dressing Places.*— Ambulance surgeons, pack animals with panniers, surgeons' tents, stewards, cooks and litter bearers of the hospital corps 1,000 yards behind fighting line, near water.

(*c*) *Ambulance Station.*— Surgeons' hospital corps men, ambulances, medical wagons, tents, operating tables, light cooking apparatus 2,500 yards from fighting line, near water, fuel and dwellings.

(*d*) *Division Field Hospital* (3 *Stations*).— Field folding furniture, bedding, medical supplies, etc., in vicinity of dwellings, water, fuel, large barns, hay, straw.

are known as litter bearers. Formerly they numbered four to each company, and they were taught the duties of first aid to the injured by the medical officers. It was their duty to assist the wounded in the fighting line until relieved by the members of the hospital corps proper. Very recently this scheme has been enlarged by orders from the War Department. The recent orders provide that not only four but all the men of a company shall be taught the duties of first aid to the injured, so that in time of battle any one or more of the men may be designated by the commander to remove the wounded or care for them in other ways.

The medical officers are no longer expected to instruct these privates; they are taught the duties of first aid, and are drilled in the handling of the wounded

[1] An Address delivered at the School for Medical Officers, M. V. M., at the South Armory, March 26, 1896.

on and off the stretchers, in and out of the ambulances, etc., by the company of officers.

The ambulances for the conveyance of the sick are distributed to the army at the rate of three to each regiment of infantry of five hundred men or more, two to each cavalry regiment and one to each battery of artillery. Two ambulances are allowed the headquarters of each army corps, and to each train of ambulances belonging to a division two army wagons are allowed.

This, briefly considered, is the method or organization of the medical department in our army on a war footing.

The work of such an organization is best studied by a diagram (see page 585) which is a modified copy from a recent article by Lieutenant-Colonel Forwood, U. S. A. It shows at once the disposition of the relief corps in the different parts of the field.

The topography of the field might be such as to require a considerable degree of variation in this scheme, in so far as the distance between stations is concerned.

This scheme is of course diagrammatic in the extreme. Such a bountiful arrangement as this would hardly ever be witnessed in any battle, but it will serve us as a working model.

(3) We now come to consider the question of the *necessity for an increase in the number of helpers to the wounded, which seems apparent with the use of the new military rifle.* With the old arm, experience taught us that the estimates already mentioned were sufficient to care for the wounded in the vast majority of instances, but now that we have discarded the large calibre rifle for the weapon of small bore, whose range and penetration exceed anything yet tried in the way of hand weapons, it is claimed by many writers that we will have a larger percentage of wounded, and that the additional work to be thus imposed upon the relief corps will be far beyond the capacity of our present allotment.

I might state, incidentally, that it is claimed that other causes will operate to impose additional work upon the relief corps, and here I have reference to the extended order of battle, by which troops are spread over more ground, and the increase in the percentage of wounded, which it is said will come from modern field artillery. The brief time at my disposal will not permit a consideration of the subject from the standpoint of the latter, and I will have to confine myself as much as I can to the effects of the new military rifle upon the question at issue.

If the casualties of battle are to be greater hereafter, there is no doubt that we should increase the numbers of our relief corps. We have no means of estimating the deadliness of the new military rifle — this can only be determined by future wars — but we can draw some deductions from the statistics of the past, by which we may be able to arrive at conclusions of reasonable value.

A study of these statistics gave us formerly a pretty accurate idea of the percentage of the wounded, which we might expect to find in a given battle fought with the old arm. In estimating the casualties of the battle heretofore, the percentage of wounds from rifles, carbines and revolvers were especially considered, because they formed the vast majority of all the wounds noted. The wounds from the artillery arm, bayonets and sabres formed but a fraction of the whole. We do know from past experience, therefore, that the great majority of the injured noted in hospitals suffered from bullet wounds. The statistics of various wars shows this very prominently. The statistics of the Crimean war give the percentage of the gunshot wounds by rifle bullets at 60. In the war of the Rebellion the nature of the missiles was ascertained in 141,961 cases, and the surgeon-general's report says 90.1 per cent. were inflicted by rifle bullets. In the Franco-Prussian war Chenu's statistics gave the percentage of those receiving bullet wounds among the French at Gravellotte at 80.19. The same author on the part of the German army for the whole of the war shows that 91 per cent. of the wounds were inflicted by rifle bullets. It is thus seen that heretofore the casualties of battle have been especially identified with bullets from hand weapons, and in reckoning upon the casualties and havoc of future wars, I believe that the majority of the writers have special reference to the perfected military rifle-propelling, steel-armored bullets. Those who argue that our present allotment of two per cent. for a relief corps is not sufficient, cite especially the dangers of the new gun in so far as they lie in —

(*a*) Greater penetration.

(*b*) Greater dangerous space.

(*c*) The employment of smokeless powders, which gives a clear field.

We may here state that increased penetration, superior velocity and extended range have ever been the aim of the ballistician, and that the perfected military rifle of to-day is the gradual outcome of his genius. For the present let us consider *a* and *b*, and see by a study of past experience what has been the effect of their development upon the casualties of battle.

I should like to call your attention to some data I have copied from a tabulated statement by Longmore in the last edition of his great work on "Gun-shot Injuries." You will see that he gives the percentage of killed and wounded in certain battles, from Blenheim, which was fought in the days of smooth-bores, down to the Franco-German war (1870–71), which witnessed the use of a more perfect military gun.

PERCENTAGE OF KILLED, WOUNDED, ETC.

Battles.	Nation.	Strength.	Killed	Wounded	Ratio of kill'd and wounded.
Blenheim, 1704,	British allies,	56,000	9.00	14.00	1 to 1.6
	GalloBavarians	60,000	20.00	23.00	1 to 1.1
Italian war,	French,	189,690	1.33	10.37	1 to 7.7
Whole war, '59,	Sardinians,	?	—	—	1 to 4.4
	Austrians,	?	—	—	1 to 4.8
Shiloh, 1862,	Unionists,	63,000	2.75	12.51	1 to 4.5
	Confederates,	40,000	4.32	20.03	1 to 4.6
Gettysburg, '63,	Unionists,	117,350	2.41	11.68	1 to 4.8
	Confederates,	68,352	5.12	21.21	1 to 4.1
Gravelotte, '70,	Germans,	278,131	1.60	5.46	1 to 3.4
	French,	125,000	0.09	5.37	1 to 5.8
Sedan, 1870,	Germans,	190,239	0.86	3.40	1 to 3.9
	French,	124,000	2.41	11.30	1 to 4.6
Franco-German war,	Whole German army,	887,876	1.97	10.83	1 to 5.4

A careful comparison of the data in this table shows that the percentage of wounded and the ratio of killed to wounded have diminished rather than increased since the days of Blenheim, and, as these engagements

were fought during a period of history coincident with the evolution of the military rifle, or, as we might put it, during a period of history coincident with the development of velocity, range and penetration of the projectiles of military hand weapons, we are forced to the conclusion that the casualties of battle have not kept pace with the improvements in the latter, and that it is very doubtful if an increase in the sanitary or relief corps will be rendered necessary from this source in the future.

The reason for a diminution in the casualties of battle is well understood, and it is not the purpose of this paper to enter into an explanation of it any more than to point out that, as the ballistician has conferred range, penetration, dangerous space, etc., upon his projectile, the tactician has sought to neutralize its deadliness by altering his tactics from a close to an extended order, by avoiding front attacks when flank movements might acomplish the desired end and by resorting to those expedients best known to the military man.

(*c*) *The employment of smokeless powder*, which gives a clear field. In answer to the argument that smokeless powder will operate to increase the percentage of wounded it may be stated that the rifles of small calibre are proverbially inaccurate in the mid and remote ranges, and that for this reason a clear field does not offer any marked advantage. The inaccuracy in fire is said to be due to the hygroscopic property of the nitro compounds which compose the new explosives as well as to their poor keeping qualities, both of which cause varying velocities.

It has been proposed to counteract the use of smokeless powder by generating smoke on the field from explosives, chemical substances, etc., in order to conceal the troops from the fire of the enemy, or for any purpose calculated to give advantage in manœuvring bodies of men. In addition to this the showy uniform and white tentage heretofore in use are to be discarded for materials with shades bearing but little contrast to those of the field. When we consider the resort to such expedients, in connection with the inaccuracy of the new arm, it is doubtful if even smokeless powder will have any influence to increase the casualties of battle, or to alter the present allotment of relief corps.

The character of wounds inflicted by steel-armored projectiles and our perfect technique in dressing them will have their weight in lessening the work of the sanitary corps in the wars of the future.

Before we proceed to the character of the wounds, let us study their regional distribution, as noted in former wars. The subjoined table is one often referred to by writers on gun-shot injuries. It shows that the regional distribution of wounds was learned in 245,739 instances, and that the different parts of the body suffered as follows:

WAR OF REBELLION (EXCLUSIVE OF KILLED IN ACTION).

Record of 245,739 Gun-shot Wounds.	Number.	Percentage.
Head, face, neck, ...	26,400	10.7
Trunk, ...	45,184	18.4
Upper extremities, ...	87,793	35.7
Lower extremities, ...	86,413	35.1

In addition to the foregoing we have statistics tabulated by Fisher concerning the wounds in the Prussian army in 1870–71, giving the gross results of 61,168 gun-shot injuries, from which it appears that in every 100 men hit 12 per cent. were killed, 49 per cent. slightly wounded, 37 per cent. severely wounded, 10 per cent. remained with command for treatment.

The severe wounds among these were distributed over the target areas of the body as follows:

Severely wounded, 23,054.	Number.	Percentage.
Head and face, ...	2,569	11.14
Throat, ...	514	2.23
Chest, ...	2,254	9.77
Back, ...	793	3.44
Abdomen, ...	1,890	8.20
Side, ...	988	4.28
Upper extremities, ...	5,628	24.41
Lower extremities, ...	8,418	36.52
	23,054	99.99

From this table we find that more than 70 per cent. of the wounds were inflicted in the extremities. If we now go back to the character of wounds to be expected in future wars we find that it is especially true that the humane features of the wounds from the small-bore gun are observed in the soft parts and joint ends of bones. Those of the soft parts need not detain us since they will seldom be classed among the severe wounds.

With reference to the bony lesions of the extremities we may divide them into two classes, namely, those of the epiphysis and those of the diaphysis.

Epiphysis. — The old conoidal leaden bullets of large calibre invariably produced comminution and splintering in the joint ends of bone, and the injuries they were wont to cause in these anatomical parts were attended with marked shock, and they were always serious at best.

On the other hand, the destructive effects of the jacketed steel bullet in the spongy ends of bone, except at relatively short ranges, are not attended with comminution or fissuring, and the element of shock may be entirely absent or faintly marked. Instead of the enormous destruction of tissues noted by the old leaden bullet, we more often find guttering, or a complete perforation of the bone without fracture, and these appearances are specially noted at ranges between three and fifteen hundred yards.

Diaphysis. — Gun-shot injuries of the shafts of the long bones by the old leaden bullet of large calibre were characterized by extensive comminution; isolated fragments free from periosteal attachments; numerous fissures. On the contrary, the jacketed bullet causes less comminution; the smaller fragments are generally bound to the main fragments by periosteal attachments; the fissures are usually subperiosteal, and the bony lesions take more of the nature of perforations, such as are commonly seen in the joint ends. Complete perforations without fracture are not infrequently seen in the results of the experiments on cadavers and lower animals, and Dr. Arnold of the Navy, while giving his recent experiences in China in the annual report of his surgeon-general for 1895, details a complete perforation of both femora in the

same individual, without fracture, by a steel-armored bullet from a new Mauser. Taking all these facts in consideration I believe it may be stated without much fear of contradiction that the gun-shot injuries of the extremities, which have formed such a large percentage of the wounded, will be less severe in the wars of the future, and that the proportion of men in this class who will require transportation to the rear will be less than heretofore, and that, therefore, an increase in the number of porters from this source need not be apprehended.

Our present knowledge of treating wounds will operate materially to lessen the burden of the relief corps. In former wars sepsis was the rule in all wounds; the constant attention and frequent dressings entailed a vast amount of work on the medical department of the various hospitals. To-day by observing aseptic and antiseptic methods, it is the exception to witness suppuration in wounds; it is seldom that a wound requires to be dressed oftener than once per week; whereas it was necessary in the preaseptic era to change the dressings daily, and often twice per day. The saving in time, material and labor is at once apparent when we contrast the old methods with the new.

Original Articles.

ARTERIO-SCLEROSIS,

WITH REPORT OF A CASE OF THROMBOSIS OF THE BASILAR AND CORONARY ARTERIES.[1]

BY W. H. PRESCOTT, M.D.

ARTERIO-SCLEROSIS is a disease of the arteries, characterized by a thickening of their walls (which is due to a deposit in the intima) with a diminution in the size of the lumen. There are three divisions into which the disease may be separated: first, the nodular — arterio sclerosis nodosa — in which the disease is circumscribed, although it may be widely distributed; second, the senile, in which the change in the arteries is one of the signs of advancing years; and, third, general arterio-sclerosis, a disease of the middle-aged (or young), and which is the form to which reference is made when the disease is mentioned.

Thoma found in the fetus that there was a marked increase of the connective tissue in the intima of the aorta between the opening of the ductus arteriosus and the bifurcation, the increase taking place after the closure of the umbilical arteries. He claims this is due to the fact that the aorta is dilated after the closure of the umbilical arteries, and as a result of the accompanying irritation of the nerves of the aortic walls, an increase of the connective tissue in the intima is brought about. This increase of the connective tissue in the intima causes a diminution in the size of the lumen, and thus a return to the normal. The same increase of connective tissue is said to happen in the main artery supplying an extremity, when for any reason the extremity has been amputated.

In arterio-sclerosis there is a disease of the media (with a destruction of its cells) which allows a dilatation of the vessel — this dilatation being followed by a deposit of (or increase in the) connective tissue in the intima, thus bringing the lumen of the vessel nearly to its normal size. This thickened intima may become degenerated and an "atheromatous plaque" result. After death this plaque appears as a slightly elevated patch of varying size and usually yellowish in color; but in life there is a depression (due to the blood pressure) corresponding to the degenerated area. This degenerated area may be partially destroyed, or washed away, and a loss of substance result — the so-called atheromatous "ulcer." A thrombus may be formed at this point, or the wall give way and an aneurism be the result.

Etiology. — Many things have been said to contribute to the destruction of the media: hard work combined with worry, chronic alcoholism, lead-poisoning, gout, syphilis, articular rheumatism, endocarditis, typhoid fever and scarlatina. In several cases which I have seen none of these could be held to be the cause, but another infectious disease, namely, influenza, might be. Dr. J. Homer Wright tells me he once heard Dr. Osler say, "arterio-sclerosis — the result of worshipping at the shrine of Vulcan, Saturn, Bacchus or Venus."

The symptoms depend a good deal upon the part most affected; an arcus senilis is common, and the arteries of the extremities may be quite rigid. "Edema and ascites are rare, except possibly just before death" (Councilman). When the arteries of the brain are affected there may be persistent headache, vertigo, loss of consciousness, hemiplegia, and other forms of paralysis. The latter symptoms are due to thrombosis, hemorrhage, embolism or spasm (?) of the arteries. Embolism is rare, and is secondary to some change in the heart or its valves. Hemorrhage may result from the rupture of a small aneurism. Spasm of the arteries is a theoretical cause, but may explain the numerous attacks of what may be called transient paralyses, with complete recovery in the intervals. When the coronary arteries are affected there is usually an irregularity in the strength and rhythm of the heart's action with the symptoms ascribed to a fatty heart or to interstitial myocarditis, or there may be attacks of angina in which the pulse-rate may differ on the two sides (arterial spasms?). Rupture of the heart wall may occur with hemorrhage into the pericardium, or a dissecting aneurism be the outcome; in these last two cases the only symptom may be sudden and severe pain in the epigastrium, with death as a result immediately, in a few hours or days. When the arteries of the kidney are affected there is a slight trace of albumin in the urine, with an occasional cast; but in those cases which I have seen where the urine was carefully examined, there has not enough abnormal been found to warrant a positive diagnosis of renal disease (the amount of urine is about normal or small). Of course, there may be advanced renal disease accompanying (or due to) the arterio-sclerosis; and in these cases the chemical examination would show the disease which is present. In arterio-sclerosis there is some increase of connective tissue in the kidney (which may be focal), and there are some depressions in its surface. The heart is usually enlarged in some cases to a great degree without any evidence of valvular disease. Dr. Councilman reports two cases where the heart weighed 800 and 850 grammes respectively. The absence of hypertrophy does not rule out the disease.

I believe many cases of indigestion are due to changes in the stomach and intestines, the result of this disease.

The treatment has hitherto been very unsatisfactory,

[1] Read before the Clinical Section of the Suffolk District Medical Society, October 21, 1896.