

with which the dressings are impregnated will prevent those putrefactive changes which are so apt to be induced in wounds by the dirt, impurities, and unhealthy influences to which soldiers, during active service, are unavoidably exposed. A supply of these little packets was forwarded for the use of our troops during the military operations in Egypt and Bechuanaland; and Surg.-Gen. Longmore tells me that on examining some of the packets which were taken out to the Soudan and brought back after the Soudan expedition returned, he found the parchment paper and tin-foil covers, in spite of the heat, had prevented all escape of tarry material and carbolic acid from the dressings they enclosed.

It would doubtless be an improvement if the triangular bandages in these packets were "illustrated"—that is, marked by diagrams shewing the methods of applying them—such as Esmarch's bandage (Fig. 7), the bandage supplied by the St. John Ambulance Association, and the bandage issued by the St. Andrew's Ambulance Association. It is very important, too, that the packets should be carried securely in some particular part—settled by the authorities—of the uniform; and *not* in the knapsack or valise, or it will inevitably be missing when most urgently needed. During the Ashanti war, the packets were carried within an inside pocket in the left breast of the soldier's tunic; but Surg.-Gen. Longmore now suggests that a suitable pocket may be made, with a flap for buttoning over it, outside the left breast of the tunic. Surg.-Major Evatt, on the other hand, thinks that there is room for a small leather pouch on the waist-belt, on the left side, in which the packets could be carried. But whichever position may seem the most suitable, eventually, to those in authority, "it is," as Surg.-Gen. Longmore remarks, "very important that a field dressing packet should be so placed that every one, whether surgeon, orderly, or soldier, should know where to find it, and should be able to get at it without difficulty, in case of need."*

* Remarks on "First Field Dressing Packets," by Surg.-Gen. Longmore. *Army Med. Dep. Reports*, vol. xiv.

LECTURE II.

BLEEDING OR HÆMORRHAGE.

The general direction of the main arteries indicating the points where the circulation may be arrested by digital pressure or by the application of a tourniquet—The difference between arterial, venous, and capillary bleeding, and the various extemporary means of arresting it—First aid in cases of internal bleeding.

I WILL try and explain to you this evening the best ways of giving assistance in cases of bleeding or hæmorrhage: and if you will bear in mind what I told you in the last lecture about the organs of the circulation—the heart, the arteries, capillaries, and veins—you will more easily understand my remarks. Remember that the heart acts as a strong pump driving bright red healthy blood through a number of tough elastic tubes all over the body to every tissue and every organ. These tubes, or arteries, divide and branch again and again, thereby becoming smaller and smaller until they at last end in an immense network of extremely thin and minute tubes—so small that they can only be seen with the aid of a microscope—called capillaries. The blood flows on through the capillaries, and these join together and gradually unite into larger tubes which pour the blood, now dark, and impure, into the thin flabby veins. The veins convey the dark blood back to the heart, whence it is forwarded on to the lungs to be purified before it is returned—bright red once more—to the left side of the heart to be driven again over the entire body.

Now, you observe that the circulation of the blood consists in the blood being driven through a complete system of tubes; and therefore if there is any escape of blood, or *bleeding*, one or more of the tubes must have given way. The quantity of blood lost, too, will depend on the size and number of the tubes injured, as well as the force with which the blood is driven along them; and the colour of the blood and the way in which it flows out of the wound will depend on the particular portion of the system of tubing that is injured. Thus, if an artery is opened, bright scarlet blood

spurts violently out in jets for a considerable distance—the red stream rising and falling like the play of a fountain—forcibly and directly driven by the strong pump action of the heart at a pressure of about four pounds to the square inch; * if a number of the small capillaries only are broken, then red blood trickles or oozes out, not from any one point, but from the whole raw surface of the wound: whereas if a vein is injured, dark purple or blackish blood flows out in one steady sluggish continuous stream.

Coming to the practical question, how can you give help in cases of bleeding? you will easily understand—still bearing in mind the general plan of the circulation—that *pressure* firmly applied to the injured tube is the best way of stopping the leakage of blood—pressure applied, of course, on the side of the wound from which the blood flows. Thus, in bleeding from an artery you would apply pressure on the side of the wound *nearest the heart*—that is in the limbs *above* the wound; in bleeding from a vein you would on the contrary, apply the pressure on the side of the wound *farthest from the heart*, that is in the limbs *below* the wound; and in bleeding from the minute capillaries, as in scratches, abrasions, and simple flesh wounds, you would apply the pressure to the whole of the raw and bleeding surface.

Second in importance only to *pressure*, as a means for the temporary arrest of bleeding, comes *position*. In health, when the heart and blood-vessels are sound, the circulation keeps steadily going on, and, no matter what position we are in—standing, lying down, or otherwise—the blood never sinks down or accumulates in the lowest or most dependent parts of the body. Thus, when in the erect position with the arms hanging down, the blood does not gravitate towards the hands and feet, because the column of blood in the arteries and the column of blood in the veins mutually balance each other, and the force that drives the blood *down* the arteries of the limbs (the pumping action of the heart) lifts *up* the column of dark blood in the veins. Once, however, let the balance of the circulation be destroyed, once let any of the blood-vessels be opened, then the blood tends to gravitate and rush down out of the wound—that is, when the injury is in a dependent part of the body; and for this reason it is

* This accounts for the peculiarly violent and dangerous character of arterial bleeding. In the veins the pressure of the blood current is much less—only about a quarter of a pound to the square inch.

always very important, in a case of bleeding, to *elevate or raise up the wounded part above the level of the trunk*.

Another resource in cases of bleeding is the application of *cold*, in the shape of cold water, ice, or cool fresh air. This acts by causing contraction and diminution in size of the arteries and capillaries at the seat of injury.

Lastly, there are certain astringent substances, or *styptics*, as alum, steel drops, and powdered galls, which have the effect of clotting the blood, and causing shrinking of the blood-vessels, when applied to the raw surface of a wound. Your resources, then, for the temporary arrest of bleeding are, first and foremost, *pressure*; then, next in importance, *position*; afterwards, I place *cold*; and lastly, as they may occasionally be useful, *styptics*. I must now show you how to apply these different means for the arrest of bleeding; and first of all I will consider the methods of giving first aid in

ARTERIAL BLEEDING OR HÆMORRHAGE.

If you refer to the diagrams, you will be able to follow me better as I point out the direction in which some of the more important arteries run. Commencing with the upper part of the body, you see that a large artery ascends on each side of the neck towards the head (Fig. 6). If you draw a line from the joint between the collar-bone and breast-bone to the angle of the jaw, that will show you the position of the artery. Feel for it in your own necks, and you will, after very little searching, feel it beating under your fingers. These are called the carotid arteries (you may have seen the name mentioned in the accounts of suicide by cutting the throat); and they split up into numerous smaller branches which carry blood to the brain inside the skull, and to the face, scalp, and other structures outside the skull. One branch courses over the side of the lower jaw-bone—about the middle of it—to supply the face with blood, and several others supply the scalp; one runs up the forehead above the eyebrow, another in front of the ear over the temple, another behind the ear, and yet another up the back of the head. All these spread about, dividing into smaller branches and communicating with each other and with corresponding arterial branches from the opposite side of the head so as to form a large network underneath the scalp.

Arterial bleeding from wounds of the head.—We often meet with men who are badly cut and bruised about the head either by tumbling on rails or other hard material; or by dirt, rock, or coal coming down on them while working in the colliery; or by blows from sticks or stones in some drunken row, the scalp being torn, and the bright red blood spouting out for a distance of one or two feet from an injured artery. Most of you have seen such cases, and if working in the colliery have probably tried to check the bleeding by pushing tobacco into the wound, whilst in other instances the flour bag has been resorted to, and the man's head covered with flour, making a matted horrible sticky mess very troublesome to get off. Such means are dirty, unreliable, and unsafe; for, though the bleeding may perhaps be checked for a time, it will in all probability break out again, and very likely the wounded artery will begin spouting afresh precisely at the time when no assistance is at hand. I met with a case of this sort recently; bleeding recurred quite unexpectedly a week after the accident. Now you can easily render valuable help in these accidents. You can at once stop the bleeding completely by pressing firmly with your finger on the spot from which you see the blood spouting, for by so doing the wounded and bleeding artery is quite compressed, squeezed, and closed between your finger and the hard skull of the patient, and any escape of blood from it is quite impossible so long as the pressure is kept applied. Here then you stop the bleeding by *pressure with the finger*, or, as it is sometimes called, *digital compression*; and if the doctor happens to be close at hand you can keep the bleeding under in this way until he takes charge of the patient. But if, as is usually the case, the patient has some little distance to go home, or he has to be assisted or carried to the neighbouring hospital or surgery, then it becomes—to say the least—irksome and inconvenient to keep on pressing his head with your finger. Pressure must still be kept on the wounded blood vessel, but in another way. You must make a pad of something—whatever is at hand—a folded handkerchief, a piece of torn clothing doubled up, wadding, tow, linen, lint, flannel, or hay rolled up hard, a piece of smooth stick, or a cork, or anything else suitable, and fix it firmly and securely on the wound by means of a bandage, so that it presses on the injured artery and keeps it from spouting. If you have time, and the material at hand is suitable, you should make

your pad of a somewhat conical shape, and press the narrow part of it direct on to the wound: you can do this by doubling up a small piece of the lint, or whatever substance you are using, and pressing it firmly down into the wound, then putting a larger piece on the top of it, a broader bit still over that, and so on until your pad reaches about an inch in thickness, and lastly you fix it tightly and securely in its place by bandaging. It does not very much matter how you put on the bandage, providing you so arrange it as to keep the pad firmly and tightly in its proper position, and maintain constant strong pressure on the wound. But it requires a little tact and care frequently to fix the pad on safely, more particularly if the wound happens to be on the side of the head: in this case lay the centre of your triangular bandage (folded narrow) on the opposite side of the head to the wound, bring it round and cross it over the pad, bringing one end up towards the top of the head and the other below the chin—much as if you were tying up a parcel—and tie the ends together at the sound side; or you may twist the bandage over the pad, turn the ends back, and tie on the sound side; or simply carry the ends over the pad and fasten as before; or if you have two bandages, you can carry the first one around the fore and back parts of the head, and the second one over the top of the head and under the chin, crossing or twisting them both over the pad. Similarly, in bleeding from the forehead, top and back part of the head, you had better place the middle of the bandage on the part of the head opposite the wound, then carrying the ends towards the wound, either twist them on the pad, turning them back again, or merely cross them over the pad carrying them forward, and tie them on the sound side of the head. In this way, if the wound is on the top of the head, the knot as well as the middle of the bandage is under the chin; if it is the forehead that is bleeding, the knot and middle of the bandage lie on the back of the head; and if the injured artery is at the back of the head, the knot and middle of the bandage are placed on the forehead.

I wish you to practice the making of small pads and the fixing of them on different parts of the head with your triangular bandages. But accidents always happen unexpectedly, and when your help is wanted in earnest you are not likely to have an illustrated triangular bandage, with a paper of instructions neatly folded and pinned, in your

pocket. You must use your wits in such a case, and make anything that is most handy and suitable do duty as a bandage—a pocket-handkerchief, a scarf, or neck-handkerchief would do; or a brace, a garter, or a leather strap might serve the purpose.

You see that in the way I have described, bleeding can be checked by *pressure with a pad and bandage*; and if you do your work properly a man dressed in this way can with perfect safety wait a long time for his medical attendant, or be conveyed either to his home or a neighbouring surgery.

Arterial bleeding from wounds of the face.—You may be called upon to give assistance in cases of injuries of the face, such as cuts and lacerations of the lips and cheeks, accompanied by smart arterial bleeding. Now remember that the artery which supplies the face with blood runs (one on each side) over about the middle of the lower jaw; if you try and find it you will easily feel it beating on yourselves. You can check the bleeding in such cases by squeezing and pressing the artery firmly against the jaw-bone with your finger or by means of a pad and bandage. If you use a pad be careful to fix it on securely, the bandage being carried from under the chin to the top of the head, crossed, and brought down to be tied beneath the chin. You may also apply pressure at the spot where the injured artery is spouting, by putting your forefinger inside the cheek or lip, as the case may be, and your thumb outside, and squeezing the wounded vessel firmly between them. Here again always use your fingers first, and then think how you can best make and apply your pad.

Arterial bleeding from wounds of the neck.—I have already described to you the position of the carotid arteries which run one on each side of the neck up towards the head. Wounds of these large vessels are generally fatal at once from loss of blood, and excepting on the battlefield, are usually the result of attempts at suicide or murder. If any of you should ever happen to be at hand in such a terrible emergency, you must do your best to check the bleeding by pressing the injured artery with all your strength backwards against the spine. You can do this either by pressing with your thumb or fingers on the side of the wound nearest the heart (that is, in this case, *below* the wound, Fig. 20), or by pressing on the broken spouting blood vessel *in* the wound. In either way your object is to compress the artery firmly against the spine until medical assistance arrives. It is, of

course, plainly impossible to fix on a pad and bandage in an injury of this kind. Your only chance of stopping the bleeding is by digital compression, and to apply it with any chance of success you must act with the greatest promptitude, coolness, determination, and courage; and you must apply very strong and continued pressure, or the blood will be forced by the heart's action through the large wounded artery.



FIG. 20.—Digital Compression of the Carotid Artery.

I now come to the upper limbs. Referring to the diagram (Fig. 6) you see that each arm is supplied with blood by a large artery which lies deep behind the collar-bone, and crosses over the first rib down into the armpit. You can, by pushing your fingers firmly down behind the middle of the collar-bone, feel the beating of the artery; and you can find it also lower down in its course by pushing your fingers up into the armpit and pressing towards the upper end of the arm-bone. From the arm-pit the vessel can still be felt in its position along the inside of the arm, its direction corresponding pretty closely with the seam of the coat sleeve. It lies close along the inner edge of the large muscle of the

arm, and reaches to a little below the front of the bend of the elbow, where it divides into two branches, one of which extends down the outer side, the other down the inner side of the fore-arm. You can feel both these arteries beating above the wrist, particularly the one situated on the outer side of the fore-arm, for it comes so close to the surface in this part of its course that its beating can be easily felt, and indeed, often as easily seen. Wherever an artery is sufficiently near the surface of the body, its beating, pulsation, or pulse, may be readily felt and in many instances seen, but the expression *the pulse* is generally applied to the beating of the artery situated on the outer or thumb side of the fore-arm just above the wrist.



FIG. 21.—Digital Compression of the Subclavian Artery.

The two arteries of the fore-arm pass on into the hand where they end by communicating with each other in such a way as to form two curves or arches, one deeper than the other, across the palm, from which smaller branches are distributed to the fingers.

I advise you to study the position of the different arteries

with the aid of the diagram before you, and also to feel, whenever you have the opportunity, for the beating or pulsation of the vessels themselves in your own arms or in the arms of your comrades. The practical knowledge gained in this way will enable you to understand and to practise the methods that I shall now explain to you for checking arterial bleeding in the upper limbs.

Arterial bleeding from wounds of the armpit.—In this case your only resource is digital compression; and you can apply this in two ways:—either by boldly pushing your fingers into the wound and jamming the injured artery tightly against the upper part of the armbone, or by pressing strongly with your thumb or fingers down behind the collar-bone (about its middle), so as to squeeze the artery against the first rib (Fig. 21). In this way you put pressure on to the artery above and away from the wound, on the side of the wound nearest the heart. It is often recommended that a door-key wrapped up and padded should be used to press the vessel behind the collar-bone; but when an accident happens you have no time to run about looking for a key, and still less time for wrapping it up and padding it. You have always got your hands with you, and, if you are to give any help in a case of this sort, you must use them immediately and determinedly, forcing the artery with your thumb or fingers tightly down against the first rib. Practise this when you meet amongst yourselves; you will always know if you are pressing the artery effectually as the pulse at the wrist will then stop.

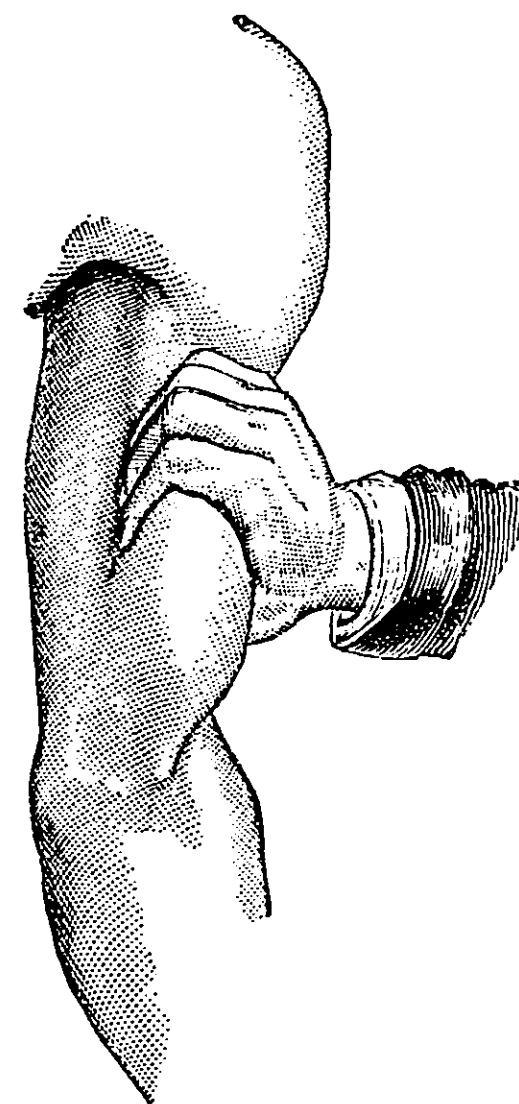


FIG. 22.—Digital Compression of the Brachial Artery.

Arterial bleeding from wounds of the arm.—There are several plans by which you can check arterial bleeding from wounds of the upper arm and elbow, but they are

really only different ways of doing the same thing—that is, applying pressure to the main artery on the side of the wound nearest the heart. The readiest method, and the one you should adopt in an emergency, is digital compression; and you do this by grasping the arm in the manner shown in the diagram (Fig. 22), so as to squeeze the artery tightly with your fingers against the arm-bone. You can stop the bleeding in this way *at once*, and then you have a little time to think what you had better do next. If a doctor is close at hand you can of course hold on to the patient's arm until the injury is attended to; but otherwise you must use some additional means to maintain pressure on the wounded artery until professional help is procured. You have received from the Ambulance Association a flat elastic band to which a small piece of tape is attached. This goes by the name of *Esmarch's elastic tourniquet*. It is an appliance, invented by Professor Esmarch, for checking bleeding by pressure on the blood-vessels.* To fix it on the arm all you have to do is to stretch it well out and then bind it tightly round and round the arm above the wound, taking care that each fold corresponds exactly with the one underneath it, and finally tying the tape over it to prevent it unlapping. If this is put on properly no bleeding can take place, and the patient can be safely carried to his home or the hospital. But you may not have this useful little elastic band with you when it is most needed, and then you will have to improvise a tourniquet, or, in other words, make one out of whatever materials are most convenient and handy. Esmarch recommends that braces and soldiers' belts should be made always of some elastic material, so that they may be used as tourniquets in case of need.† This suggestion seems a good one, more particularly in connection with military service, as it is calculated that one-fifth of those who die on the battlefield lose their lives from bleeding.‡ The chief advantage of having elastic bands, tubing, or cord available

* Several different tourniquets, varying much in shape and construction, are used by surgeons; but all these instruments are simply mechanical contrivances for the arrest of bleeding by pressure which can be regulated—that is, increased or diminished—as occasion requires.

† Tourniquet braces, invented by Esmarch, were exhibited at the Health Exhibition, and are now supplied by the Ambulance Association, together with a sheet of diagrams and instructions illustrating their use.

‡ *Manual of Instruction for Attendants on Sick and Wounded in War*, Staff-Assistant-Surgeon A. Moffit.

is that it does not require any knowledge of the position of the arteries to enable you to fix such appliances on the limb, all you have to do being to wind your indiarubber band or cord several times tightly around the arm or leg *above* the wound.

But there are other ways of improvising a tourniquet. You can make a very good one by means of a *pad*, a *triangular bandage* or *pocket-handkerchief*, and a *stick*. Place the pad over the artery, and fix it by winding the handkerchief (folded narrow) around the limb and tying it on the opposite side—not tightly, but sufficiently slack to allow of the stick being pushed under it. Thrusting the stick under the handkerchief, twist it vigorously round; the handkerchief of course tightens, and the artery is jammed between the pad and the arm-bone (Fig. 23).* You can practise making this

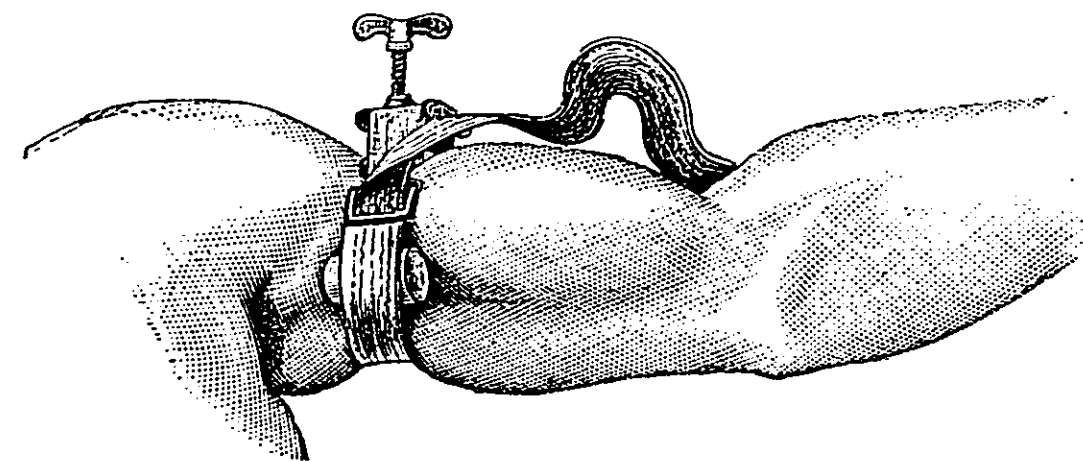


FIG. 23.—Compression of the Brachial Artery by a Tourniquet.

* In this figure the artery is compressed by means of an ordinary surgical tourniquet; but an improvised tourniquet—as shown in Fig. 26—acts exactly in the same manner.

kind of tourniquet with your folded triangular bandage, a roller bandage for a pad, and your walking-stick or an office ruler. But you must not expect to have these particular articles always about you. You must be prepared to act independently in any emergency, and be quick to utilise any materials, no matter what, so that they are close at hand and suitable to your requirements. Thus you may make a pad of a wine-cork or a bung, a smooth stone, a billiard, bagatelle or racket ball, a ball of worsted or a reel, a piece of wadding, tow, lint, linen, flannel, or cloth rolled up tightly, or a knot on the bandage around the limb will suffice. Instead of the triangular bandage a handkerchief or scarf, a belt, brace, or strap of any kind would do. On a battle-field

there are always plenty of straps, belts, and pieces of accoutrements, etc., suitable for the purpose. To tighten your tourniquet you could use on the battlefield bayonets, scabbards, rifle-cleaners, and fragments of lances, etc.; while in civilian life there are usually available such articles as sticks, parasols, umbrellas, pencils, wooden measures, knife-handles,

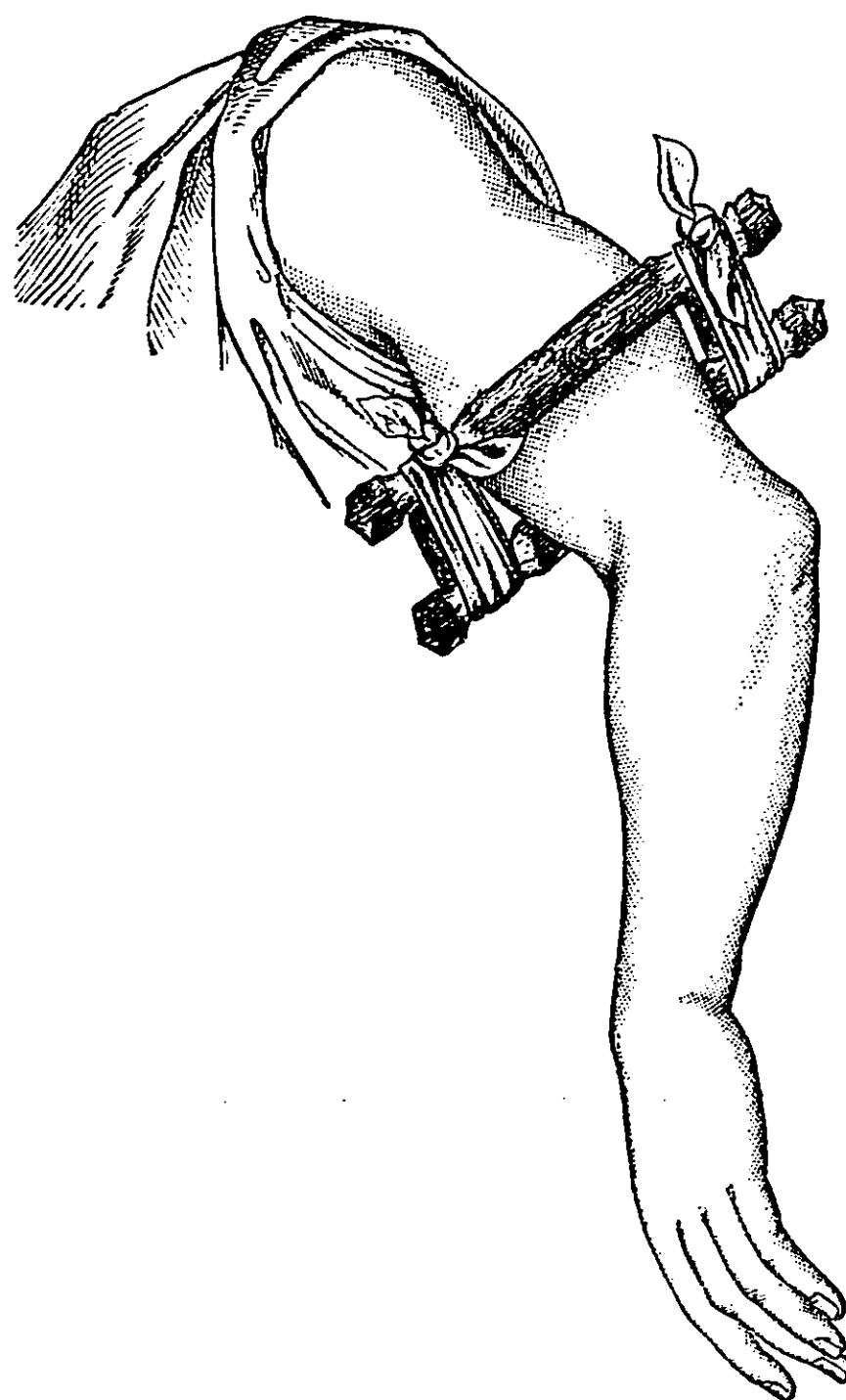


FIG. 24.—Compression of the brachial artery by Völker's stick tourniquet.

large keys, rulers, pieces of wood, or branches of trees. The police could use their truncheons, cricketers their wickets, billiard-players their cues, and tennis-players their racket handles. Should you be unable in a case of emergency to

improvise a pad, you must not lose time, but at once tie your scarf or handkerchief round the arm, and twist it tighter and tighter with your stick until the bleeding is stopped. You may improvise a tourniquet in another way, viz., by taking two pieces of stick about eight inches long, and placing one across the inside and the other across the outside of the arm, and tying them tightly together by a couple of handkerchiefs or straps (Fig. 24). By this plan the artery is compressed between the inside stick and the arm-bone. This arrangement goes by the name of *Völker's stick tourniquet*. The same result is attained by placing one stout stick between the chest and arm and binding the latter tightly to the side.

Now you must practise the application of digital compression and the making of improvised tourniquets frequently amongst yourselves; but, should an accident happen, do not let the injured man die from loss of blood while you are hunting about for an Esmarch's tourniquet, or feeling in your pockets for a handkerchief. Remember that whatever else may be missing you always have your hands, and act at once by flattening the artery against the arm-bone (at the *upper* and *inner* part of the arm) with your fingers, and then having arrested the bleeding, think how you may best improvise a tourniquet.

Arterial bleeding from wounds of the fore-arm.—You can stop arterial bleeding in the fore-arm by arresting the current of blood in the main artery higher up. You may either apply digital compression, an Esmarch's elastic band, or an improvised tourniquet to the upper arm, in the manner I have already explained; or you may forcibly bend the patient's elbow, tying the fore-arm tightly with a handkerchief, triangular bandage, scarf, or anything else suitable to the upper arm. In this way the artery is so much bent that the current of blood is arrested. If there is anything handy with which you can make a pad, fix it in the hollow of the elbow before you bend the arm, and then you will have, as an additional safeguard, pressure on the artery as it lies in front of the lower end of the arm-bone. Should one of the arteries of the fore-arm be injured where it comes close to the surface just above the wrist, you can apply strong digital compression to the wound itself, or fix a pad and bandage tightly on. Not so long ago a man's wrist was laid open by the bursting of a steam gauge; many in this room must recollect the case, and must also remember how well and effectually a comrade

checked the violent bleeding by twisting and tying a knotted handkerchief tightly round the wrist, arranging it so that the knot acted as a firm pad, pressing strongly on the wounded artery, and squeezing it against the hard bone underneath. But if you have any difficulty in a case of this description, remember you can always arrest the bleeding at once by pressure on the main artery in the upper arm, or by placing a pad in front of the elbow and forcibly bending the fore-arm against the arm.

Arterial bleeding from wounds of the palm of the hand.—You can check arterial bleeding from wounds of the palm of the hand either (a) by direct pressure on the injured vessel at the seat of injury, or (b) by arresting the arterial current higher up in the arm. (a) The readiest method is digital compression, and the best way to apply this is to press firmly down on the bleeding point with your thumb. If professional aid is at hand this will be sufficient; but if the patient has to be taken some distance to his medical attendant, then you must apply pressure to the wounded vessel by a good strong pad placed on the palm. The pad should be made of a conical shape, the point of the cone to be thrust into the wound right down on to the injured artery. Pads should, when possible, always be arranged in this form when applied directly to a wound for the purpose of arresting arterial bleeding, as they are much more effective than an ordinary-shaped flat pad. I have already told you how to make a conical pad, or, as it is sometimes called, a *graduated compress*, when speaking of arterial bleeding in cases of scalp wounds. To keep the pad firmly in its place, you double the fingers over it, and tie them tightly down by bandaging round the closed hand with your handkerchief, triangular bandage, or scarf. You will find this plan of applying direct pressure to the wounded artery suitable in most cases of arterial bleeding from the palm; but if the injury to the hand is extensive, then you can easily arrest the arterial circulation higher up—just above the wrist, at the elbow, or at the upper arm. (b) You can apply digital compression above the wrist to the two arteries of the fore-arm where they run close to the surface just before they enter the hand: and you do this by tightly squeezing the vessels with your thumbs against the bones of the fore-arm, but to act effectually you will have to press very hard and perseveringly, and the probability is that your hands will soon get wearied. If you can manage it, therefore, it is better to apply

pressure to the two arteries by fixing two firm pads tightly on them by means of a bandage or strap. You will have to use your ingenuity in making suitable pads—very good ones can be made of a cork cut down the middle, or of pieces of a penholder or pencil, placed lengthways. But if you get nervous, or if you bungle over your efforts to stop the bleeding by pressure at the seat of injury and at the wrist, never forget that you can at once control bleeding in the hand, as well as in the fore-arm, by either forcibly bending the elbow, or by compressing the artery in the upper arm with your fingers or a tourniquet.

There is one very important point to which I have not yet alluded in connection with the rendering of first aid in cases of arterial bleeding from wounds of the upper limb. I mean the *position* of the limb. Always keep it *raised*. No matter what else you are doing to staunch the bleeding—whether you are applying digital compression, or pressure by a pad and bandage, or an improvised tourniquet—always remember to keep the arm raised. If the injured man is lying down, keep the arm lifted up yourself, or prop it at a higher level than the body on cushions or folded clothes. If he walks home or to his doctor, see that the arm is slung up well before he starts—don't merely talk about it and leave others to do it, but sling it for him yourself high up so that the fingers of the injured limb are close to his opposite shoulder. If it is required to sling an arm (in a case of bleeding, fracture, or any other injury) and there is no bandage, handkerchief, or scarf available, you may either utilise the patient's clothing or you can make a *pin sling*. Thus, you may turn up the skirt of the coat and pin it in proper position to form a support for the arm; or you may cut up the coat and shirt sleeves and pin them up so as to make a sling;* or in some instances you may bend the patient's elbow, raise his hand well up, and pin the coat sleeve *at the wrist* firmly to the coat, fixing as well a fold of the sleeve *under the elbow* tightly to the coat in the same way—additional security being attained by the use of a third pin to fix the *inside of the arm* sleeve to the body of the coat.† In these kinds of improvised slings it is of course much better to use safety pins when they are available in preference to ordinary pins. If the patient is carried off on a stretcher it is the business of one of the bearers (as

* *The Treatment of Wounded in War*, Esmarch, translated by Clutton.

† "A pin sling," Sampson Gamgee, *Lancet*, September 22, 1884.

I shall explain in the final lecture) to specially attend to the injured limb, and see that it is supported in a proper position.

I now come to the *lower* limb. This is supplied with blood by a large artery which crosses from the trunk of the body over the fore part of the haunch-bone into the thigh (Fig. 6). The artery enters the thigh at the centre of the fold of the groin, and for the first three or four inches runs near the surface and can easily be felt pulsating; it courses downwards and inwards, finally passing backwards on the inner side of the thigh-bone towards the ham.*

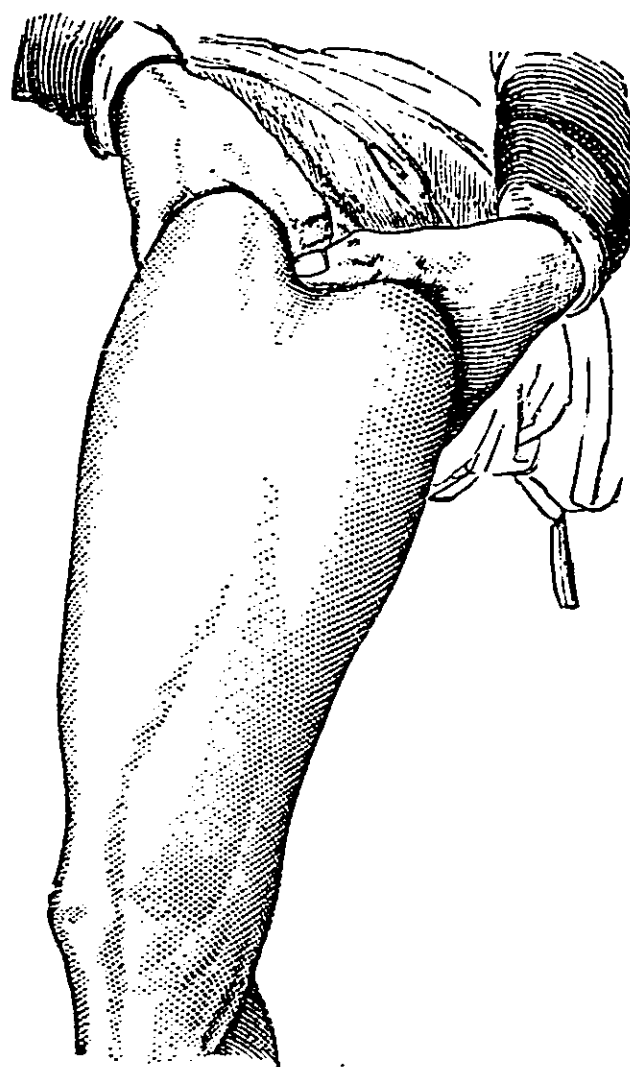


FIG. 25.—Digital Compression of the Femoral Artery.

The position of the artery is shown when the knee is partly bent and the thigh twisted a little outwards, by a line drawn from the middle of the fold of the groin to the inner side of the knee. Reaching the back of the thigh about its lower third, the artery runs down the middle of the ham at the back of the knee-joint, and a little below the joint it divides into two branches. One of these runs down the fore part of the leg, but is deeply placed until it gets near the ankle, when it comes close to the surface and can be felt beating as it courses along the front of the instep towards the back of the foot. The other branch descends the back part of the leg, and it also is deeply placed at first, but as it approaches the ankle it comes near to the surface, and can be felt pulsating as it passes behind the inner ankle to the sole of the foot. Both these arteries terminate in smaller branches that go to supply the different parts of the foot.

You see that the plan of the arterial circulation in the two limbs is somewhat similar. The blood is conveyed to both

* The part of the lower limb behind the knee, between the thigh and leg, is termed the *ham*.

arm and leg by means of one large main artery which courses along, in both cases, the entire upper part of the limb, dividing—below the elbow-joint in the arm, below the knee-joint in the leg—into two branches. These branches in both limbs are more or less deeply seated in the first part of their course, but come close to the surface as they approach the wrist and ankle joints respectively. In the palm of the hand there are two arterial curves or arches: in the sole of the foot there is one arterial arch. Again, the methods of checking arterial bleeding in the lower limb are very similar to those I have acquainted you with for stopping hæmorrhage in the upper limb. Your resources are the same, viz., digital compression, Esmarch's tourniquet, improvised tourniquets, and the pad (graduated compress) and bandage. The application of them only is different.

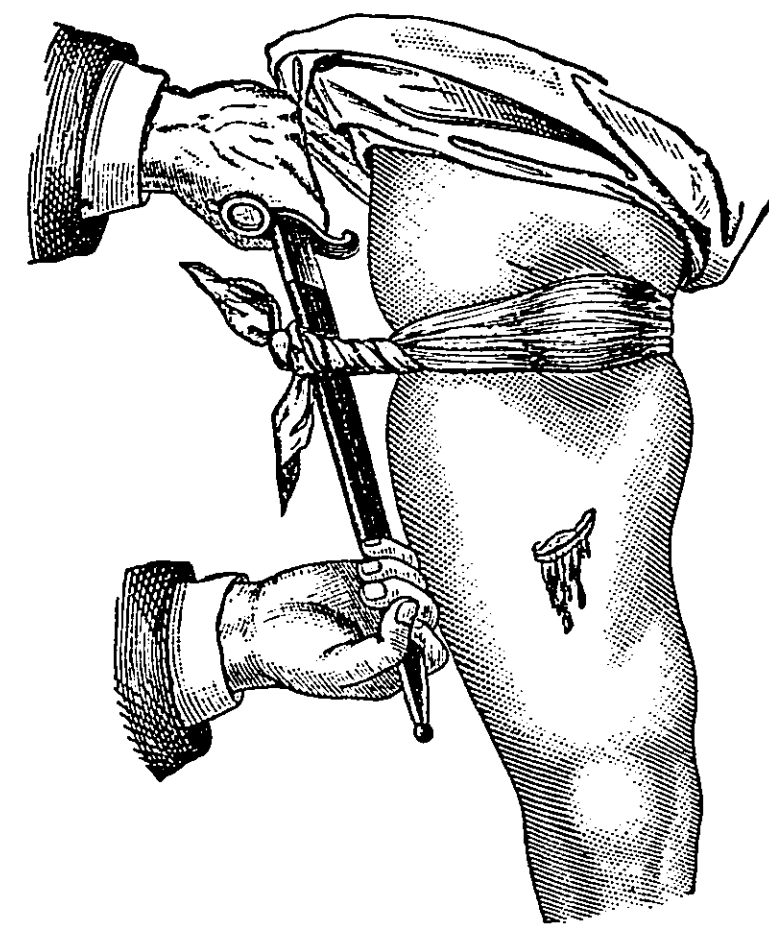


FIG. 26.—Compression of Femoral Artery by an Improvised Tourniquet.

Arterial bleeding from wounds of the thigh.—Strong and immediate pressure must be applied to the main artery above the wound in case of arterial bleeding from the thigh. To give effectual aid you must act at once, and with great determination. If you lose your head and hesitate, the patient will be dead from loss of blood before you have decided what

to do. In a case of this kind you must resort immediately to digital compression, and the way to do this is to press with your two thumbs as forcibly as you possibly can (in the manner shown in the diagram, Fig. 25) down on the artery at the centre of the fold of the groin. In this way you compress the vessel against the fore part of the large ring of bone called the pelvis; and this is the best and safest place to use digital compression. If the wound is not too high up to allow of it, you can, it is true, compress the artery with your thumbs against the thigh-bone for three or four inches lower down (that is, in the upper and inner part of the thigh), where the vessel lies near the surface; but you are not so sure of your grip in this position, more especially if the patient is stout. But whether you apply digital compression at the centre of the fold of the groin (flattening the artery against the fore part of the pelvis) or in the upper and inner part of the thigh (flattening the vessel against the thigh-bone), your hand will soon get tired—such is the force and persistency with which you have to press. While you hold on, then, one of your comrades must get your Esmarch's elastic tourniquet, or, if that is not available, he must improvise one, in the way that I have already explained, and fix it tightly on the upper part of the thigh above the wound, taking care that the pad is placed correctly over the artery (Fig. 26). By means of a tourniquet you can bring enormous pressure to bear on the injured artery, and can easily arrest the bleeding until the arrival of professional aid.

Arterial bleeding from wounds of the ham.—In this case, you can either apply pressure to the artery of the ham above the wound by means of a tourniquet, or you can arrest the arterial current higher up (and this is the readiest way) by digital compression of the main vessel at the centre of the fold of the groin or in the upper third of the thigh, and then with the aid of a comrade apply a tourniquet.

Arterial bleeding from wounds of the leg.—Here, again, you can stop arterial bleeding from wounds of the leg by compression of the artery of the ham or the artery of the thigh, or—just as you can check bleeding in the fore-arm by forcibly bending the elbow—you can arrest the hæmorrhage by forcibly bending the knee and tying the leg tightly to the thigh. "This treatment," writes Esmarch, "can be successfully practised in cases where other means of ar-

resting hæmorrhage are not at hand. It is, however, to be observed that a position sufficiently flexed to completely arrest hæmorrhage cannot be long tolerated."* In this way the artery of the ham is bent at such a sharp angle that the flow of blood through it is stopped. You can apply compression to the vessel as well by placing a pad in the hollow of the ham before you bend the knee. The artery of the front of the leg is liable to be injured at the lower part of its course where it comes near the surface, as it runs down in front of the lower portion of the large leg-bone over the ankle-joint to the top of the foot; but the bleeding can be easily stopped by pressure on the vessel above the wound. Use digital compression to stop the bleeding until you can get a good pad fixed tightly on.

Arterial bleeding from wounds of the sole of the foot.—To check arterial bleeding from wounds of the sole of the foot you can—as in hæmorrhage from the palm of the hand—either apply (a) direct pressure at the seat of injury, or (b) arrest the arterial current higher up. (a) If you try the first method thrust your thumb down into the wound right on to the spouting blood-vessel,† and then with the assistance of a comrade proceed to apply a good firm graduated cone-shaped pad tightly on with a handkerchief, scarf, or strap of some kind. (b) If you try the second method (and should the wound be an extensive one and the bleeding profuse, it is the best) apply firm pressure to the artery which supplies the sole of the foot where it lies near the surface behind the inner ankle. Examine your own lower limbs and you will easily feel the artery pulsating in this position, and you will also notice that it can be easily compressed with the fingers or by a pad fixed on with a handkerchief. If after fixing on your pad there is still some bleeding, place a second pad in front of the ankle, and a third behind the outer ankle, and bind all three pads tightly on with your handkerchief, scarf, or a strap. The purpose of the two additional pads is to compress the

* *The Treatment of Wounded in War*, Esmarch, translated by Clutton.

† Several military surgeons think that, on the battlefield, the best plan for the bearers, attendants, and troops to adopt for the arrest of bleeding—from any part of the body—is to thrust their fingers into the wound and press directly on to the injured vessel. The Russians in the Crimean War, and the Austrians in the campaign of 1859, adopted this plan with success. It is on record that a young Austrian soldier arrested the bleeding from an injured femoral artery (of his own left thigh) for four hours by forcibly thrusting his left thumb into the wound, and so preserved his own life until treated by the surgeon.—*Gunshot Injuries*, Surgeon-General Longmore.

artery supplying the back of the foot and a small artery that lies behind the outer ankle, because both these communicate with the arterial branches of the sole. If you put on your pads properly the bleeding must cease, as the supply of arterial blood to the foot is quite cut off; but always remember that if you are in any difficulty you can at once arrest bleeding in the lower parts of the limb by compression of the artery of the ham or artery of the thigh.

Lastly, in all cases of arterial bleeding from wounds of the leg, as in all similar injuries of the arm, always be very careful to see to the *position* of the limb. Always keep it *raised*. If the injured man is lying down or being carried on a stretcher, the limb must be lifted up or propped up on cushions, pillows, folded clothes, or anything else suitable, at a higher level than the body. In *all* cases of arterial bleeding from the lower limb, place the injured man *at once*, when you can, in the lying-down position, and if possible, have the limb elevated while you apply compression above the wound.

I think I have now told you all that is most important in connection with arterial bleeding. It remains for you to practise the application of improvised tourniquets, digital compression, etc., amongst yourselves; and I hope you will seize frequent opportunities of examining yourselves and each other, and trying to feel the beating of the different arteries in those positions where they run near to the surface, and where they can be compressed, for it is by such kind of practice that you will acquire practical knowledge. When practising digital compression, and the application of Esmarch's elastic band and improvised tourniquets to the larger arteries, you should always test your work by feeling for the pulsation of smaller vessels lower down in the limb—such as the arterial branches near the wrist and ankle joints. If the pressure you apply to the main arteries is effective, all pulsation lower down the limb ceases; on the other hand, if the pulsation continues, you are either applying insufficient pressure or you are applying it at the wrong spot.

CAPILLARY BLEEDING OR HÆMORRHAGE.

The bright red blood is pumped by the action of the heart through the arteries into the capillaries, and it is during its passage through these little delicate tubes that the blood

gives up the nourishment it contains to the surrounding tissues. To be healthy, all the different parts of the body must perpetually receive sustenance from the blood, and this is ensured by all the tissues and organs being pervaded throughout by a complete network of the small capillary tubes. You can understand, therefore, that when any part of the body is wounded, numbers of the capillaries are necessarily broken, and there is a leakage of blood from them, or, as it is termed, capillary bleeding or hæmorrhage. In *all* wounds there is capillary bleeding, and should an artery or vein be injured, it is accompanied of course by arterial or venous bleeding, as the case may be. But in many wounds, particularly in slight ones, as scratches, abrasions, trivial cuts, etc., and also in ordinary flesh wounds, there is only capillary bleeding. This kind of bleeding is trivial, compared with arterial and venous bleeding. In cuts from sharp substances, as bits of glass, razors, &c., and in extensive flesh wounds, the bright red blood may flow off pretty sharply, but there is no spouting from an opened artery, nor any dark stream pouring continuously down from an injured vein, but simply oozing—rapid it may be, for a short time—from the entire raw surface of the wound. Capillary bleeding is easily stopped by *pressure* applied to the *whole of the bleeding surface*—pressure with your finger or thumb; by means of a soft piece of linen, lint, or any clean wrag wrapped around the part; by the application of a pad and bandage; or by a piece of ordinary sticking-plaster strapped tightly across the wound; in short, by any simple, clean, temporary “first dressing.” *Cold* is another remedy. It can be used by washing with cold water, exposing the wound to the cool air, or by the application of ice. You can combine pressure with cold by fixing on a pad that has been soaked in cold water. *Styptics*, such as alum, steel drops, powdered galls, and tannin, cause clotting of blood, and are occasionally useful for checking troublesome oozing.

VENOUS BLEEDING OR HÆMORRHAGE.

The different tissues of the body not only receive nourishment from the blood during its passage through the capillaries, but also give up to it certain hurtful and useless materials which they must necessarily be rid of, and so the

blood is rendered impure, and as it flows on from the capillaries into the veins becomes of a dark purple or blackish colour. The dark impure blood is carried from all parts of the body by the veins back to the heart, the direction of the blood current being exactly opposite to that in the arteries. The veins vary a good deal in position, some lying deep under the flesh, and others being quite close to the surface and often visible through the skin as dark blue lines or cords. It is these superficial veins that are more liable to injury. In thin people you can easily see them, particularly after exertion, on the back of the hand, the front of the fore-arm and elbow, the top of the foot, the back and sides of the leg, and often in the neck.

The veins of the neck are sometimes cut in suicidal attempts, those of the arm may be injured by the slipping of a knife, and those of the leg by the careless use of a scythe. A more frequent occurrence is the rupture or bursting of one of the veins of the leg as a result of disease. This is an occurrence which it is by no means unlikely that you will meet with, and it is precisely one of those cases where you can give the most valuable assistance, even to the extent of saving life.

Many persons, especially women, suffer from an enlarged and diseased condition of the veins of the leg. The veins are seen to be swollen, knotted in appearance, and gorged with dark blood; and there is frequently, as a result of this state of the veins, dark red discoloration, swelling, and, it may be, ulceration of the limb. These people are suffering from *varicose veins* of the leg, and it is not at all an uncommon occurrence for one of these swollen diseased veins to give way with profuse—sometimes fatal—bleeding as the result. A pint or more of dark venous blood may be in this way lost in a few seconds; and yet, if you only know how, you can immediately stop the bleeding with the greatest possible ease.

To arrest the bleeding from an injured vein you must—as in the other varieties of bleeding—resort to *pressure*, but in this case the pressure must be applied to the wounded vessel on the side of the wound *farthest from the heart*—that is in the limbs, *below the wound*. The readiest plan is to press your finger or thumb, whichever happens to be most convenient, on to the hole in the vein, and you can easily stop the bleeding in that way until you have time to make a pad and fix it

firmly on to the wound by means of a triangular bandage, handkerchief, or scarf. If the wound is large and gaping, then of course you must apply pressure to the injured vein, on the side of the wound farthest from the heart.

There is a point of importance in connection with bleeding from a ruptured varicose vein of the leg that I must explain to you. You are aware that veins, unlike arteries, are provided with valves, and these valves when they are in working order allow the blood in the veins to flow in its proper direction to the heart, but arrest it at once if, from certain movements or positions of the body, it tends to flow the opposite way *from the heart*. Thus it is that when a vein is cut the dark blood only wells up from the cut end farthest from the heart, escape of blood from the cut end nearest to the heart, being prevented by the valves (that is, with the exception of the small quantity of blood in the vein between the cut end and the nearest valve). Now veins that have become diseased and varicose are unnaturally and permanently enlarged, stretched, and swollen, and consequently the valves in them are rendered useless, so that if a varicose vein of the leg is accidentally cut across, bleeding not only occurs from the cut end farthest from the heart, but also is profuse from the cut end nearest to the heart, the blood rushing copiously down through the wound direct from the trunk. This is the reason why, in a rupture or injury of a varicose vein of the leg, the bleeding is so profuse and dangerous; it also explains why, in order to stop the bleeding, it is necessary to apply pressure on *both sides* of the opening in the vein. If a varicose vein gives way, or if the wound is small, then by pressing on the bleeding point with your thumb or finger, or by means of a pad, you do actually apply pressure on both sides of the opening in the vein; but if the wound is large and gaping, and particularly if it is vertical in direction, slitting the vein up, then you must be very careful to apply pressure both above and below the wound.

Next to *pressure*, your chief resource in venous—as in other severe bleeding—is *position*. Always keep the wounded limb *raised*. In the case of a varicose vein of the leg bursting you can at once arrest the bleeding by pressing with your finger on the hole in the vein, at the same time placing the patient in a lying down position with the leg well raised.

Lastly, always be careful to remove any article of clothing that is at all tight and worn anywhere on the side of the

wound next the heart, as any constriction in such a position interferes with the flow of blood through the veins, and tends to increase the bleeding. Thus in the case of a ruptured varicose vein always remove the garter; in venous bleeding from the neck loosen the collar and necktie; and in other cases loosen the braces, belt, waistband of trousers, etc., according to the position of the wound.

INTERNAL BLEEDING OR HÆMORRHAGE.

Bleeding, when the blood escapes directly outside the body, is called *external*; and I have shown you how by the proper application of *pressure*, due attention to *position*, the use of *cold*, and occasionally of *styptics*, you may generally give most valuable assistance in cases of external bleeding. Bleeding is called *internal* when it occurs inside the body. The blood-vessels inside the head, chest, and belly may be ruptured either from disease or injury, the blood escaping into one of the cavities, organs, or passages, of the body. Thus, as a result of disease, blood-vessels may give way in the brain, the lungs, and the stomach; and any of the deeply-placed blood-vessels may be opened by such injuries as bullet wounds and stabs. Internal bleeding is sometimes the result of a bone being broken; for instance, bleeding inside the head may be caused by a broken skull, or bleeding inside the chest by a broken rib. In many cases of internal bleeding you never see any blood at all; in other instances the blood escapes from the body in one way or another; thus the patient may cough up blood if there is bleeding in the lungs, or vomit blood if a blood-vessel in the stomach has ruptured.

You cannot give so much assistance in cases of internal as in external bleeding, because you cannot get at the wounded vessel to apply pressure to it. But you can attend to the *position* of the patient, and resort to *cold*, and you can give him astringent drinks. You should place the patient in a comfortable lying down position, with the head slightly raised, and, above all things, let him rest as quietly as possible. Do not allow bystanders to worry and excite him with talk. Keep people from crowding around him, and if in a room open the window so that there shall be plenty of cool fresh air. If there is any spitting or vomiting of blood get ice if possible, and give small pieces of it to suck. If ice is not available

give small quantities of cold water or vinegar and water for the patient to drink, and apply cloths steeped in cold water, or ice in a bladder, to the chest, or as near as possible over the spot where bleeding is going on. Lastly, you can give the patient astringent drinks, such as alum and water, or cold strong tea (which contains tannin). Of course all tight clothing should be removed.

Bleeding from the nose is occasionally very severe and troublesome, whether it be the result of accident or disease. To check it, keep the patient's head raised, *not hanging forward*, and apply cold—in the shape of ice, iced water, or sponges, cloths, or handkerchiefs steeped in cold water—to the root of the nose and to the back of the neck. If the bleeding is obstinate make the patient stand up, then suddenly lift his arms straight above his head, and keep them up for a few minutes. If he only lifts one arm up it should be the one on the same side as the bleeding nostril, and with the disengaged hand he should squeeze the nostril. Dr. Negrier of France and others have used this plan with the greatest success, and it has also been successfully adopted in cases occurring among the men of the 104th Regiment.* If you happen to have a syringe, you can syringe the bleeding nostril with cold water, or alum and water; but the application of cold, and the plan of raising the arms, is usually sufficient.

For *bleeding from the tongue* wash the mouth out well with cold water, or alum and water. If ice is available small pieces should be sucked. The collar and all other parts of the clothing about the neck should be loosened. The patient should breathe through the mouth, and he should be placed so as to get the benefit of as much cool fresh air as possible.

* *Diseases of the Nose*, W. Spencer Watson.