A few practical observations on the injuries incidental to warfare : the substance of three lectures addressed to the officers of the Royal London Militia / by G. Borlase Childs.

G. BORLASE CHILDS'

LECTURES

ON INJURIES INCIDENTAL TO WARFARE

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THE

Substance of Three Lectures

ADDRESSED TO THE

OFFICERS AND PRIVATES OF THE ROYAL LONDON MILITIA,

BY

G. BORLASE CHILDS, F.R.C.S. BY EXAM.

SURGEON TO THE CORPS.

Dedicated by Permission

TO

THE RIGHT HON. LORD VISCOUNT PALMERSTON.

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JOHN CHURCHILL, NEW BURLINGTON STREET.

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TO THE

RIGHT HON. LORD VISCOUNT PALMERSTON,

SECRETARY OF STATE, HOME DEPARTMENT.

My Lord,

The following Lectures, to which I respectfully solicit your Lordship's attention, were prepared by me for the officers and privates of the Royal London Regiment of Militia, to which corps I have the honour to belong.

The Regiment forms a part of that real national force on which the safety of the country must ever depend, and which, in these eventful times, happens to be placed more immediately under your Lordship's command.

The Lectures have for their object an attempt to alleviate the condition of the wounded in war; to restore to the soldier, when injured by shot or sabre, his presence of mind, and with it the energy required to place himself in comparative safety on the field:—an attempt which I feel assured will meet with your Lordship's approval.

The disasters of a well-fought battle fall heaviest on the unfortunate wounded, nor can any nation support a surgical staff equal to such an emergency. Convinced of this fact, I have thought it to be a duty incumbent on all Army Surgeons to give to the officers and soldiers of the corps to which they belong, that practical information which might enable them, though wounded, to escape at least from the horrors of abandonment on the field.

To be educated, perhaps I ought to say instructed, in what is useful and appropriate, seems to be the eager desire of nearly all classes of the community. Why should the soldier be excluded from a movement destined no doubt to produce great results? Should this attempt prove suc-

cessful, it will and must give to the soldier coolness and firmness in the hour of trial—counteract panics, restore confidence, and, above all, endow him with that well-founded self-reliance which is universally admitted to be a distinguishing feature of the true British soldier.

I have the honour to be,

My Lord,

Your Lordship's most obedient servant,

G. Borlase Childs.

11, *Finsbury Place South*,
June 20th, 1854.

THREE LECTURES,

&c.

LECTURE I.

THE OSSEOUS SYSTEM OF MAN—ITS MECHANISM AND THE INJURIES TO WHICH IT IS EXPOSED IN WAR.

THE interior of man and in an especial manner the skeleton or osseous framework is usually regarded, by the bulk of mankind, as an object if not of horror, at least of aversion and dislike.

This arises, in a great measure, from our education, as is evident from the apathy or indifference with which the interior of animals closely resembling ourselves is universally looked at and examined. By education alone can this dislike be overcome, and accordingly we find that strong minds, men of genius and great ability, whatever was their walk in life, uniformly overcame it, and

that too at an early period of their lives. Anxious to extend their knowledge, to perfect it, to leave no link wanting in their deductions as to man's actions and motives for actions, no chasm whereby the correctness of their inductions might be assailed, and ignorance of some important item found to exist;—all such men, we find, have made anatomy, in one form or another, part of their studies and of their education.

To men of a divine genius like Newton may be conceded the extraordinary gift of arriving by substantive views, that is views drawn from a perception of external objects, so brief that it escapes even their own notice,—to such men may be conceded the gift of arriving by a sort of instinct, as it were, at the truth in sciences which they have not studied in detail. Others must follow a more humble course. They must proceed from detail to generalizations, whether these refer to the philosophy of the matter, or to its practical application to the ordinary affair of life.

It is with a view to your education, practical if you will, that I ask you on this and the too subsequent Lectures to examine with me some of the details connected with two great systems of organs of man; with those in fact, for I have purposely selected them, which though they may be the least amusing, yet practically most interest you. The title of the present Lecture announces to you

its nature and object :—"The osseous framework or skeleton of man, and the injuries to which it may be subject in war." This wonderful assemblage of bones, the human skeleton, may be and has been viewed in many ways; considered from a philosophical point of view it is wonderful; I mean to confine myself wholly, or nearly so, to the practical.

If you cast your eyes cursorily over a skeleton, it will no doubt appear to you confused, irregular, and without form. That it has no form, properly speaking, I admit, for the expression "form" belongs in an especial manner to the exterior of man and animals. These are the forms which nature decorates, befitting them for the glorious landscape, the earth's surface on which she has placed them, and of which they constitute the highest ornament. But the skeleton has its mechanical construction, its proportions, its adaptations, and its uses—to these I claim your attention.

Neglect for a moment every other bone of this framework, and look only to this the chain of bones which we, anatomists, call the vertebral column. Observe well its most singular and admirable composition; one great and important object held in view by nature in the formation and articulation of this chain of bones, being the protection of the spinal marrow—an organ of infinite delicacy, and of vital importance to man

—nothing therefore has been omitted to secure its safety.

But here arises a difficulty which Nature's Architect was alone equal adequately to meet This same column is of necessity the centre of all movements performed by the body and limbs: hence the necessity for numerous joints, lest, by a sudden angular bending the delicate spinal marrow may be injured. Many of the connecting ligaments are elastic and of great strength, and these restore the column to its natural form after being bent. Strong fleshy masses of muscles, placed on the back, raise up the trunk at will, and convert this admirable series of broken levers into a fixed column of vast strength; lastly, when you look at it in one way it is straight, but if viewed in profile it presents several curves, which in the well formed are exquisitely beautiful.

Our time being limited, and not to exhaust your kind attention to this Lecture, I shall select but one or two points of observation in respect of the vertebral column.

1. The portions we call the bodies of these bones are tied together by very powerful elastic ligaments.

After a long repose, as during sleep at night, these ligaments expand so that the person, if tall, may and does gain an inch or more in stature; that is, if after the day's exertion and towards

evening he measures five feet eleven, in the morning when rising he will measure six feet. The full height then, you perceive, of any person is only to be ascertained by a morning measurement.

2. The curves are beautiful and they constitute the most perfect form ; were you to see a person with a perfectly straight upright back, you would be astonished and amused at the ludicrous appearance.

3. The importance of the column is such that its name is employed to designate the two grand classes of the animal kingdom, the one being called vertebral, the other avertebral, which merely means animals which have a back-bone and those which have not.

It represents therefore the basis, as it were, of the construction of all the higher animals, and I shall now endeavour to show you that all the other parts of the skeleton are either simple extensions of this column, repetitions in fact of it, or mere appendages. In proof of which let me direct your attention to the proteus, an animal perfect of its kind, and yet, all that it has of a skeleton is the part we call the vertebral column and the head.

Now the bones of the head are viewed by all philosophic anatomists as a mere repetition of these vertebræ, and indeed are frequently called vertebræ of the head.

If we ascend a little higher in the scale, we find that to this column, central and typical of animal forms, Nature has superadded ribs, as you may see in the skeleton of a snake; ascending still higher, she gives a breast-bone, and lastly limbs. Thus none of these parts are essential excepting the column and head which is a part of it; all the rest are merely appendages superadded to fit the animal for its position or place in the grand scale of life.

Let me now review these structures in succession; inquiring briefly into their uses; by what means they are made useful; how acted on, and for what purposes.

These osseous levers are tied together by inelastic ligaments permitting of motion only in certain directions, for the most obvious of all reasons, namely a direct co-ordination with the nature of the movements to be performed; I select an example or two, not so much for the purpose of convincing you that Nature is all foreseeing, for of that you cannot doubt, but rather to strengthen, by a direct appeal to the fact, a conviction which, though safely based on an à priori argument, may receive a sort of mathematical demonstration also, a demonstration at least by intuitive or direct inspection.

The first I select for its simplicity, is the elbow-joint. Observe that its movements are hinge-like,

that is, merely backwards and forwards ; therefore, you perceive, its ligaments must be placed at the sides, so as to prevent all motion in that direction ; here is a ball-and-socket joint ; although we may never have seen the ligament which secures this joint, we may at once pronounce upon its form, which must be orbicular, or all round, to admit of the universal motion the osseous surfaces imply.

I show you next the lower jaw.

Reflecting on the character of its movements, its ligament or ligaments, properly speaking, can be placed only in one direction, and no other ; I speak with reference to the movements enabling us to use the important molar or grinding teeth. One extremity of the ligament must be placed in advance of the other, and, on an appeal to the structure we find that it is so ; but not to tire you with too many examples of this beautiful law of harmony of structure and adaptation to use, I shall cite but one more : you see this little cord crossing from one part of this bone (the atlas) to the other : on its integrity life depends.

Observe its uses, how it secures in its place this projecting piece of bone (processus dentatus) of the second vertebra ; but it does more than this ; it enables the first, together with the head, to move around it, as on a pivot ; this motion, which mathematicians call universal, if allowed to become

rotatory, would immediately destroy life; Nature therefore checks it by two very strong cords called check ligaments, connecting the pivot to the head, thus limiting the rotatory motion to half a circle.

There is nothing in the world more wonderful than this; but, indeed of the mechanism of animal structure it may be truly said, in the language of England's greatest historian, the greatest perhaps of all historians, "that human handiwork even of the highest order is infinitely inferior to the humblest mechanism of animal structure."

We have examined some of the means by which the bones are rendered useful; connected in this way they are prepared for action or use. Now what is that use? It requires but a few words to explain this to you.

Some of the uses of the skull are obvious—it protects the brain in the most admirable manner—its arched form gives it additional strength. The osseous chest is a mechanism which is said to solve a problem in mechanics which human hands could never imitate; though perfectly moveable in all its parts and joints, yet it can be rendered fixed and immoveable in much less time than a second; it becomes then a fixed point for numerous powerful muscles to act upon it, for it is by means of the muscles or the flesh that we move the bones.

Nothing is more simple; you see this arm clothed with flesh; usually, with our will and consciousness, but sometimes without either, these fleshy masses contract, shorten themselves, and by these means the more moveable part is forcibly drawn towards the fixed or less moveable part. This is the whole. One generalization expresses it and includes all.

But now, if we look into the details we shall find an infinitude of admirable contrivances, all arranged to render the organs of the highest utility to man. Nor have beauty and grace been overlooked! That fine position, expressing deep feeling, when the hand is placed over the chest and heart, is effected simply by the two great levers, the bone of the arm and the bones of the fore-arm not running in the same plane or axis. By this simple mechanism, overlooked by unobserving minds, the hand, in every appeal to human sympathies, assumes the most graceful, dignified, and touching posture conceivable.

Observe the wonderful mechanism of the hand! The extremities of the bones, by supporting the delicate elastic nervous pulp of the fingers, so strengthens the touch as to furnish us with what really amounts to a sixth sense—the sense of resistance.

Observe the hand how it turns on the fore-arm, supine and prone alternately. This is effected by

the peculiar form of this joint (radio-humeral), and by the interposition of a structure, unlike ligaments, by permitting a twisting motion (which ligaments do not admit of), and yet serving the purpose of a powerful ligament.

How varied the motions of the human hand! How admirable as an instrument when directed by genius! Without the hand of the labourer, where were our ramparts, temples, domes, ships, cannon? Where the glorious labours which, above all, characterise man? Where the divine arts of the sculptor and painter? Agriculture, peaceful agriculture, first of arts, parent of civilization, which, from the bosom of the fruitful earth, draws food for countless millions, is simply the result of almost untaught, unskilled labour.

Equally wonderful, though leading to less striking results, is the mechanism of the limbs and feet. It must, no doubt, have been to many here a matter of surprise, how we should stand easier on one limb than on both. The explanation is this: to stand upright on both limbs requires a strong muscular effort, and this ends in fatigue; but if we throw the weight of the body forward at such an angle as to cause the line of gravitation to fall a little in front of the knee-joint of the limb on which we rest, as in the position of standing at ease, the knee-joint becomes secured

by a muscle and ligament placed on the back of the joint, and the limb is thus changed into a fixed lever ; little muscular effort being required, the trunk is supported without fatigue.

Equally admirable is the mechanism of the foot, on which I regret I shall not have time to dwell. Permit me merely to allude to one or two points in its structure which may have escaped your notice.

The skeleton of the foot, it is true, bears no resemblance to the matchless foot of the Venus, when clothed with all the beauty of form which nature intended it should have ; for the exterior alone is beautiful ; it is this which attracts, delights, and dazzles the eyes of all. The interior must be looked at from another point of view ; to be admired its laws and adaptations and mysterious springs of action must be inquired into by the reasoning powers of man.

The arch of the skeleton foot, for example, is not admired merely for its beauty ; in it we find a wonderful adaptation of structures to a special object ; it is not wholly composed of bone, were it so it would probably be broken every time we fell from a great height, alighting on our feet. In order seemingly to secure the frame against this mischance, and still further, no doubt, to protect the brain from concussion, nature has cunningly devised an elastic ligament (for so may we call

the structure I now show you), which by strongly tying these bones together (the heel-bone and boat-shaped bone), and receiving on its upper surface the rounded head of the ankle-bone, sustains, in point of fact, not merely the weight of the body, but its impulse in leaping, running, falling, &c.

The key-stone of the arch of the foot (if I may so say) is formed then by a bar of great strength and elasticity, with physical qualities fitting it admirably for its intended uses. Thus it happens that the shoe or boot which fits the foot at rest tightens beyond endurance when we walk, for the foot lengthens fully half an inch whilst sustaining the weight of the body.

This matter, which appears so small and unimportant, touches the efficiency of an army; accordingly we find that it has not escaped the authorities at the War Office, for in the instructions issued to medical officers regarding the examination of recruits, a flat foot is included amongst the more common causes of rejection. When the plan of battle has been arranged, I need not point out to my brother officers and soldiers how that the success of great and glorious achievements is mainly dependent on celerity of action and the rapid occupation of vantage ground.

To a Light Infantry man a well arched foot is

of the utmost importance, as it enables him to be swift and capable of moving with safety over ground difficult and rugged, and thus to avail himself of points and positions, not only harassing and annoying to the enemy, but which, if properly supported by the mechanical power of the whole army, must inevitably lead to victory.

It was remarked by Xenophon, who conducted the retreat of the 10,000, so celebrated in history, and yet so full of romance, that in selecting a horse the first and the last point to look to is the feet. The reasons I need not enumerate to you. Now, in some respects, the same remark applies to the soldier. To him the firm, rapid, and sure step is of vital consequence; five minutes lost in traversing the ground has cost an army a fearful slaughter, and has occasionally lost a battle. I have heard the slaughter of the Dutch troops at Waterloo ascribed to the slowness of their movements.

Modern tactics and strategy, combined with the use of firearms and artillery, by no means do away with the necessity for cultivating the individual strength of every soldier; on his agility depends, not unfrequently, his safety and success. To the Light Infantry and to the Rifles the qualities of speed, agility, and strength, are absolutely essential, whilst Cavalry are wholly dependent on them. All manly exercises calculated to im-

prove the strength and fleetness should be cultivated by the soldier.

But I do not intend dwelling further on this topic, which indeed has reference rather to that system, the muscular, by which the bones are moved; for these last, as you no doubt perfectly understand, are merely passive levers, the muscles being the active organs of motion.

It is not improbable that in modern warfare the cultivation of the muscular strength of the soldier may have been too much neglected. An improved system of projectiles, of discipline, and of strategy, has no doubt led to this; yet muscular strength, activity, and energy must ever be of great value to him. Besides, the manly exercises preserve him in health and spirits, ever ready for action. Garrisons, where the troops lead an inactive life in a certain sense, or are reduced merely to the routine of mounting military guard, are notoriously unhealthy stations. They have proved the graves of fine armies; and citadels, otherwise impregnable, have fallen before the strides of famine and disease.

As these Lectures are intended to convey to my hearers practical information, I purposely refrain from dwelling on the beauty and elegance of the well arched and symmetrical proportions of the female foot. This is a theme which has occupied

the pen and the genius of poets of all ages; the "light and bounding step," the "airy tread," and "twinkling feet," have been alike extolled in verse, chisselled in sculpture, and depicted on canvass.

In my next Lecture, which I hope to have the honour to deliver to you, it is my intention to consider the mechanical injuries this wonderful system of leverage is apt to sustain by the accidents of war.

LECTURE II.

SAME SUBJECT CONTINUED AND FINISHED.

In the dread chances of war, humanity demands, and a nation's interest and honour are pledged to exhibit, a tender care of the sick and wounded of their armies and navies; to provide for them the best of medical and surgical skill, a commissariat equal to the exigencies of the moment, and a medical staff sufficiently numerous and talented, to relieve the minds of the soldier, his relatives, and the nation at large, of any serious doubt or fear which might arise on so momentous a matter, as the fate of the wounded after a great battle by sea or land.

The task I undertake this evening is not to offer any opinion on the respective duties of the Government and the profession as to the constitution of an efficient surgical and medical staff; as to whether military and naval surgeons should be young or old—men just entering on the career

of life, or men full of experience and knowledge of the difficult circumstances under which they are sure to be placed. My task is a simple, and I must say a more agreeable one,—it invites no discussion or censure upon any man or system. I simply purpose showing you, by a little practical education, how you may, unaided by our profession, rescue yourselves and fellow-soldiers from the most deplorable condition, when left on the field of battle, wounded and abandoned for a time by friend and foe.

I do not propose to teach you surgery, military or naval; all surgeons should, if possible, be popular men and well esteemed, but there is no such thing as popular surgery, or popular medicine; it were misleading you dangerously to leave you under such an impression. The system of levers which I have exhibited to you has been termed by systematic anatomists, "the passive organs of locomotion." The propriety of this phrase or expression is unquestionable; for, although they are, during life, as much alive as any part of the body, they do not of themselves move, but require to be moved by other organs.

These organs of active motion, I have already explained to you, are the masses of flesh called muscles. These act on the bones, and by their means, as levers, transport the body from one part of the earth's surface to another. It is by means

also of these same muscles that we breathe and speak, in short, wherever motion is evident, with certain exceptions, it is performed by the more immediate means of these fleshy masses. In all this the bones are the passive instruments acted on.

Look again attentively at the skeleton, and you must observe, I think, that in the erect position the feet carry the whole weight of the body, and all what it carries—one or both feet, as the case may be. It must be clear to you that these limbs act merely as levers, broken or fixed, according to the exigencies of the movement. But in these levers, or limbs, it is also manifest that some are more important than others, and that the utility of the limb, as an instrument of support, must depend on its integrity; that if broken, in fact, at any point, the limb becomes useless. The same remark applies equally to the arms, as instruments of prehension; when this bone (the humerus) is broken, the arm falls powerless, the lever, in fact, upon which the muscles are acting, and by which they raise the arm, has been destroyed, and is now useless as a fixed lever.

What is required to restore its utility? Fix it. In its present state, that is when broken, it has a joint too many, an accidental joint for which nature had not provided. She would do

so in time, even were the lever not to become united; to this singular process I may afterwards advert, but the accommodation is never so perfect, nor the lever in this broken state ever so useful. When a long bone then is broken, the first object is to set it, to place the broken extremities in direct apposition. If the bone be broken transversely this is easily done, and the lever again becomes in some measure perfect; but, unfortunately, this does not always happen, and, indeed, generally in war, from the nature of the projectiles which strike the bones, the fracture is but too often oblique and shattered; hence the lever for a great length of time becomes wholly useless, and so difficult to treat that many surgeons have preferred to an attempt to save the limb, the terrible alternative, namely, the removal of the limb above the injured parts. Should these levers be struck by a musket-ball, it does not necessarily follow that fracture is the result; balls will frequently pass through the shafts of the long bones without breaking them; nay more, they will often become lodged in the dense parts of such bones for years, or even a whole life, without inconvenience or pain.

The course which a musket-ball sometimes takes is both curious and interesting. However quick its course, it is readily changed by a very slight resistance; for it should be recollected that

a ball has two motions when shot from a musket, a paraboloid curve and a rotation or spinning on its own axis. Dr. Hennen relates a case in which a musket-ball entered in front of the wind-pipe, and passed all round the neck, nearly to the point opposite to that at which it first pierced the skin. Instances have also been known in which a ball pierced the centre of the upper arm, passed over the back of the chest, thence amongst the abdominal muscles, stopped about half way down the opposite thigh, on the forepart of which it presented itself. Mr. Guthrie, my talented and much revered teacher, says, "After the battle of Toulouse a ball, which penetrated the surface of the chest and passed under the pectoral muscle for two inches, was ejected by the elasticity of the rib against which it struck, scarcely any inconvenience followed, and the officer rapidly recovered."

Dupuytren, during the disturbances in Paris of 1832, witnessed many curious instances of gun-shot wounds, and not the least peculiar were those in which balls, entering the lower part of the leg and striking against the spine or sharp edge of the tibia, were split into two fragments; these fragments then, diverging a little, passed through the calf of the leg and lodged in the fleshy part of the other leg, which happened at the moment to be behind the other limb; thus

five openings may be caused by one and the same ball. Instances have been also known in which a ball striking the bridge of the nose has been split in halves, the two portions taking a circuit round the face and head, and making an exit from one opening behind.

It will not probably be out of place here casually to allude to those peculiar form of gun-shot injuries which are vulgarly called "wind contusions." In reference to such cases, Mr. Cooper says, "A cannon ball, especially when nearly spent, frequently strikes the surface of the body or a limb obliquely, and is reflected without breaking the skin. A soldier may be killed in this way without any appearance of external violence. His comrades suppose, therefore, that he has been killed by the wind of the ball. But the error of this opinion is immediately manifest, when it is remembered that cannon-balls often carry away parts of the dress without doing any harm to the person. I remember a case where a cannon-ball passed amongst the six legs of three officers walking together arm in arm; yet both legs of the officer in the middle escaped injury, while one leg of each of the outside parties was so shattered as to require immediate amputation;" thus making good the old Latin proverb, "in medio tutissimus ibis." Mr. Cooper continues, in explanation of these wind contusions, "When a cannon-ball rolls, as it

were, over the surface of the body or a limb, the toughness and elasticity of the skin keep it entire, while the muscles and even the bones may 'be crushed to atoms.'"

But to return from this partial digression, the principles I have laid down are, in some sense applicable to all fractured bones.

Before I request you to listen to some details which may be useful or interesting to you, permit me at once to accompany the soldier to the battle field, and there to view him as struck by a shot or shell.

If it be the larger bones of the lower limbs which are struck and broken, the accident is dangerous and terrible, for the soldier may be left on the field of battle; he cannot get out of the way of charges of Cavalry; the Artillery, in their eager rush to or from the action, move regardless of everything in their way, no one has time or opportunity to attend to another—the soldier must then look to himself.

Even if humanely carried to the rear, the very act of conveying him there, unless skilfully performed, may ensure his certain destruction. But I shall first consider the accidents which may happen to the levers composing the skeleton of the arm.

When the soldier finds that he has been so struck in either arm as to render the limb no

longer of use, his first effort should be to find a sling for it, so as to prevent it from dangling about and causing the broken bone to tear and lacerate the flesh and skin, thus converting an accident, at first simple, into one of a much more serious character. What is to be done? Get the arm into a sling. A neckerchief of any kind, a handkerchief, the sleeve or strip of a shirt, or the crossbelt. Either of these will form as good a sling for the occasion, as any that can be produced by the first mechanist. It should be short, broad, and kept close to the body. So arranged, the arm is safe for the time; if cool and collected, as a soldier should always be, he may remain with the corps, and show face to the enemy.

A single file is of consequence on some occasions, and he may retire at a safe moment, carrying with him his arms, if possible, for a true soldier never abandons these. On reaching a safe station, there may be no surgeon present, how is the soldier then to act? Let him look to the state of the fingers or hand, if swollen or livid, numbed or painful, something is the matter and must be looked to. The danger may arise from some undue pressure on the arm by the dress, and this ought to be cut through or removed. It is not often that gun-shot wounds bleed; if the wound be in the arm and it bleeds, apply cold lotions over it, which merely means, dip a handkerchief or a rag

into cold water and lay it over the wounded part; keep the rag constantly moist or even wet. Of all remedies to wounds this is the best application —a cloth wetted with cold water, Nature's medicament; it checks or even arrests inflammation, and all the terrible consequences resulting from this: many a limb might be saved could the soldier have a free access to a plentiful supply of cold water, using it as I have advised.

But when the levers of the lower limbs are broken, the case is altered, for the soldier falls helpless on the field. Yet, even here, were he to bind up the limb, or had but the means of doing so, could he even for a short space apply an unyielding splint to the injured limb, a strong piece of pasteboard, a portion of his knapsack, or two such splints as I now exhibit to you, secured by a roller or circular strips of adhesive plaister, he might, by means of a long sling and the aid of his musket, remove himself out of the range of shot and danger.

The whole principle, as you now no doubt perceive, consists in reconverting the broken lever for a time into a sound one, or at least one sufficiently so as to prevent the broken ends of the bone from destroying the limb, which they are sure to do if the sufferer be carried carelessly from the field. Hence you perceive, that even in civil life, when a person falls in the street and breaks a

limb, a shutter is called for and he is carried away, either on men's shoulders, or on a carriage with springs. For the ambulance in war must be a spring carriage, for the reasons I have stated to you.

As the subject I treat of is almost mechanical, it ought to be readily understood by all; so important indeed is the first treatment of such injuries, that it seems but reasonable that all persons, whether educated or not, should be taught the simple elementary principles of our profession. There is not one here who may not at some future day be called on either to act for himself, to advise, and even to render assistance on occasions such as I have mentioned; let him therefore never forget the simple elementary principles I have striven to enforce.

Turn we next to some of the details as illustrative of these principles, or forming the basis for their generalization.

In charges of Cavalry, or when Artillery advance or retire rapidly, horses are apt to stumble and roll over their riders; or the carriages may be driven over the chest of the dismounted soldier. On recovering his feet, besides great pain, the soldier feels that he cannot breathe with freedom; that if he moves he is threatened with suffocation, and he naturally imagines that something serious has happened. After all it may be but a few ribs

broken; a large handkerchief, folded like a bandage and bound tightly round the chest, will test this and very probably enable the soldier to walk off the field as if nothing had happened. For the pain felt in such injuries is caused by the motions of the broken ribs, and these being fixed by means of the bandage, the pain ceases and the breathing becomes free.

Should a ball strike the hand or foot, do not hastily despair of its recovery; remember the healing powers of cold wet rags; many a limb have they saved; be assiduous in keeping the wounded surface thoroughly wet. Be not too anxious to get into large hospitals; these are necessary evils, and after general actions the mortality in them is often terrible; you will be safer and better treated in humble cottages, or at least smaller apartments. You are better even in fields than in crowded hospitals, where fever, erysipelas, and hospital gangrene often destroy many more than the field of battle. Indeed during the Peninsular War, Mr. Guthrie states that this latter disease was fatal to thousands. Above all things be of good cheer and never despair, your country will never forget—will never abandon you. Be faithful and true to yourselves.

In attacks of Cavalry and Infantry it sometimes happens that a sword or musket-ball traverses the chest passing through and through: yet, from

this accident, terrible though it appears, many escape. Be careful what you do under such circumstances. Avoid wine and spirits, everything likely to hurry the passage of blood through the lungs.

In reference to bayonet wounds, Mr. Guthrie observes, "A great delusion is cherished in Great Britain on this subject.—a sort of monomania, very gratifying to the national vanity, but not quite in accordance with matter of fact. Opposing regiments," he says, "when formed in line and charging with fixed bayonets, never meet and struggle hand to hand and foot to foot; and this for the very best possible reason—that one side turns round and runs away as soon as the other comes close enough to do mischief; doubtless considering that discretion is the better part of valour."

He still further goes on to say, "The battle of Maida is usually referred to as a remarkable instance of a bayonet fight; nevertheless, the sufferers, whether killed or wounded, French or English, suffered from bullets, not bayonets. Wounds from bayonets were not less rare in the Peninsular War. It may be that all those who were bayoneted were killed, yet their bodies were seldom found. A certain fighting regiment had the misfortune, one very misty morning, to have a large number of men carried off by a charge of

Polish Lancers, many being also killed. The commanding officer concluded they must all be killed, for his men possessed exactly the same spirit as a part of the French Imperial Guard at Waterloo—they might be killed, but they could not by any possibility be taken prisoners. He returned them all dead accordingly. A few days afterwards they re-appeared, to the astonishment of everybody, having been swept off by the Cavalry, and had made their escape in the retreat of the French army through the wood. The regiment, from that day obtained the ludicrous name of the 'resurrection men.'"

But, returning to the history of mechanical lesions of the bones, I may further observe that wounded joints are considered even more dangerous than mere fracture of the bones. Thus a ball passing through the knee-joint caused the almost immediate loss of a limb to one of our most distinguished officers, the Marquis of Anglesea, the surgeon declining to take upon himself the responsibility of delay.

Since that period great improvements have taken place in respect of wounded joints, and we now lay them open fully when they are diseased. But what more immediately concerns you is, to recollect that a wounded joint does not admit of being handled or moved, and ought to be secured on the field of battle, so as to be rendered quite

as immovable as a broken limb. Nothing is easier to the person instructed in first principles. Let the soldier have with him, as a part of his necessaries, some lint, a bandage, and a small roll of strong adhesive plaister, and a couple of splints, these applied to a broken limb and firmly secured, will enable him to get away from further danger. It is but the work of a couple of minutes.

Weigh well the principles I have laid down; rightly applied you will find them of incalculable service to yourselves and friends. The safety of a nation, based on a due regard to their honour and interest, imposes on mankind the sad necessity of asserting their rights on the field of battle, and it might appear that the aim of an army is to destroy their enemy. Still, great armies have been broken up almost without bloodshed, showing the superiority of genius over mere brute force. Marlborough drove a splendid French army from an intrenched camp without causing the death of a single soldier. By the most skilful strategy he rendered their position untenable, and so they were forced to abandon it. This is the perfection of war—to place an enemy in such a position that he cannot fight with the slightest chance of success. Such, I think, mankind expects from high genius applied to the art of war.

From us, who mingle not generally in the struggle, but are expected to remain cool undis-

turbed spectators of the fight, the country and mankind generally expect prompt aid and all the relief which modern science affords. The surgeon on the battle field has no foes if he be recognized, to him all wounded are alike, for him it is sufficient that the soldier be injured and requires assistance. Whatever be the colours under which that brave fellow just struck down has fought and fallen, whatever complexion nature has stamped upon him, be he Pagan or Christian, savage or civilized, by reason of his wounds, he enters the great portal of humanity; his wound removes from him all nationalities, protects him against all antipathies of race, and places him at once within the pale of universal philanthropy which surgeons have ever recognized. Thus the wounded of all nations have equal claims; with a truth they may be said to have no foes. From all they may demand and do generally obtain protection, but from our profession they expect something more—skill, humanity, and a tender solicitude for their recovery. Under such circumstances the medical art assumes something of a divine character, being thus elevated above all the animosities of mankind.

LECTURE III.

THE VASCULAR SYSTEM OF MAN—THE INJURIES IT IS EXPOSED TO IN WAR, AND THE MECHANICAL REMEDIES APPLICABLE TO SUCH INJURIES.

THE universal and everlasting Geometer, the Being with whom originated, and who first applied the laws of animal life, has, in the construction of their wonderful frames, neglected nothing calculated to enable them to resist, for a fixed period at least, deleterious external influences, and to subsist as independent beings, in spite of an internal machinery of inconceivable complexity and delicacy.

With the springs of action of this machinery we are as yet profoundly ignorant. It is to the mechanical laws merely of a portion of this machinery, that I purpose calling your attention this evening.

There is no accident to which man is more

liable than wounds causing the effusion of blood, that fluid on which life depends.

From the slightest incision into the finger, merely causing a momentary alarm, to those deep and terrible wounds inflicted in war, by the knife of the assassin, or by unhappy chance, the principles to be followed in meeting them successfully are the same.

These principles as acknowledged and practised by surgeons are simple beyond what you can imagine;—nevertheless, this very simplicity implies a preceding high generalization, based on scientific details. For, although it be true that by empirical methods many arts have been practised even with success, and amongst others the arts of surgery and of medicine, yet in practice the empirical workman is never sure, never safe, never perfectly adroit, and above all never equal to every emergency.

Now these details are extremely simple and curious, and interesting even in a mechanical point of view, beyond all that art and science can place before you.

Have the kindness to give your whole attention; for a link in the chain of demonstration being overlooked destroys the evidence on which the generalization rests.

In order the better to fix your attention on the question before us, I might with success adopt the

usual appeal to your own interests—the most powerful, it is usually thought, of all appeals; but I can safely take higher grounds than this; for there are higher grounds involved in the consideration of animal structure and life.

You have all seen, and admired no doubt, the grandeur of a great architectural achievement. The Temple of St. Paul's for example, the solemn Minster of York, and many here may yet see that Church of St. Sophia at Constantinople, which is said to surpass, or to have surpassed in beauty and grandeur all human works. Now listen to what the first of English historians says of this grandest of human labours:—

"A magnificent temple is a laudable monument of national taste, and religion, and the enthusiast who entered the dome of St. Sophia might be tempted to suppose that it was the residence or even the workmanship of the Deity, yet how dull is the artifice, how insignificant is the labour, if it be compared with the formation of the vilest insect that crawls upon the surface of the temple." *

If a point of the finger, if any part indeed of the surface, be touched by a sharp instrument, a knife or a needle, blood flows in a greater or less quantity, according to the depth of the incision or the puncture, according also to the part in-

* Gibbon's "Decline and Fall," vol. vii. Millman's Ed.

jured. The sharp instrument has opened two sorts of vessels, or tubes, which anatomists call arteries and veins. They are very different in their nature, as we shall see presently, both as regards their contents, their vital and mechanical action, and the treatment required to arrest the flow of blood from them, when they happen accidentally to be cut across or opened ; for—

1st. The veins convey dark blood from the extremities and from all parts of the body towards the heart. If opened by accident they are easily closed. The mere pressure of the finger of a child will effect this. The veins heal readily, and give but little trouble. The loss of blood even from those of the largest calibre in the limbs, for example, may be controlled, and even arrested, by raising the limb up above the level of the head, in other words by the position of the limb.

The veins, in fact, receive their supply of blood from the extremities of the arteries, as may be proved by placing an arm across the back of a chair, and so compressing, for a few minutes, the main artery which supplies the limb.

Observe in how short a time the whole arm shrinks, and becomes pale, bloodless, and colourless. You arrest by the pressure the supply of blood to the limb, and hence, bleeding from the most serious wounds of the fore-arm and hand

may be easily arrested for a time, by so simple a a mechanical means as placing the arm across the back of a chair, and allowing its weight to accomplish that which otherwise requires direct pressure to effect. It is quite otherwise with the arteries ; for—

1st. The fluid in them is arterial, and of the utmost consequence to life.

2nd. When punctured they do not heal, but must be altogether closed.

3rd. The fluid in them is driven along or impelled through them by a powerful forcing-pump placed at their origin—that forcing-pump is the heart.

You perceive, I trust, how simple the mechanical arrangements are when divested of their technicalities, but still viewed through the light of science.

The heart, the centre of the circulation of the blood, is a fleshy hollow organ with four cavities, into which the blood is poured by the veins, and from which it is driven and conveyed through every part of the body by the arteries ; now these terminating in the veins the blood by their means is reconveyed back again to the heart. Thus when a vein is opened there is no forcing-pump behind it and the blood flows continuously, and may be checked by the slightest pressure ; but when an artery is opened, the fluid it contains

being urged on by the strong forcing-pump behind, it rushes out in alarming gushes, and if the artery be large, and means be not instantly taken to close it effectually, life, in a few seconds, becomes extinct.

No statistics exist enabling us to determine the average loss of men in battle by the various kinds of wounds, but there exists a general impression that a vast number die on the field from loss of blood, and of these many would have been saved had they but known practically the brief instructions I have now the honour to address to you.

Let me next direct your attention to the distribution of the great arteries and their branches. I have told you that all the dark blood of the body returns to the heart through the veins; you see it here flowing from the head and neck, limbs and trunk, towards the heart, pouring it into one of its cavities called the right auricle. From this it flows into another cavity called the right ventricle, the object of which seems to be to give to the blood in its course an additional impetus; for by this muscular cavity it is driven towards and through the lungs.

Returning from the lungs the blood, now wholly altered in its character and called arterial, flows into this cavity, the left auricle, and from thence, by an opening protected by a valve, into the left ventricle. This muscular cavity, the left ven-

tricle, acting on the arterial system, is the great forcing-pump; from it you perceive springs that large tube or artery called the aorta, the branches of which extend uninterruptedly into every part of the frame.

The discovery of the mechanism of this hydraulic system, for such it is, immortalised our countryman, William Harvey. It may be proved in many ways, but it is not necessary that I should, by demonstrating these proofs to you, divert your attention from the main object of the lecture.

You are now sensible that when an artery of a certain size has been punctured or opened (for the very small arteries and veins cease to bleed of their own accord), the loss of blood from it can only be arrested by mechanical means, which, although extremely simple, and, in point of fact, amounting only to pressure judiciously applied, yet necessitates the clearest practical knowledge of the course of the great artery involved, or, in other words, the course of the principal arteries in the limbs, neck, and heart, and the most eligible points for the application of pressure.

I shall speak to you, first, of the great arteries which supply the limbs; and, secondly, of those which supply the head and neck; and, in conclusion, of the general means of arresting the

effusion of blood which cannot be controlled in the way I have mentioned.

Look attentively at the figure displaying the course of the great arteries (branches of the main trunk) which supply the arms, limbs, head, and neck. One you perceive crosses the first rib, and proceeds as a single great trunk as far as the elbow. Now, if you reflect upon this simple fact, it will show you that pressure applied by the fingers, or what is still better by this little bandage, on any point of this great vessel a little above the elbow, will stop the bleeding from any wound, no matter how deep and dangerous it be, from the elbow to the extremities of the fingers, or rather from every point beyond your ligature.

The wounded man may accomplish this by grasping his arm with his own hand until a comrade assists him in placing on the arm this little bandage; or he may do it himself with a strap or a handkerchief, provided he but know the object of the pressure. On the instant the calibre of the artery is closed, the hæmorrhage ceases in every part beyond that point and the farthest extremity of the limb.

The experiment may be made in the easiest manner. At the wrist you have the pulsations of the artery we call radial, the tube which transmits a flow of blood to the hand. Ask a friend

to place his finger firmly against the bone, high in the arm, and the pulse will immediately cease to be felt. What has happened? Your friend's finger has cut off the supply of blood to every part of the arm below the point of pressure, and were a wound to be inflicted on the hand or arm so terrible as to require amputation of the limb, there would not flow one ounce of arterial blood. Thus you see how comprehensible all this is, provided the simple laws of hydraulics and structures implicated be well and clearly understood.

Let me suppose now that the wound is high up; still the same principle applies quite to the top of the arm. There is but one great vessel you are required to command.

Let us now take the more dangerous case of all, when the wound is so high in the arm that there is not room to apply a circular strip or bandage; still the bandage itself rolled up, and forcibly pushed against the arm first, and then brought tightly over the top of the shoulder and firmly tied, may again be the means of saving life.

Pressure with the hand above and behind the collar-bone, by forcing the great artery against the first rib, stops the circulation in the arm at every point beyond the part compressed.

It is but proper to advise you on a point of much importance but little understood. A tight

bandage around the arm cannot be long maintained. It causes the limb to swell, and the fluids stagnate in the vessels, and mortification or destruction of all beyond the bandage will be the inevitable result of the neglect to relieve the limb of the tight pressure as soon as possible. Should a surgeon not be speedily found, the wounded person will find great relief by supporting the arm in a sling raised as high as possible, he may even place the hand on the head and support it there. This position of the arm has been found equal to the suppression of bleeding from severe wounds, without the employment of any pressure.

The same remarks apply strictly to the lower limbs—one great artery supplies them. At the point where the artery crosses the bone it is easy by the pressure of the hand to arrest the circulation in the whole limb, and thus save life; or it may be stopped all the way down to the knee by a circular strap and pad, or a bandage and little pad, formed of any material a soldier can command. Should the bleeding be serious the person must lie down and raise the limb above the level of the head.

Before I speak to you of the more dangerous regions of the head and neck, allow me to point out to you a few errors in respect of the treatment of wounds which one might suppose that common

sense and mere observation would long since have corrected. But common sense, though a most admirable thing in itself, never can and never will supply the want of a correct practical scientific education.

A boy climbing a wall, for example, cuts his hand deeply with glass; a person draws a cork, the neck of the bottle breaks, and, as the phrase is, he cuts his hand to the bone; or in a drunken brawl a large knife is drawn through the hand of the assailant or assailed. Now is it not lamentable that, although numbers of persons may be standing by, many of whom are said to be educated, yet not one can be found to give rational advice to the sufferer—not one competent to act on an occasion of so much importance—it may be of life and death. A cry is raised, "Run for a surgeon!"—the wounded person feels perhaps that he had better run himself; he does so; the faster he runs the faster the purple tide gushes from the wound, he has kindled up the heart's action; the forcing-pump or piston, I spoke of to you, now acts with tenfold energy, in consequence of the excitement of running, and thus, instead of losing a few ounces of blood, pounds speedily flow on the pavement as he runs along. All the common sense of the persons standing by is of no avail, nor ever would, in countless ages, have arrived at the correct treat-

ment of dangerous bleeding wounds, but through an appeal to sacred science, to genius; on the popular darkness, profound and hopeless, genius directs the torch of inquiry, by that light man discovers the absolutely true—a single great fact is made out, a single generalization reached, distinctly demonstrated. In its train follows the world of practical science—the men who apply to practical purposes the discoveries of genius. The torch in this case was kindled by Harvey; he discovered and demonstrated the circulation of the blood. From that moment false teaching and mal-practice were forced from the field, and common sense gently whispered to practical men, "Follow the path pointed out by the torch of genius. Apply the principle to the great business of life." If the genius be real, it cannot, will not mislead you, for the discovery of absolute truth must ever lead to great and sure results.

Throughout this discourse I have but endeavoured to apply to practical purposes a portion of the great discovery of Harvey. "The veins," he said, "carry the blood to the heart." They have no strong piston forcing that blood onwards; when opened accidentally, the flow of blood from them is easily arrested. But the blood in the arteries is forcibly impelled onwards in its course by a forcing syringe of great

power ; should any of these vessels be accidentally opened, the loss of blood can be arrested only by the obliteration of the calibre of the vessel by powerful pressure. This discovery, which leads us to such results, cost Harvey his practice—its application has made the fortunes of thousands of his successors.

In dangerous wounds of the head and neck, all that I fear the soldier can do is to maintain, if possible, the erect position, for by this he lessens the flow towards the head. It is safer to attempt no pressure at all than what is incomplete and ill-arranged.

The practice of applying cloth upon cloth, and bandage upon bandage, is fraught with great danger ; it merely conceals without meeting the danger. Better expose the wound freely to the external air, laying on it a rag dipped in cold water, or water and vinegar, than attempt inadequate pressure. A firm hard piece of sponge, strongly pressed together and maintained on the part with a single narrow bandage or strip of adhesive plaister, is superior to all the wretched contrivances of the uneducated. In this manner I saved the life of a policeman who had attempted self-destruction by a wound of the throat.

Permit me to assure you how highly I esteem

the honour of your attendance at these Lectures, and to express to you the pleasure it will ever afford me to be able to contribute, by my humble efforts, to your amusement and instruction.

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