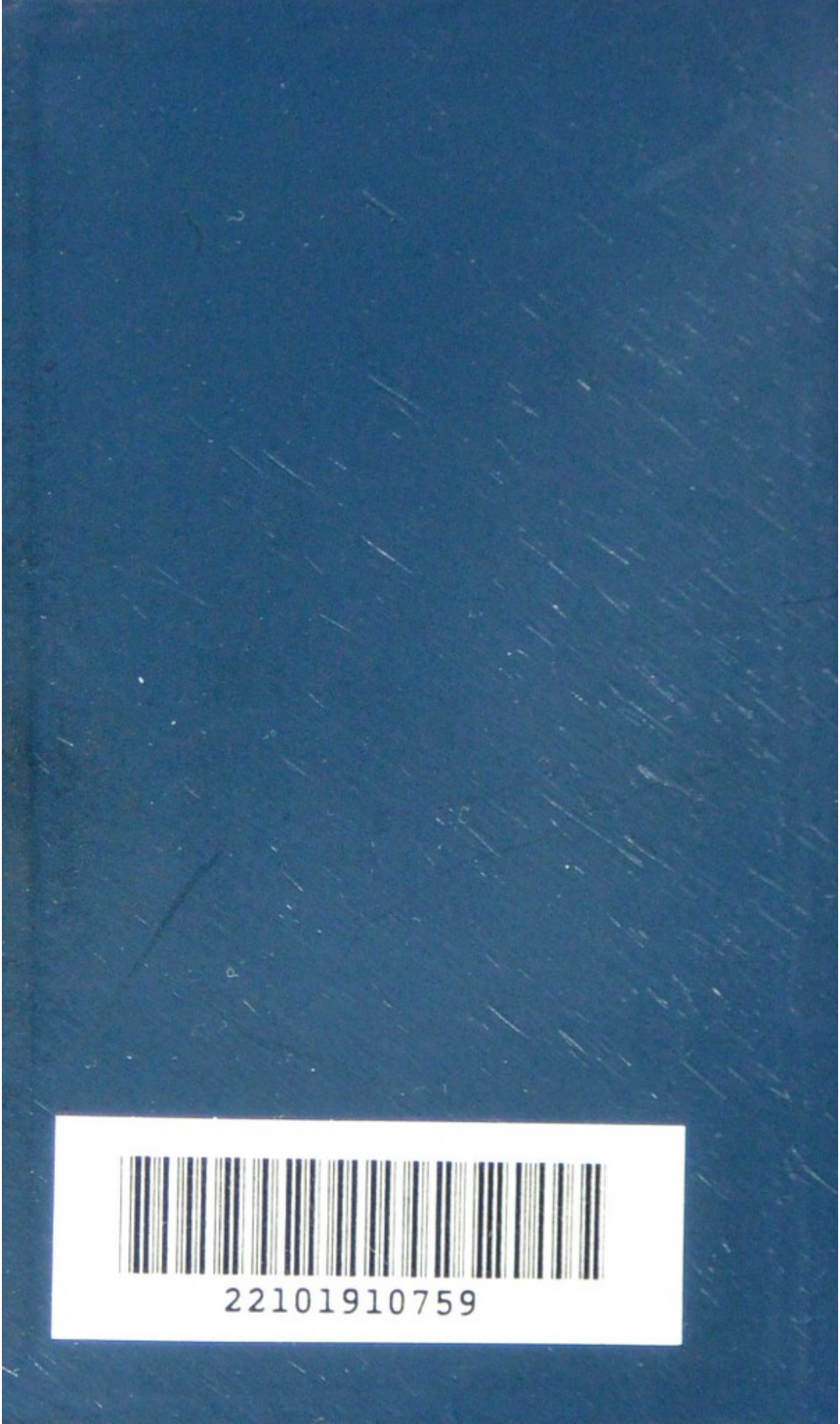
Accidental injuries, their relief and immediate treatment : How to prevent accidents becoming more serious / [Sir James Cantlie].

ACCIDENTAL INJURIES

CANTLIE.



PREFACE TO THE FIRST EDITION.

THIS Handbook is intended as a guide, in simple language, from which the public may learn how to render efficient aid at the moment of injury. Not only wounds, bruises, and broken bones, events of everyday occurrence, but a number of minor ailments, which might be relieved by the knowledge of some simple common-sense rules, are taken into consideration and dealt with in a popular and yet not in a superficial manner.

14, SUFFOLK STREET,
PALL MALL, S.W.,
June 18, 1884.

PREFACE TO THE TWELFTH EDITION.

The demand for this book has induced the author to revise carefully the subject-matter, and to add to the text of the previous editions. The chief addition will be found at the end of the book, where, by the kind permission of the Council of St. John's Ambulance Association, systematized forms of loading, carrying, and unloading stretchers, as adapted to civil life, are given in the form of "Stretcher Exercises."

Forty-two new woodcuts are added in the present edition.

The author has to thank William R. Smith, M.D., F.R.S.Ed., for kindly undertaking to review the proofs on his departure for the East.

J. C.

14, Suffolk Street,
Pall Mall, S.W.,
July, 1887.

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ACCIDENTAL INJURIES.

"How soon an accident occurs!" has come to be almost a proverb, and every one has within his or her recollection and experience, memories of accidents and injuries, some of greater, some of lesser severity. All must remember, at the time when some particular accident occurred, how bitter was the repentance of ignorance as to what was best to be done, and how earnest the wish that some means of telling what to do were at hand.

To prevent accidents occurring in our streets, factories, and mines, would be to teach people to exercise care and caution whilst crossing a street; to warn the worker that the sharp saw which revolves as he pleases may one day be his death; and to teach the miner to keep his safety-lamp shut. But not only is it in these more dangerous situations and occupations that care has to be exercised. In the house and the home the most simple things may become instruments of death: the kettle on the fire contains as certain a death to the child wandering near the unguarded fire-place as the most rank poison; the lap-dog may become rabid, and cause the torments of hydrophobia; whilst the bread-knife, or the pulling of a cork, may inflict as deadly a wound as a rifle-bullet. To prevent accidents occurring lies within the province of the

policeman, the local authorities, and the mother of every home; but, "as accidents will occur," it is expedient to know *what to do to prevent them giving rise to more serious consequences still.*

It is to this purpose, then, that this handbook is directed: it is to tell the bystander in simple language what to do to stop the flow of blood, to prevent a broken bone doing more damage, to restore a person from a faint, and to render such assistance as will allay suffering and prevent more serious complications until such time as the doctor arrives.

It is objected to books and lectures of this sort that every one is being taught doctoring, and that "a little knowledge is a dangerous thing," etc., and such-like well-worn sayings. If to tell a mother how to save her child's life be teaching her doctoring, then the sooner she is taught the better. Again, it is not a little knowledge that is to be told you; it is complete of its kind, and there is nothing beyond it that is necessary for you to know upon the subjects dealt with, to enable you to render first aid to injured people correctly.

To the Ambulance Department of the Order of St. John of Jerusalem in England, not only has Great Britain, but the civilized world, to tender thanks and admiration for the introduction of the means of teaching "First Aid to the Injured." In the excellent syllabus published by that association will be found a guide to the nature of the accidents and everyday calamities most likely to be met with, and in the lectures given by the teachers co-operating with that association, the means of rendering first aid are taught both theoretically and practically. The regret is, not that every one is being taught the much-dreaded subject, "a little doctoring," but that such knowledge is not made at least morally if not legally compulsory.

Where freedom exists in such subjects, there will be found plenty of fools to take advantage of it; and just as amongst the seafaring population the knowledge of swimming is the exception, so much more common is it to meet with crass ignorance in regard to the alleviation of the most ordinary of accidents.

It is difficult to know where to begin to teach such a subject so as to prevent it being merely *parrot-like*—known to-day and forgotten to-morrow; hence it is necessary to tell you something of the structure and functions of the body before launching out into details of how to proceed in cases of injury. You must know the machine before you set to work upon it; you must know the economy before you begin to set it right. With this short apology, I beg of you to bear with me whilst I go through a succinct account of such points in anatomy and physiology as you *must* know.

Now the best starting-point is

THE SKELETON,

because it presents to us something fixed and, for the most part, appreciable to touch, even in the living body.

The best point to start from is the **Backbone**, or backbones, as it should be called, owing to its numerous component elements. It is also called the "spine," the "spinal column," and the "vertebral column." The latter term requires explanation. The name *vertebra* is given to each separate segment or bone of which the column is made up; hence the term *vertebral* column. The separate bones are not allowed to rub one against another, but are tied together by strong fibres and tissues, which at the same time form a pad or buffer to allow of compression or relaxation. This is known as the inter-

vertebral substance, and the next skeleton you have the courage to look at, examine between the vertebræ, and you will observe that pieces of cork or leather are inserted to represent the tissue of which we are speaking.

On looking a little more closely at the spine, you will observe that it increases in size from above, downwards. It is natural that it should do so, owing to the increase in weight which the bones have to bear at the lower, compared with the upper, part. The highest vertebræ, those of the neck, termed the *cervical*, support the head only. Lower down we meet with the vertebræ of the back, or *dorsal* vertebræ, which, twelve in number, extend from the neck to the loins, and support the twelve pairs of ribs, the upper limbs and chest. In the next region, that of the loin, we meet with the five *lumbar* vertebræ; they, being the only bones met with in the region, are naturally larger still, having the weight of the whole body to support.

The vertebral column ends off in two solid pieces of bone, the rump-bone and tail-piece, named the *sacrum* and *coccyx* respectively, which have the appearance of having been originally separate pieces of bone, but now grown together. The bony masses taper to a point, and in animals they are prolonged to form the tail. Both the sacrum and coccyx are concerned in the formation of the large girdle of bone met with at the lowest part of the trunk under the name of the PELVIS, a large basin of bone which receives the weight of the body, and hands it over to the lower extremities at the hip-joints. This mass is composed, not of a solid continuous piece of bone, but of two large pieces, the haunch-bones or innominate (nameless) bones, separated in front by only a small piece of gristle or cartilage; but between them, behind, a wide gap exists. Into this gap is fitted the lowest two pieces

of the vertebral column, the sacrum and coccyx; and all four parts are lashed together by the strongest bands or ligaments met with in the body, to constitute the pelvis.

On each side of the pelvis a large pit is dug out in each haunch-bone for the reception of the head of the thigh-bone, and it is here that we first meet with a true joint, in the form of the hip-joint.

A joint may be described as the spot where two bones meet. Over the surfaces of the bones, so as to prevent friction, is a covering of "gristle," or *cartilage*. Anointing the joint is a quantity of fluid, "joint-oil," or *synovia*, enclosed in a membrane to prevent its escape. Tying the bones together, so as to restrain the motions of the joint, are a number of bands, or *ligaments*. Briefly, therefore, a joint consists of bones, cartilage, synovial membrane, and ligaments.

Entering into the hip-joint is the **Thigh-bone**, or FEMUR, which, being the only bone met with in the thigh, shows clearly, when broken, all the signs of fracture. Its upper end consists of a globular head, supported by a neck, which projects at an angle from the shaft; it is the neck which is so frequently broken, especially in old people. The shaft of the bone, a long thick cylinder, ends below at the knee as two stout knuckles, or *condyles*, which form the upper part of the knee-joint.

The Knee-joint consists of three bones—the thigh-bone, or *femur*, above; the knee-cap, or *patella*, in front; and the shin-bone, or *tibia*, below. This is a huge joint, and is composed of bones, cartilage, ligaments, and synovial membrane, as already described. The knee-joint is of an enormous size, being four times larger than any other joint in the body. Its extent and its proximity to the skin render it apt to get injured, and serious consequences ensue unless care is taken that even slight

injuries near the joint are speedily and strictly attended to; otherwise, should inflammation occur in the wound, the joint itself may become inflamed, and there is no knowing where that may end; probably with either a stiff knee, or loss of limb, or loss of life. A knee-joint once weakened can always be felt afterwards; and thirty years afterwards, when the east wind blows, or on a sudden straightening of the limb, "the old hurt" will assert itself by a sudden twinge in the joint.

Beyond the knee we come to the leg, and I beg of you to note carefully the names of the different regions of the lower extremity. They are the *hip*, *hip-joint*, *thigh*, *knee-joint*, *leg*, *ankle-joint*, and *foot*. The leg, then, is only the portion between the knee and the ankle, and the name *lower extremity* is given to the whole limb.

The Leg consists of two bones—the larger one the **Shin-bone**, or TIBIA, on the inner side, and close below the skin; the smaller one the **Splint-bone**, or FIBULA, on the outer side, and deeply sunk amongst the muscles of the calf of the leg. The tibia is named from its likeness to the old Roman musical instrument of that name, and the fibula from its likeness in position to the clasp of a brooch. These bones are frequently both broken, but the fibula, just above the ankle, is the bone most frequently broken in the lower extremity. The tibia upon the inside, and the fibula on the outer side, both present below two stout tongues or projections of bones, which serve to embrace the first bone of the foot, the whole constituting the ankle-joint.

The Ankle-joint is made up of the shin-bone, or tibia, above, the first bone of the foot (the astragalus) below, and on either side the two tongues spoken of (beneath either elastic of the boot, the inner from the tibia, the outer from the fibula),

which embrace the astragalus and complete the ankle-joint. Seeing that the structures of a joint are fresh in our memories, we may here discuss:—

A Sprain.—By a sprain is meant a twist, strain, or rick occurring at a joint, and of such severity as to cause, it may be, serious trouble. The ankle, the most frequently sprained joint, is especially liable to wrenches and twists from slipping, on a smooth floor, or down stairs, or on a piece of orange-peel and the like on the pavement, or treading on the edge of a fair-sized stone, or putting the foot into a hole on uneven ground, or simply from the tendency "to go over" the ankle.

When from any of these causes a sprained ankle results, what happens is this: The sudden wrench starts the bones from each other for an instant, and during that instant various things occur. The bands or ligaments which hold the bones of the joint together are suddenly stretched, torn, and made to bleed, the gap which occurs between the bones sucks the blood into the joint, so that the joint instantly swells. Before even the stocking and shoe can be got off, the joint has swollen. Nothing could accumulate at such a rate except blood; and if further proof be wanted, it will be found two or three days afterwards by the skin becoming discoloured "black and blue" when the blood comes to the surface. *To relieve pain* in such an accident, and to prevent more serious trouble, the joint should be kept quiet, and the use of it prevented. To take the pain and sting out of it, the foot and ankle should be placed in hot water (100° F.), if it can be obtained. If the accident occur on a country road, the ankle should be bound round tightly with a handkerchief, either dry or dipped in cold water, or in equal parts of whisky or brandy and water, to procure rapid evaporation and produce cold thereby, the stocking pulled over it,

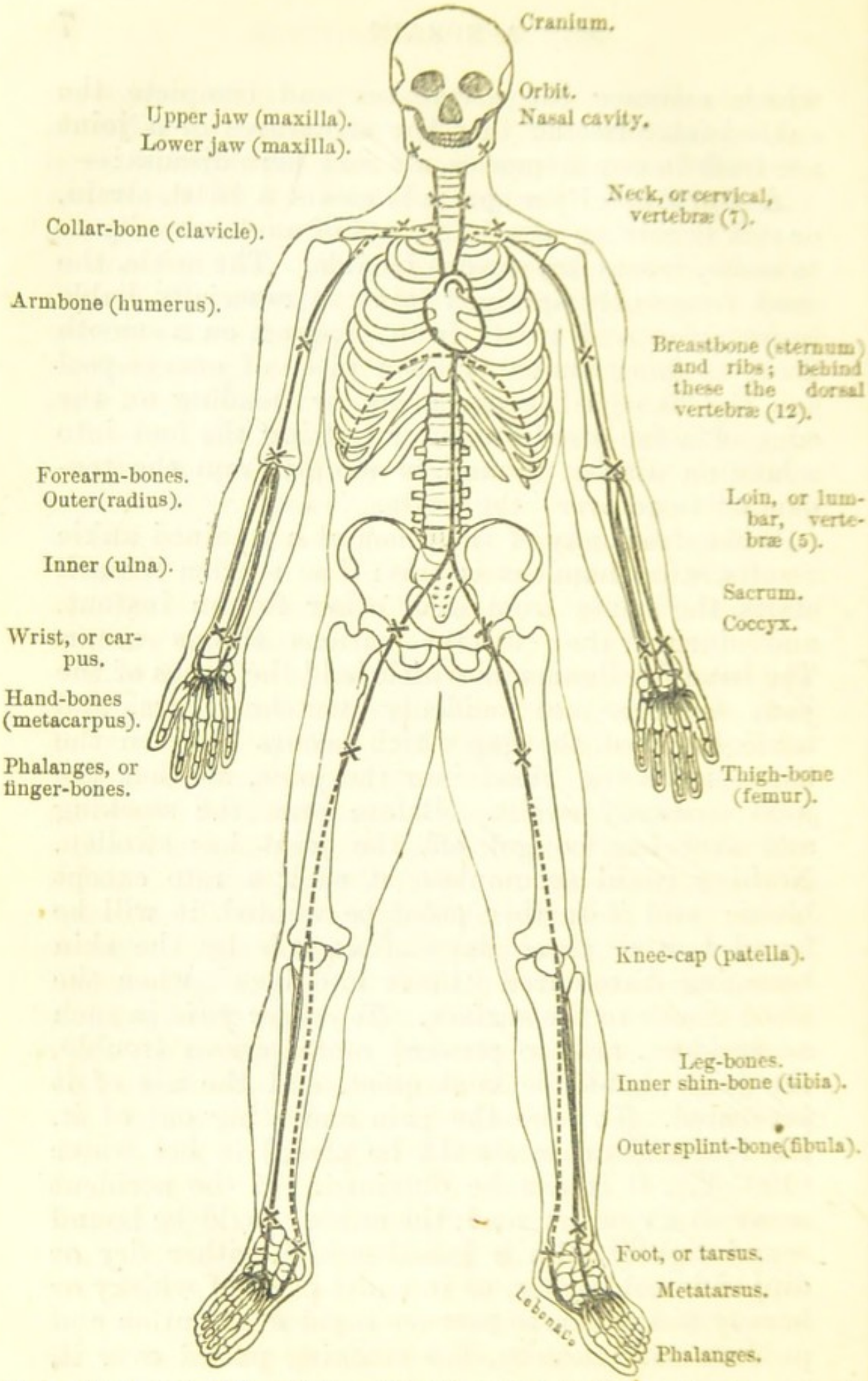

FIG. 1.—Showing: 1. The skeleton. 2. Black and dotted lines indicating course of arteries. 3. XX, showing where compression may be applied.

and the boot tightly laced; or, without removing the boot, tie a handkerchief or strap tightly over all. If the cold or spirit lotion is agreeable, re-apply it; but if the pain is great, place the ankle in hot water, or apply a fomentation, *i.e.* a flannel wrung out of hot water, or a bran poultice with a tablespoonful of vinegar over the poultice. In all cases a medical practitioner should examine the joint as soon as possible, as, to all but the skilled, what looks like a mere sprain may be a broken bone.

Beyond the ankle-joint is the **Foot.** Seeing the pressure, at times very sudden, which the foot has to bear, the necessity for a number of small bones in the foot instead of one large bone is readily understood (Fig. 1). A single bone would be apt to get broken, whereas a number of small bones distribute the shock, and lessen it by handing the pressure over from one to another. The first part of the foot proper is called the *tarsus*, consisting of seven bones, one of which forms the heel, and another (the astragalus) forms the lower part of the ankle-joint. In front of the tarsus are the five bones supporting the five toes; they are called *metatarsal*, meaning that they are in front of the tarsus. Finally we have the bones constituting the toes, and going by the name of the *phalanges*, from the fact of the bones being arranged in rows, or like soldiers in a phalanx. The foot has two surfaces—an upper, or back, or *dorsum* of the foot; and an under surface, or sole, or *plantar* aspect of the foot. The human being plants his whole foot upon the ground, differing from a dog, ox, or horse, as these walk actually on their toes; what one calls a horse's hind knee, or more technically hock, really corresponds to our ankle, although it is placed almost half-way up the animal's limb.

To sum up the facts already given of so much

of the bony skeleton, we have seen how the weight of the head was supported by the neck or cervical vertebræ; how that, owing to the increase of weight, from the necessity of supporting the upper limbs, the vertebræ of the back or the dorsal vertebræ became larger; and that the lumbar or loin vertebræ, having the whole of the upper part of the body to support, were huge. It was also pointed out that, at the haunch-bone, or pelvis, the weight divided and passed across the hip-joint to the thigh-bone or femur, from thence across the knee-joint to the shin-bone or tibia, which, along with the small bone or fibula, make up the leg; and that, finally, crossing the ankle-joint, the weight was received by the tarsus and handed over therefrom to the sole of the foot generally.

Whilst tracing the weight and the bones which sustain it on the way down, however, it is evident that numerous parts have been omitted; they are the ribs and sternum, the upper limbs, and the skull.

The Ribs, or *costæ*, number twelve pairs, exactly the same in men and women, although most have heard of the belief, got from concrete creative notions, that man has one fewer than woman. The upper seven ribs run from the backbone behind to join in front with the **Breastbone,** or *sternum;* these are called the *true ribs*, making a strong elastic cage (the chest) for important organs. The remaining five, which fall short of the breastbone, go by the name of the *false ribs*, of which the lowest two, being free in front, are called the *floating or winged ribs.* The breastbone, or sternum, runs from the root of the neck down to the pit of the stomach.

Enclosed within the ribs are the various organs met with in the chest and upper part of the belly, and it becomes necessary to shortly indicate the positions of the large organs of the body.

The trunk of the body is portioned off by a large muscular partition, the **Midriff**, or DIAPHRAGM, which completely divides the trunk into two parts (see dotted line, Fig. 1); the part above it is called the chest, or THORAX, and the part below it the belly, or ABDOMEN. The thorax has bony walls, the ribs bounding it; but the abdomen is soft-walled, and capable of being easily compressed. The organs contained within the abdomen encroach upon the thorax, so that the ribs give protection to many of the abdominal as well as the thoracic organs, or viscera. This is allowed for by the shape of the diaphragm, which, arching up towards the thorax, as the dotted line on Fig. 1 shows, accommodates the *stomach*, *liver*, *spleen*, *pancreas*, and the upper end of the *kidneys* on its under surface.

The Chest, or THORAX, is bounded behind by the vertebral column, on either side by the ribs, and in front by the breastbone, or sternum. The upper end is at the root of the neck, the lower limit is the midriff, or diaphragm. Its chief contents are the *heart* and the *lungs*.

The HEART, safely ensconced between the two lungs, rests upon the top of the diaphragm, midway between the backbone and breastbone; it is about the size of the clenched fist of the person it belongs to, whereas each lung is as big as the person's head. Huge things these LUNGS are, reaching from the neck, even above the collar-bone, down to the midriff, or diaphragm, and filling, except for the heart, the whole area of the chest—front, back, and sides. There can be no difficulty in being able to tell where the lungs are, because everywhere where a rib can be felt there is the lung beneath—not far off, but absolutely in contact, so that should a rib get broken, there is danger to the lung on account of the close proximity of the one to the other. The circulation and respiration will be described further

on; in the mean time, allow the brief indication of the position of the heart and lungs to suffice.

In the **Abdomen** the organs met with occupy the following positions. The STOMACH is beneath the region called the "pit of the stomach." The LIVER lies on the right side. It is a large solid organ as big as the brain, and it pushes up the diaphragm so as to ensconce itself under the cover and protection of the ribs. The position of the liver on the right side may help in the explanation of the use of the right hand; this heavy organ, fifty ounces in weight, placed near the middle of the body, must have some influence upon the rotation of our bodies. However it may be as to the use of the right hand, the fact may help the memory that the liver is on the same side as the right hand, and that pain in the right shoulder may mean disease of the liver.

The SPLEEN is placed on the left side, in a line with the stomach, and wholly protected by the ribs. It is almost the size of the palm of the hand, solid in structure, and containing a large quantity of blood. Both the liver and the spleen are apt to get ruptured by blows, but more especially when the lower ribs are broken on the right or left side, so may the liver or spleen respectively get damaged.

The positions of the other organs are easily understood. Every one knows that the kidneys are behind, in the region of the loin; that the intestines occupy the chief part of the front of the abdomen; and that within the pelvis lie the organs of excretion and reproduction. This must suffice for the position of the organs of the body; and now there remains the upper extremity and the skull.

The Upper Extremity includes the parts known under the names of the *shoulder*, the *shoulder-joint*, the *arm*, the *elbow*, the *forearm*, *wrist*, and *hand*.

The Shoulder is the mass moved when one shrugs the shoulders, when it feels as though half

the body was moving. This is owing to the large expanse of the **Bladebone,** or SCAPULA, and the mass of muscles connected with it. The only other bone met with is the **Collar-bone,** or CLAVICLE, a narrow rod-like bone, which can be felt as it passes from the top of the breastbone, or sternum, out to the top of the shoulder, where it meets a process of the bladebone, or scapula, and completes the summit of the shoulder. When these two bones have to sustain severe pressure, as by a fall on the hand or elbow, the collar-bone has the full weight to bear, and as it is fixed between two bones it gets snapped and broken, in spite of its S-shaped curve. The curve upon this bone brings the fact home to us that bones are not stiff and brittle things that snap like a stick of chalk or a piece of dry twig, but behave rather like a piece of green twig, which, whilst it bends easily enough, requires a deal of twisting, twining, and wriggling before the two parts can be got asunder. Bones, also, especially in the young, but less so in the elderly, will stand a deal of bending before they break, and this is especially the case with the clavicle, which, with its double curve, is doubly provided with a power of resistance to fracture from falls on the hand, elbow, or shoulder whilst the child is learning to walk. The **Bladebone,** or SCAPULA, on the other hand, is a movable bone, and can, when pressure is exercised on it, move out of the way and save itself; hence, except direct violence be aimed at it, no fracture is likely to ensue.

Beyond the shoulder is the **Shoulder-joint,** a joint provided with a wonderful facility of motion, and capable of the most varied movements. This is allowed for by the shape and condition of the bones forming it; they are the rounded head of the bone of the arm, the humerus, and the shallow, saucer-like (or glenoid) cavity on the scapula. The

cavity is so shallow and small that it does not in any way interfere with free movement. In this way, then, it is that the shoulder-joint and hip-joint differ, for it is plain they are both situated at the top of the part where the limbs sprout from the trunk, and upon their looseness or fixity will depend the extent of motion with which the whole limb is endowed.

The hip-joint, we saw previously, possesses a cup-shaped cavity, but we find that the shoulder-joint is like a saucer. The head of the thigh-bone is round like a ball, so is the head of the humerus. Now a ball placed in a cup has but little free motion, but on a saucer it can roll about with freedom. But here arises also the source of danger: the shallow saucer may allow the ball to roll over the edge, whereas in the cup that is well-nigh impossible; similarly, the saucer-like depression at the shoulder-joint may allow the round humerus to slip over the edge, constituting a dislocation, whilst in the case of the hip the cup-like cavity will restrain the head of the femur and prevent dislocation. Hence it comes about that dislocation, *i.e.* the bones slipping out of their sockets, is very common at the shoulder-joint, in fact, ten times more common than all the other dislocations in the body put together.

By a Dislocation is meant the slipping from off each other of the surfaces of the bones constituting a joint; by a *compound dislocation* is meant a simple dislocation compounded with an injury to the tissues and skin over the joint, in fact, the ends of the bones may protrude through the skin. Seeing that the joint we have just been speaking of—the shoulder-joint—is the most frequent seat of dislocation, it will be well here to dwell upon dislocation for a time. The causes of dislocations are chiefly falls in some position which, catching the joint at a disadvantage, cause the ligaments around it to give way and the

bones to slip. Thus the shoulder is most frequently put out by a fall on the hand or elbow. The elbow, the second most commonly dislocated joint, is also put out by a fall on the hand when the forearm is bent on the arm. A fall from a horse is a common cause of dislocation of the shoulder, hence it is a common hunting-field accident. A backward fall, and the person trying to save himself by putting his hands out behind him, is also a likely position in which to dislocate the shoulder; hence it is common in the football field, in boxing, and in some forms of wrestling.

The way to tell when a shoulder or other joint is out, *i.e.* dislocated, is—

1. The person in whom it has occurred—the patient, we shall say—feels something has given way.
2. The pain is severe, of a sickening, numbing, wrenching character.
3. The joint is immovable, and attempts at motion elicit severe pain.
4. The part when actually *seen* will be found to be deformed as compared with the corresponding joint of the limb on the sound side.
5. The deformity of the parts may be actually *felt*.
6. The change of shape occurs *at* a joint, and not in the continuity or course of a bone.

TO PREVENT this accident becoming more serious, and to allay the patient's suffering, get the limb in as easy a position as possible. If it is in the house, lay the patient on a couch or bed in the position of repose, and place a pillow below the injured limb in the position which is most easy. Slit up the seam of the coat or trousers when the patient is made comfortable, and get the coat and all clothing removed or made easy around the joint. Send for the doctor, but meantime one may apply cold-water rags, or a lotion of half spirits (whisky, brandy, gin, spirits of wine) and water, or sal-volatile a drachm

(*i.e.* a teaspoonful) to an ounce (*i.e.* two tablespoonfuls) of water. If heat is more agreeable, apply a fomentation, *i.e.* a flannel wrung out of very hot water, and if it is pleasant to the patient, repeat it frequently—say, every fifteen minutes. Should the accident have occurred in the hunting or football field, or anywhere away from house or home, then the seam of the coat should be slit up, the limb fixed to the side in the most easy position possible; this is done by means of a sling or support (see p. 64). If the underclothing is felt to be pressing, slit up the seam or cut the linen or under-vest, undo the brace on that side, and give the patient a mouthful of water, whisky-and-water, brandy-and-water, cold tea, or whatever else of the kind may be at hand. If the patient is near home, take him home; if far from home, with, say, a long drive, a ride, or a journey by train, then the nearest doctor ought to be sent for, and one should not yield to the solicitations of the patient who insists that he will be all right when he gets home, or that he wishes "his own doctor" to see it, and what not. Every medical man is capable of reducing a recently dislocated shoulder-joint with or without the aid of chloroform and assistants, and it is only inflicting unnecessary pain to defer the reduction until the patient gets home. He can go home soon after it has been reduced, but it is cruelty to send him twenty miles on a railway-journey home from a football match with an unreduced dislocation. Let none but a medical man attempt to reduce dislocations of the large joints such as the shoulder or elbow. It seems hard to let the patient lie suffering until the medical man comes, but nothing but repentance will follow active interference, and that friend will perform the greatest kindness to the patient who places the limb in the easiest position possible and prevents further interference until the doctor arrives.

A man who has had his shoulder-joint frequently dislocated will know what to do to rectify the displacement, and will either pull it in himself or tell a bystander what to do.

We have dwelt so long on dislocations that it well-nigh slipped from the memory that we have left the description of the upper limb still unfinished. Well,

The Arm is the name of the section of the limb beyond the shoulder-joint, and in it we have, as in the thigh, only one bone—the HUMERUS. Its upper end is rounded to form the ball met with at the shoulder, whilst its lower end is broadened so as to give surfaces for articulation with the two bones of the forearm.

The Elbow-joint is made up of the arm-bone, the humerus, above, and the two bones of the forearm below. The bones forming it are liable to dislocations and fractures; the joint is close to the skin, hence any unskilled person attempting anything more than simple measures after dislocations may do much harm (see p. 15).

In the **Forearm**, as in the leg, there are two bones, but, unlike the leg, the bones of the forearm are nearly of a size; the inside bone, that is, the little-finger-side bone, is called the ULNA; the outside bone, that is, the thumb-side bone, is called the RADIUS, because it twists or rotates or radiates round its fellow. Now, between these two bones a motion peculiar to the forearm takes place. To demonstrate this, with the forefinger and thumb of the right hand grasp the bone felt on the little-finger side of the left forearm, just above the wrist; the bone so grasped is the lower end of the left ulna; now it will be found possible to move the left hand so that now the palm is upwards, now the back, and it is plain that this is a motion of the outer, or thumb-side bone, the radius, on the inner bone, the ulna.

It is observed that the hand moves with the radius, and that it alone supports the hand, so that a fall upon the hand may cause a fracture, through the stress thrown on this its supporting bone. The motions so essential to the utility of the human hand, which have been pointed out, are called supination and pronation—*supination* when the palm of the hand is upwards, or forwards, and the thumb outwards; *pronation* when the palm of the hand looks downwards towards the ground, or backwards, and the thumb inwards towards the body.

These movements have to be carefully preserved when any accident happens to the forearm threatening rigidity.

Beyond the forearm comes the wrist-joint, made up of the forearm-bones above, and the first row of the bones of the wrist below.

The Wrist, or CARPUS, is composed of eight small bones in two rows, four in each row. Two lines on the skin in front of the wrist, frequently met with, mark the position of the rows of bones. Beyond the carpus are the five bones supporting the five fingers, and on these bones the front or palm, and the back or dorsum, of the hand are placed; they are called the *metacarpal* bones, and they form the knuckles. The **Fingers** are made up, with the exception of the thumb, of three bones called *phalanges*, from being arranged like soldiers in a phalanx; and they are named, commencing from the knuckles, the first, second, and third phalanges, respectively. The thumb, like the big toe, has only two phalanges.

Last of all in the bony skeleton we have to discuss the skull.

The Skull comprehends the brain-case or *cranium*, and the *face*. It is balanced on the top of the backbone, the uppermost vertebra of the neck forming a joint with it, at which the nodding motion of the head takes place. The limit of the cranium, and

consequently of the brain, can be made out by taking a line on each side forwards, from where the hair joins the skin of the neck behind, through the middle of the ear, and forwards to the eyebrow. All above this line contains brain.

The CRANIUM is about a quarter of an inch in thickness, and has the brain in contact with it; hence any injury to the bone will almost of necessity injure the soft brain-mass within. The bones forming the cranium are so fitted by toothed edges into each other that they cannot be displaced; they are named according to their position—*frontal* forming the forehead-bone; the *temporal* containing the ear-bones; the *parietals* forming the vault or top of the skull; the *occiput* forming the back of the head, and so on.

Below the cranium is the FACE, composed of bones arranged to form the nose, orbit, cheek, and mouth. The only movable bone of the face is the lower jaw, or *inferior maxilla*, named so in contradistinction to the *superior maxilla*, or upper jawbone; the lower-jaw joint lies in front of the ear, and the bone can be felt to move when one places the finger on the skin immediately in front of the lappet of the ear. This joint may get dislocated, when the mouth will be found gaping, and all attempts at closure will prove ineffectual until reduction is performed. This can only be done by skilled hands, so it must be left to a doctor.

MUSCLES.

Every motion in the body takes place by muscles, be it the blow of a pugilist, the act of frowning, or the glib motion of the tongue. Hence muscles are almost everywhere, and they make up, with the bones, the mass of our limbs. It is difficult to

believe, when first told, that muscle and flesh are the same tissue, but such is the case. The flesh of an animal is composed of the muscles of either a young animal or one in which much fat has accumulated in the substance of the muscle; what one calls "muscle," or tough meat, are muscles of an old animal, or one which has had to exercise them much in the search for food. Flesh, then, is muscle with fat incorporated in its tissue.

Peculiar to muscular elements is the property of contraction, and it is this property that renders muscle the all-important factor in motion. Every one is familiar with muscular contraction. To illustrate it, let the reader place the right hand over the front of the left arm midway between the shoulder and the elbow; now slowly bend the elbow, *i.e.* bring the forearm up to the arm. Whilst this is taking place, a hard swelling rises up beneath the right hand, which most people know to be a muscle called the biceps. The cause of its swelling is that the muscular elements have rearranged themselves so that the muscle becomes hard as a ball, and the effect produced by the contraction is the motion of the forearm.

The muscles in the limb are thick and fleshy in the middle of their course, but at the spot where they cross joints they form for the most part hard, dense, fibrous bands called *tendons*. These go popularly by the name of "leaders;" and at the wrist, where we hear of leaders being so frequently strained, we can feel numbers of these hard cords. In the walls of various organs, such as the stomach, heart, intestine, gullet, lung and bladder, we meet with muscular structures which are not under the direct command of the brain; these go by the name of the *involuntary muscles*. They are regulated by a separate set of nerves (see Nervous System), are at work during sleep, and in appearance and behaviour

are totally different from the voluntary muscles or flesh of the body. The mention just made of two sets of nerves brings us to consider—

THE NERVOUS SYSTEM.

The elements of the nervous system consist of masses of nervous matter, proceeding from which nerves go to all parts. It is in the masses of nervous matter that will, memory, intellect, etc., are resident, and it is by the nerves that messages are carried from these seats of force to the muscles, etc.

The great mass of nervous matter is the *Brain*, or cerebrum, resident in the brain-case, or cranium, from which a long tail-like piece passes down the backbone under the name of the *spinal cord*. These together constitute the *cerebro-spinal* system. *Nerves* proceed in the form of white cords to and from the brain and spinal cord to the skin and muscles. Nerves connected directly with the brain, and finding entrance and exit through holes in the cranium, are called **cranial**, such as the nerve to the nose (olfactory), the nerve to the eye (optic), the nerve to the ear (auditory), and so on. Nerves proceeding from the spinal cord (all of which, however, ultimately reach the brain) are called **spinal**. Nerves carrying sensations from the skin to the spinal cord and brain are called **sensory**; on the other hand, nerves conveying commands or brain-impulses from the brain to the muscles are called **motor**. The two sets of impulse are conveyed along separate fibres, which are, however, firmly bound together, constituting a nerve. Close to the spinal cord, however, the fibres part company, and a motor and sensory bundle enter the cord separately.

The nerves, in fact, act as the telegraph wires of our bodies, capable of carrying messages in either

direction. Suppose the skin of the palm of the hand tickled, pricked, or burnt, the sensation is carried along the nerve to the spinal cord, and hence to the brain. Previous experience or present pain informs the brain that it is not good to have the skin of the hand so affected, and it sends a message down the spinal cord and out by a nerve to the muscles of the limb, to withdraw the hand or remove the irritation. The time between the application of the irritation and the withdrawal of the part seems infinitesimal, the action seems instantaneous; but an interval does ensue: the wasp has time to alight, insert its sting, and escape before the hand can reach to brush it away from the part on which it is felt to alight.

The involuntary muscles of the body are under the regulation of a separate system of nerves, which, as it presides over the organs of the mere animal or vegetative part of our system, is called the system of organic life; and from the fact that the organs presided over by it work in harmony or are sympathetically disturbed in disease, it is usually called the *sympathetic* system. It consists of a double chain of small nervous masses called ganglia, a pair being placed in community with each vertebra. All the ganglia are joined together by nerves, and from them also nerves pass to the heart, the lungs, and the organs of the alimentary canal, such as the stomach, intestine, liver, and pancreas. These systems—the circulatory, the respiratory, and the digestive—are supplied by a common system, keeping them in harmony or sympathy of action. Disturbance of one of them leads to irregularity of action of the others; thus a piece of undigested food in the intestine will lead to altered action in all.

Hence we find that we have two sets of muscles presided over, in the main, by two sets of nerves—the voluntary muscles by the cerebro-spinal system,

and the involuntary by the sympathetic. The chief difference between the two sets is that one, the sympathetic system, belonging to the heart, lungs, and digestive system, continues in action from the birth to the death of the individual, knowing neither rest nor stoppage, as we understand rest; whilst the other, the cerebro-spinal system, presiding over the voluntary muscles, requires long intervals of quietude, provided for by sleep.

We have absolute command, then, of the one set, but not of the other: we can lay our pens down when we like, but we cannot stop our heart's beat; we can push away the tempting fluid, but cannot prevent its absorption, or stay its digestion, when once it is swallowed.

It is plain, therefore, that when a nerve is cut there will be arrest of motion and sensation in the part—**paralysis**, so called. When the spinal cord is itself torn through, there will be paralysis in the parts below. If the injury is in the back, the lower limbs will be paralyzed; if in the lower part of the neck, the upper limbs as well; if in the upper part of the neck, instantaneous death.

THE ALIMENTARY CANAL.

Interesting as the subject of the digestion and absorption of food is, it is altogether beyond the province of the knowledge necessary to acquire to enable one to render "first aid to the injured." Disorders of digestion are seldom accidental. Let the following short sketch, therefore, of the organs concerned suffice. The food received by the mouth is there subjected to the action of the teeth, and to the digestive fluid, the saliva. By the teeth it is reduced to a finer state of division, and by the saliva the starchy matters of our food, taken in as bread and potatoes, are converted into sugar. The import-

ance of slow mastication is evident so as to allow of the conversion. The food so prepared is formed into a round ball, and by the action of swallowing it is passed from the mouth through the throat (**fauces**), hence to the cavity at the back of the throat (**pharynx**), and down by the gullet (**œsophagus**) to the stomach. The stomach is a large bag about twelve inches long from right to left, from which the fluid portions of the food are quickly absorbed, but in which the solid portions are retained for some hours, and there slowly acted on by the gastric juice. The acid (**hydrochloric**) and the ferment (**pepsin**) of the juice convert all forms of meat, flesh, etc., into a condition in which they can be taken up by the absorbents. The food passes from the stomach into the small intestine, a tube about twenty feet long, in which the food is further subjected to digestive fluids and in which it is largely absorbed. The digestive fluids are those poured in from the liver, the bile, and the juice of the pancreas (**sweetbread**). The bile aids the digestion of the fats, and the pancreas supplies a juice which seems to have the properties of all three fluids mentioned—the saliva, the gastric juice, and the bile.

The walls of the small intestine are richly provided with vessels, whereby the food is absorbed and carried into the blood. The vessels are called *absorbents*, and they belong to a system called *the lymphatic*, which, made up of vessels (**lymphatics**) and *glands*, are met with everywhere in the body. From a poisoned finger, red streaks are often seen running up the forearm and arm, and in the armpit a tender swelling is often met with. The red streaks are caused by the inflamed lymphatics, and the tender swelling is an inflamed gland. One is also familiar with enlarged glands in the neck and other regions, especially in children, and these are

part of the system we are discussing. By the lymphatics the food is picked up in the intestine and conveyed by and collected into a central tube—the thoracic duct—to the root of the neck, where the contents are poured into the blood of the veins. In this manner does food reach the blood.

The small intestine opens into the large, and by it the excrementitious matters are carried to the lower part of the body, where they are got rid of.

THE CIRCULATION OF THE BLOOD.

The position of the heart and lungs was discussed at p. 11.

To understand the course of the blood, look at the back of your hand, and you will see blue vessels (**veins**) immediately beneath the skin. You may be able to follow one of these up the forearm to the elbow, where, in front, two large veins are found. Grasp now the arm above the elbow, and you will find that the veins stand out more prominently. What does this teach you? It teaches you that the blood in the veins is passing from the fingers *up* the arm towards the root of the neck, and so on to the heart. In the lower extremities, the veins carry the blood from the toes up the leg and thigh, and finally through the body to the heart. So in like manner, veins (**jugular**) pass from the skull down the neck to the top of the chest, where, joining the veins of the upper limbs, they open into the heart. All the blood, therefore, contained in the veins comes to the heart. The blood contained in them is dark purple, waste, or venous blood that has been used by the tissues, and is on its way back to the heart. It there passes (Fig. 2) into (1) the first chamber of the heart (the *right auricle*), and is driven thence, by muscular contraction, into (2) the second chamber (the *right ventricle*). This in turn

contracts and sends the blood to the lungs by a large vessel called the *pulmonary artery*. In the lungs the blood is exposed to the oxygen in the air we breathe, and a magical effect is produced. The blood becomes scarlet in colour, purified, as it is termed, and is now ready to go through the body, carrying oxygen to the tissues. It does not, however, go straight from the lungs to the body, but is first collected by vessels called *pulmonary veins*, and

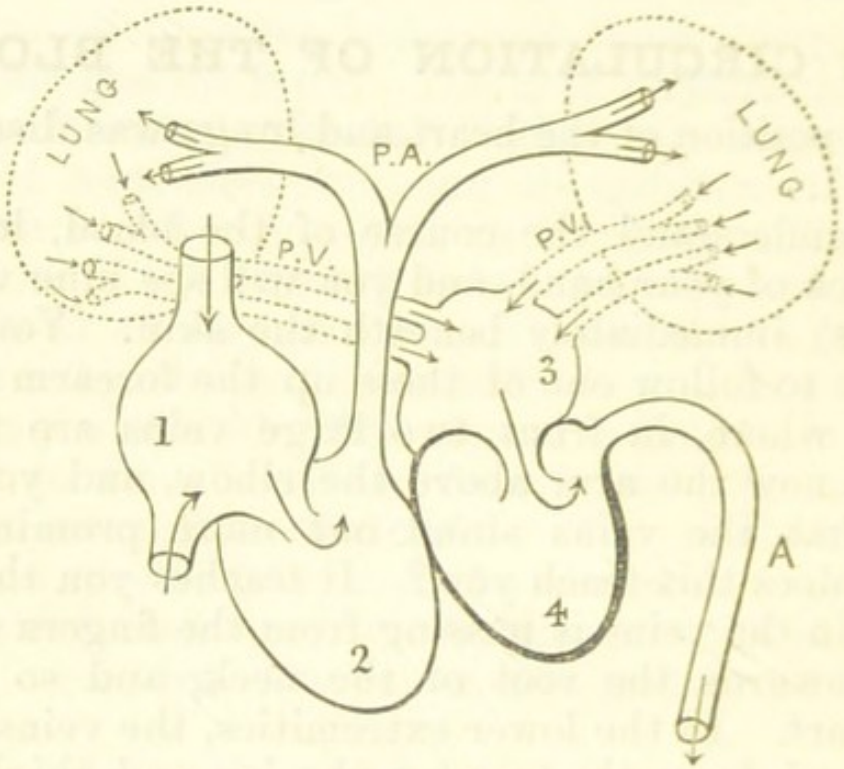

FIG. 2.—Diagram of circulation of blood. 1. Right auricle. 2. Right ventricle. 3. Left auricle. 4. Left ventricle. P.A. Pulmonary artery. P.V. Pulmonary veins. A. Aorta. Commence at cavity 1 and follow the arrows out of cavity 4.

is carried back to the heart, first to (3) the *left auricle*, or third chamber, thence to (4) the *left ventricle*, or fourth chamber, and finally leaves the heart by a large artery called the *aorta*. It will be observed that the two right cavities contain venous blood, and that the two left cavities contain scarlet, or arterial blood. The blood cannot go backwards when the heart contracts, by reason of valves placed at the entrance and exit of the cavities of the heart.

The AORTA is the great arterial stem, arising from the left ventricle, which gives off branches (**arteries**) to all parts of the body, carrying pure blood to the tissues. Each muscular contraction of the left ventricle sends the blood with an impulse into the arteries, causing the increase in pressure we call *the pulse;* and a pulse exists in the course of the arteries everywhere in the body. The number of times the pulse beats tells us the number of times our heart contracts, because the one is caused by the other. Hence if we feel the pulse at the wrist, and it beats, say, seventy-two to the minute, we know that the heart beats, or contracts, likewise seventy-two times a minute. To find the pulse at the wrist, place the forefinger on a spot an inch above the wrist, and half an inch internal to the thumb side of the forearm. Arteries can be felt in many other places; for instance, place your forefinger immediately in front of the lappet that projects in front of the ear-opening, and you there feel an artery, the temporal, beat. Now, the quicker the heart beats, the quicker the pulse, and *vice versâ*.

By the aid of a microscope, fine, hair-like tubes, called **capillaries,** are to be seen in all parts of the body. These minute vessels are everywhere: one large muscle may contain millions; they are the spots at which the interchange of fluid and gaseous nutrition takes place, as evinced by the change produced on the colour and character of the blood. The blood *enters* an area of capillaries from an artery as pure, oxygenated, scarlet, or arterial blood, and *emerges* in a vein as impure, dark purple, or venous blood, having lost part of its oxygen and being charged with carbonic acid. The carbonic acid is now conveyed away to the lungs in the venous blood by the veins; and in the lungs the blood gives up part of the carbonic acid during expiration, and receives oxygen from the air during inspiration.

RESPIRATION.

Respiration, or breathing, is carried on by the lungs, or "lights," as they are popularly called. The position of the heart and lungs was given at p. 11. The air enters by the nose or mouth, passes to the back of the throat—the pharynx—hence through the larynx, or "apple in the throat," down the windpipe, and then through the bronchial tubes into the lungs.

The air around us consists, for the most part, of oxygen and nitrogen. The oxygen constitutes about one-fifth part of the atmosphere, and is the active element in maintaining life. The nitrogen, however, we inhale as well, but it is passive in its action, serving simply as a diluent.

The process of breathing consists of two steps: the taking in—*inhalation*, and the letting out—*exhalation*. What is inhaled is air; what are exhaled are various products from the venous blood. What are these?

1. Water. Breathe on a glass for a time, and it will be found to become dim, and by-and-by drip with moisture; or when the temperature is low, as on a frosty morning, one can "see" one's breath; this is owing to the rapid condensation of the aqueous vapour in the breath, from its contact with cold air.

2. Heat. When our fingers are cold we involuntarily put them to our mouths and breathe upon them to warm them; hence we lose heat by our breathing.

3. Carbonic acid gas. When one sits in a room with doors and windows shut and no fire, the room gets stuffy or close; this is from the carbonic acid gas escaping from our lungs and accumulating in the air of the room.

A simple experiment proves this. Put some lime-water in a tumbler, and breathe into it through a

glass tube; the lime-water becomes milky white: the lime and the carbonic acid gas have united to form chalk. Hence during exhalation we lose moisture, heat, and carbonic acid gas.

The process of inhalation is chiefly a muscular, that of exhalation a mechanical act. We breathe at the rate of from fifteen to eighteen times per minute.

THE BLOOD-VESSELS, AND ARREST OF BLEEDING.

The blood, leaving the heart by the **Aorta,** is carried down the front of the backbone, and passes through the midriff, or diaphragm, to reach the abdomen. Its first portion is shaped like the handle of a staff or shepherd's crook, and is called the *arch of the aorta*. It is not a smooth-handled staff, for it is seen that three great twigs or branches come off from it and pass up to the head, neck, and upper extremity. The first great vessel is the *innominate* (see diagram); it passes upwards to divide into the *right common carotid* and *right subclavian*, which respectively go to the neck and upper extremity. The second great vessel is the *left common carotid*, and the third is the *left subclavian*. So that the vessels of the two sides, although not at first symmetrical, come after the innominate divides to resemble each other. Following the handle of the staff (the

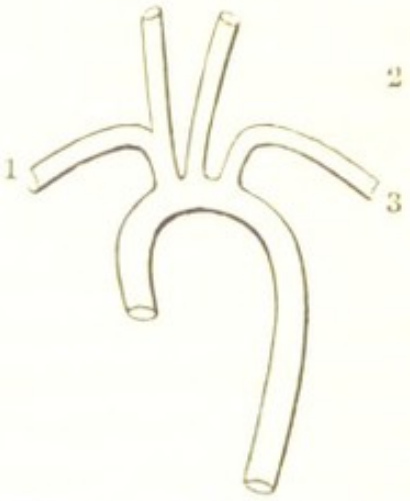

FIG. 3.—Arch of aorta giving off from left to right of diagram. 1. Innominate artery, dividing into right subclavian and right common carotid. 2. The left common carotid. 3. The left subclavian artery.

aorta) downwards through the thorax and abdomen, where it is called respectively the *thoracic* and *abdominal aorta*, it is found about half-way down the abdomen to divide into two branches. The large original trunks from the aorta, called the *common iliacs*, divide into two—*the internal and external iliac* arteries (see diagrams, pp. 8, 40). One, the internal, drops down inside the pelvis and supplies all the organs there—the bladder, etc.; whilst the other, the external iliac, passes downwards to the top of the thigh and there enters the lower limb exactly in the centre of the top of the thigh, *i.e.* the fold of the groin. Here, then, a large artery as big as the ring finger enters the thigh, and we must consider for a moment **the characters of an artery.**

We know an artery carries pure blood, as it is called, from the heart to the different parts of the body, hence the stream in the arteries is from the heart towards the extremities; in the particular vessels we are now concerned with, it is flowing down towards the feet. The blood is also *scarlet*—not red, but scarlet in colour, as is the case with all arteries. When one gets the finger upon an artery it can be felt to beat or pulsate, and this is the case not only "at the pulse" at the wrist, where we speak of "the pulse" as if there were no other in the body, but wherever one can compress a fair-sized artery against a bone.

There are certain definite bony points against which arteries may be compressed with ease and advantage, and it is these points I want to elucidate and bring clearly home to you. Now you must know first something about

THE COURSE OF THE ARTERIES IN THE LOWER LIMB.

The Artery of the Thigh is termed the *femoral* artery, but there is no necessity for your remembering the technical name; the artery of the thigh every one understands, so call it that. Entering the thigh in front, in the middle of the fold of the groin, it passes downwards towards the inner side of the knee (see diagrams, pp. 8, 40). The position of the artery is exactly found, when the knee and hip are slightly bent, by taking a line from the middle of the fold of the groin down to the inside of the knee. A deep wound anywhere in this line is apt to wound the main artery. In many trades such an accident is likely to occur. A shoemaker at work involuntarily brings his knees together to catch the knife he drops; the consequence is, that with the butt-end of the handle against the inside of one thigh and the point of the blade towards the opposite, and the thighs suddenly brought together, the point is sent into the artery.

The main artery in the thigh is a large vessel which, if fairly cut across, would cause death in one or two minutes. Luckily the vessel is not usually completely cut across, but only wounded, when many minutes may pass before bleeding to death ensues. The first officer killed in the Egyptian war (1882) was shot about two inches below the fold of the groin, and the artery completely cut across. The soldiers with him knew not what to do, and in two minutes his young life spent itself on the arid sand. It is as cruel to allow soldiers to go into battle ignorant of the means of stopping hæmorrhage as it is to allow the seafaring population to be ignorant of swimming.

Place a walking-stick along the inside of the

thigh, with its upper end in front of the groin and its lower end behind the knee,—you have at once indicated the course of the artery of the thigh, and you will see how straight its course is. The artery therefore is *in front* at the hip, *to the inner side* at the centre of the thigh, and *behind* at the knee; it in this way avoids the pressure to which it would be subjected were it anywhere else. Were the artery placed behind the hip, every time one sat down the vessel would be stopped; hence it lies in front. Whilst passing from front to back of the thigh, it might have gone down either the inner or outer side; on the inner side, however, it gets protection, on the outer side it would be exposed; hence Nature in her wisdom brings it along the inner side to be out of danger's way. Were the artery anywhere else than behind the knee, it would be compressed when one knelt down were it in front, compressed when one brought the knees together were it on the inner side, and exposed to danger were it on the outer side; hence the artery is behind. With these general observations, namely, that vessels pass along the protected part of a limb and on the flexure side of a joint, we can now rapidly finish an account of the vessels in the lower extremity. **The Artery behind the Knee,** the continuation of the femoral, is called the artery of the ham, or the *popliteal;* it is about equal in size to a cedar pencil. It is deeply placed, and can with much pushing and difficulty be felt pulsating. The popliteal artery, or artery of the ham, divides into the **Two Arteries of the Leg.** The large bone of the leg, the tibia, affords protection to the arteries, and baptizes them both *tibial;* one is called the *anterior*, meaning in front of, the other is called the *posterior*, meaning at the back of, the tibia. They are, however, really deeply sunk between the two bones of the leg. Were they otherwise they

would be in danger, as no part of the leg is protected either front, back, or sides; hence is it that the arteries are sunk deeply between the bones for protection's sake. So deeply placed are they, that although they do not escape being wounded, still it is impossible to stop the bleeding from them by pressure *on* them either by the fingers or by any appliances. The two vessels pass across the ankle and enter the **Foot**: the one on the front of the leg passing naturally across the front of the ankle and on to the top, back, or dorsum of the foot; the other from the back of the leg, passing along the inner side of the ankle to enter the inside of the sole of the foot below the instep, where the arch of the foot is. It thus avoids the pressure to which it would be subjected in any other part. As soon as the artery enters the under surface, sole, or plantar region, it divides into two vessels, *the internal and external plantar;* these vessels, a little larger than crowquills, supply branches to the tissues of the foot and the toes.

When an Artery is Cut it is very plain what will take place: (1) The blood will spurt out in jets, the jets corresponding to the pulse, *i.e.* the beats of the heart; (2) the blood will be scarlet in colour; (3) it will flow in a direction away from the body.

Bleeding from Arteries.—Now, then, what is to be done when bleeding from an artery occurs anywhere in the thigh? for when you master the principle of stopping bleeding in one region you know it for all others.

The object is to stop the flow. Can this always be done? In the limbs, yes. How? By applying pressure, in some cases on the bleeding point itself, in others between the wound and the heart. Thus in a wound of the artery in the centre of the thigh, the bleeding can be stopped by pressure applied above that point, *i.e.* between the wound and the

groin. This is easily enough understood when it is borne in mind that the blood is flowing downwards from the heart towards the limb. Now, just as you stop a garden watering-pipe that has burst from deluging the lawn by putting your foot on the india-rubber anywhere between the water-tap and the burst point, so may you stop bleeding from an artery; and just as it is well-nigh impossible to stop such a pipe if it goes across a bed of straw by putting your foot on it, so is it well-nigh impossible to compress an artery against soft tissues like muscles. It is important then to press against something hard; this is, in the case of a water-pipe, the ground, and in the case of an artery, a bone.

To STOP BLEEDING at any given spot in the lower limb, it is necessary to apply pressure upon the vessel above the wound, *i.e.* between it and the heart. Pressure may be applied by—

1. The fingers. This is technically called *digital compression*, *i.e.* pressure by the digits, or fingers. This is the most useful to know, as you have your fingers always with you, and you can call them into immediate use; bandages, and even pocket-handkerchiefs to be used as bandages, may not be at hand when the critical moment arrives, and pads, such as stones, corks, etc., are always out of the way just when you want them. So trust to your fingers, and most of all trust to your thumbs. Use your fingers, especially your forefinger, to feel with, use your thumb to press with; from its very appearance its broad flat end is evidently meant for pressure, whereas your forefinger, educated to touch, and so sensitive, is evidently intended, and has been trained by generations before us, to become the perceptive organ it is.

2. Instrumental compression by what are called *tourniquets*. These instruments are specially made, are to be had of any surgical instrument maker,

and are of many varieties. A knowledge of their mechanism and action will enable one to understand how to improvise a tourniquet.

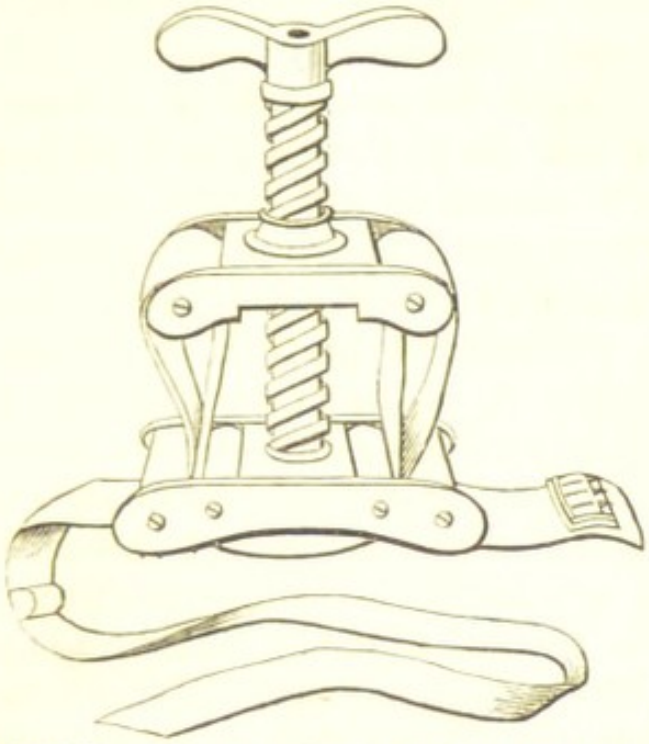

FIG. 4.—Petit's tourniquet. See pp. 38 and 45 for application.

The one figured here is only a type. It is called Petit's, and has a claim to precedence on account of

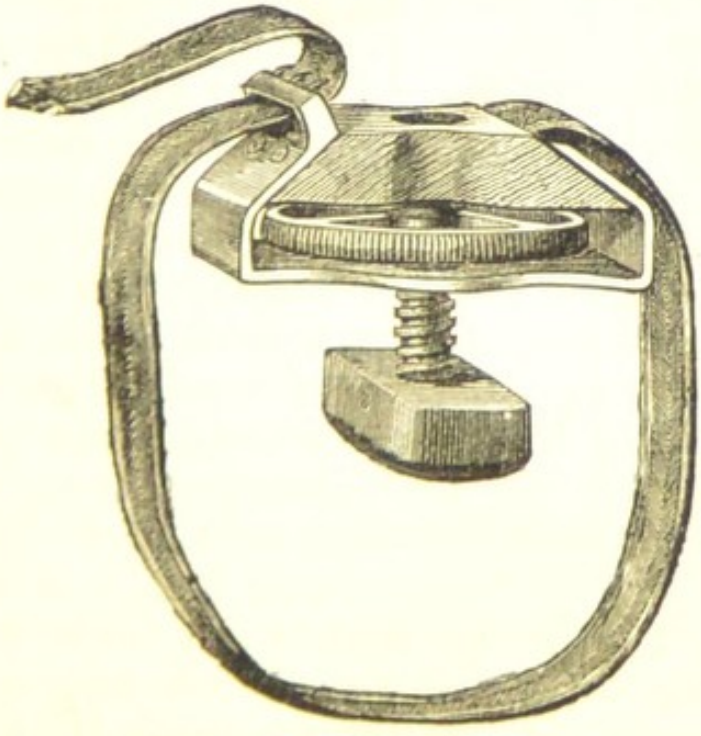

FIG. 5.—Maclure's tourniquet.

its excellence and its age. Others are called—Signorini's; the field tourniquet; the winged tourniquet; Esmarch's tourniquet; and the most recent one is an excellent invention, simple and complete, by Mr. Andrew Maclure (Fig. 5).

They all act on the principle of a strap round the limb, with a pad on the vessel, and a screw or wheel apparatus by which to tighten the strap and press the pad further and deeper on to the artery. These instruments are excellent, and fulfil their purposes in surgical operations and in hospitals; but the further discussion of them is useless, as they are not in the hands of the community. It is the principle only which is useful, namely, that a *strap* round the limb, a *pad* on the vessel, and the *means of tightening* the strap, are all that is wanted.

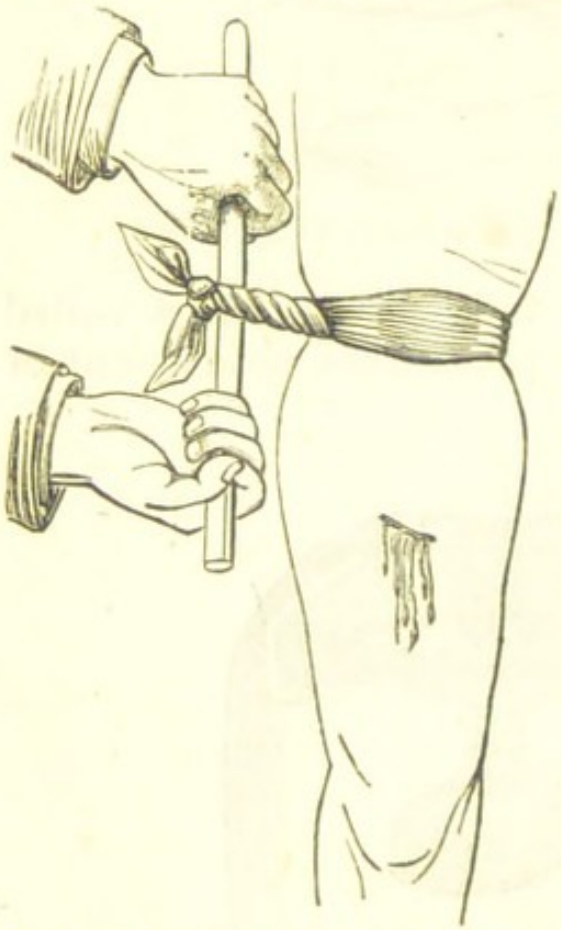

FIG. 6.—Improvised tourniquet to stop bleeding in thigh.

3. Tourniquets may be *improvised* on the principle of the instruments just mentioned, but instead of being provided with ready-made pads, straps, and screws, the *pad* may be a stone, marble, cork, snuff-box, piece of coal, piece of wood, pocket matchbox, a small watch, a reel of cotton, a ball of wool, a bunch of keys wrapped up well in a handkerchief, etc., etc. Anything which is hard and handy is all that is wanted. The *strap* round the limb may be a handkerchief—two, if one is not long enough—a leather strap, an elastic trouser-belt, such as is

worn at football, cricket, etc., a trouser-brace, a long cotton stocking, a garter, etc.—anything which is long enough and strong enough to surround the limb, and capable of standing traction without tearing. The *screw*, or wheel, is represented by a stick used to twist the bandage or strap so as to make it tight. To accomplish this, a walking-stick may be used, an umbrella, a key, a pencil, a penholder, a knife (shut), a bayonet, a sword-sheath, a ramrod or cleaner, a policeman's truncheon, etc.—anything of the kind, which is strong enough whereby to employ force, and which is most handy.

These are the means at our command; and now to apply them.

I. Supposing *a wound in the upper third of the thigh*, say three inches below the groin. What is to be done? Pressure must be applied above the wound by the thumbs (digital compression, that is) at the point indicated in Fig. 7. It is well-nigh impossible to fix a tourniquet here; besides, you must compress with the fingers first on all occasions, so apply your thumbs at the point indicated, namely, the centre of the fold of the groin, and press straight back. Both thumbs are to be used, the one over the other, as indicated in the figure.

FIG. 7.—Compression of the artery at the groin for bleeding below that point.

How hard are you to press? Until the blood stops flowing from the wound below. There is no fear of your not pressing hard enough; you will be so wildly excited by the gush of blood, and the endeavour to stop it, that you will likely push with all your might. Now the joints of your thumbs are not able to bear the full weight and pressure of your body for more than a minute, and your thumbs will get tired long before assistance can come. You should, then, harbour your strength; and if at first,

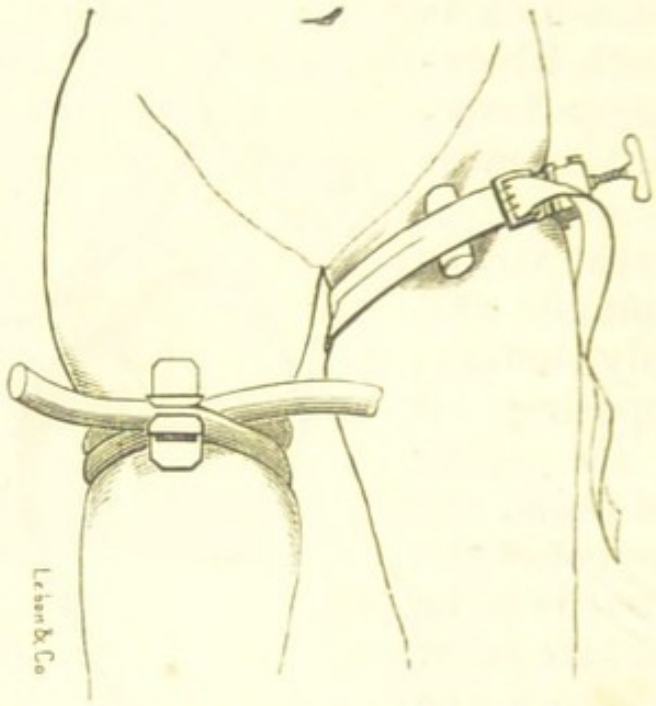

FIG. 8.—On the right thigh is an Esmarch's tourniquet, consisting of an elastic band with a catch to hold it. On the left thigh a Petit's tourniquet is applied.

in the moment of excitement, you press as hard as you can, you will remember, perhaps, by-and-by, that this amount of pressure is unnecessary, and that only sufficient is wanted just to stop the flow of blood.

Is this certain to stop the bleeding? Absolutely, if you have your thumbs upon the artery. How can you tell when you get your fingers on an artery? Because you can feel the artery beat or pulsate.

Supposing your thumbs get tired, you would ask

a bystander, acting under your directions, to slip his thumbs on over yours, and you would then slip yours from beneath his.

Supposing assistance, that is a doctor, is a long way off—say five, ten, forty, or fifty miles, as may occur in the colonies—you cannot go on grasping with the thumbs, but you must act as follows:—Put a pad, *i.e.* a stone, cork, etc. (wrapped up in a handkerchief), on the vessel near the spot at which you are compressing with the thumbs; tie an elastic band, if you can get it, if not, a trouser-brace. or leather strap, etc.. etc., round the top of the thigh and along the fold in the groin; and, crossing the ends on the side of the hip, bring the ends round the body, and tie tightly. This will stop bleeding until the doctor comes, when your responsibility is given up.

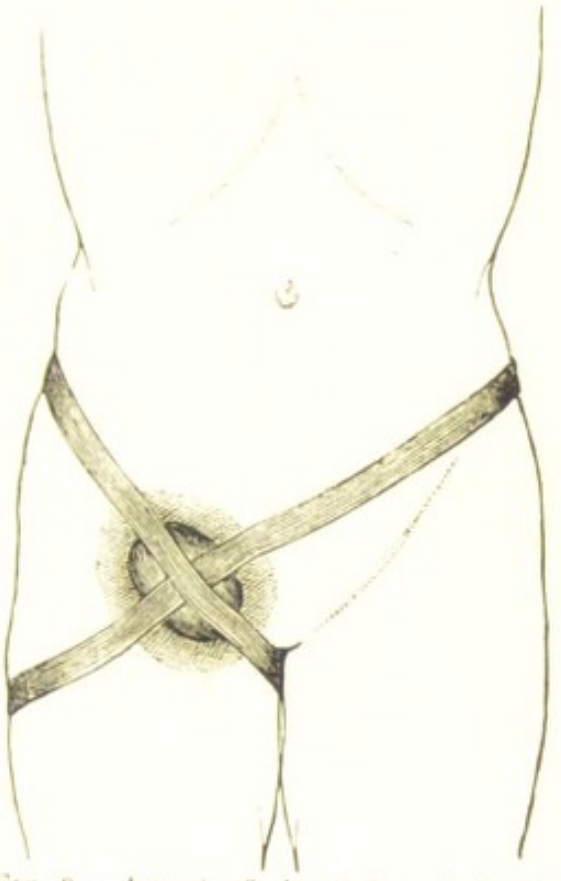

Fig. 9.—Arrest of circulation in lower limb by a pad and bandage. Apply over the artery at the groin.

II. *A wound involving the main artery* (the femoral) *at or below the middle of the thigh, or the artery at the back of the knee-joint—the artery of the ham*—the popliteal. Proceed as follows:—

1. Compress the vessel at the groin with the thumbs in the way directed (p. 37) and get a bystander to make a pad and get a bandage (see p. 37).

2. Then apply a pad, *e.g.* a stone, etc. (wrapped in a handkerchief) (see p. 36, Fig. 6), somewhere in

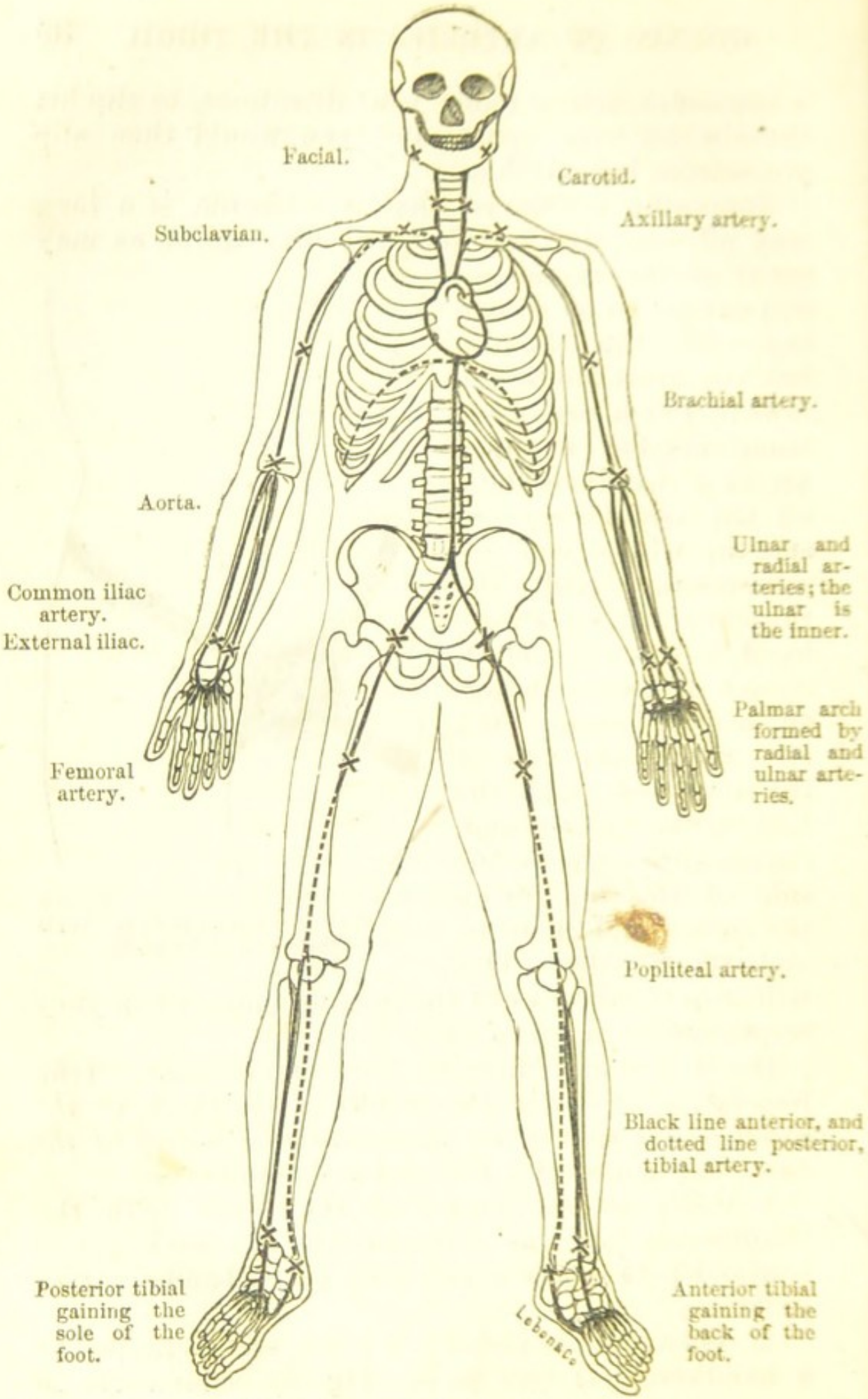

FIG. 10.—Showing: 1. The skeleton. 2. Black and dotted lines indicating course of arteries. 3. XX, showing where compression may be applied.

the line of the artery on the inside of the thigh, and above the wound. Round the limb and over the pad pass a handkerchief, tie the ends with one catch of the knot, *i.e.* with a half-knot only, then apply a stick or umbrella on the half-knot, and, including the stick, make a complete knot; the stick which is to be used as a tourniquet is tied thereby between or in the knot. Now twist the stick until the bandage gets tight, and the bleeding is controlled. Whoever has the thumbs on the artery may not remove them until the stick is being twisted. When the bleeding has stopped, fix the stick, umbrella, or what not, by tying it to the limb above and below the seat of the tourniquet. It will thus act as a splint and keep the leg still. In this state the patient can be moved on a stretcher or in a vehicle to the doctor. If on the way there the bleeding recurs, undo the ends of the stick, and give it another twist, replacing it again by the side of the limb.

You will be anxious to know how long this tourniquet can be left on. Until the doctor comes. But supposing he does not come for six hours—you can do this: after an hour or two, you might carefully undo the stick above and below, and slowly and gradually untwist, keeping your eye fixed on the wound. On the blood appearing twist the tourniquet tightly again and fix it. At the end of another hour or two, you may untwist slowly again. Supposing this time no bleeding occurs, you ought, having slackened the tourniquet, to leave it applied loosely, so that on the reappearance of bleeding it may be twisted up immediately. Never remove the tourniquet altogether before the doctor has seen the patient.

III. *Wounds of the arteries in the legs* are not very common, but when they do occur—

1. Compress the artery of the thigh by digital compression. (See Fig. 7, p. 37.)

2. Apply a pad and tourniquet over the artery in the thigh (Fig. 6, p. 36), and apply a piece of lint or handkerchief soaked in cold water on the wound, and tie it tightly with a handkerchief or triangular bandage.

3. Another method is to put a pad behind the knee, and, flexing the leg forcibly, tie the leg to the thigh, as indicated in the diagram.

IV. *The arteries of the foot* may get wounded either above or below; above by something falling on the foot, below by treading on a piece of glass, etc. What is to be done?

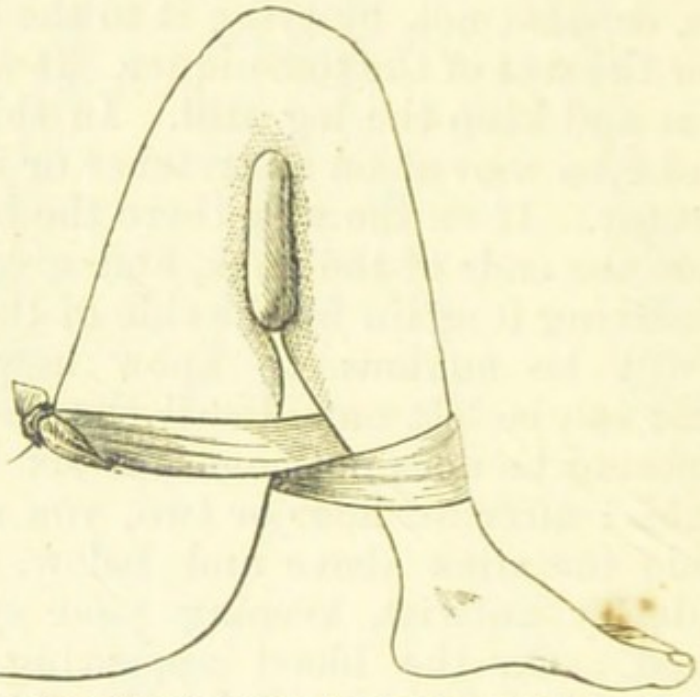

FIG. 11.—Stopping bleeding from the leg by a pad placed behind the knee-joint.

1. Get the boot and stocking off quickly—cutting both.

2. Place the thumb on the bleeding point. The tissues here are so dense and thin that direct pressure will be of avail.

3. Now do one or other of the following:—

(*a.*) Apply a pad (a conical-shaped one is best) on the wound, and tie it on tightly with a handkerchief or triangular bandage put on like a figure of eight round the ankle. If this be insufficient—

(*b.*) Place a pad, a couple of corks, one on the front, the other on the inside, of the ankle-joint, and tie tightly round with a handkerchief. (See the XX marked on Fig. 10, p. 40.) If this be insufficient—

(*c.*) Put a pad behind the knee, and double the leg on the thigh (see Fig. 11); or,

(*d.*) Put a pad and tourniquet on the artery in the middle of the thigh. (See Fig. 6, p. 36.)

So much, then, for the main arteries of the lower extremity.

It is now necessary to revert, and to follow the vessels spoken of as coming off from the arch of the aorta,—they are two arteries to the head and neck, the *carotids;* and two arteries to the upper extremity, the subclavians,—and to see what can be done to stop bleeding in the regions to which they go.

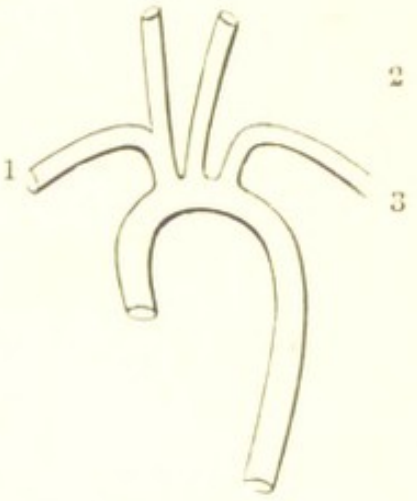

FIG. 12.—Arch of aorta giving off from left to right of diagram. 1. Innominate artery dividing into right subclavian and right common carotid. 2. The left common carotid. 3. The left subclavian artery.

In the first place, then—

The Arteries of the Upper Extremities. — Coming off as the diagram indicates, each of the arteries to the upper extremities, THE RIGHT AND LEFT SUBCLAVIAN, passes up to the root of the neck, lying immediately behind the collar-bone. To feel either vessel, and to ascertain its position, you may either bare your own neck, and standing in front of a looking-glass take a deep breath, when a hollow, "the bird's-nest," is seen to become apparent just above the clavicles, or you may get a friend to bare the neck, when the same thing may be seen. Into this hollow push the thumb or forefinger downwards against the first

rib, when the artery can be felt to pulsate. We shall see by-and-by that this is the means of compressing it. The subclavian artery passes from behind the collar-bone down to the armpit. The technical name for **the armpit** is the *axilla*, hence the artery, vein, etc., are called

THE AXILLARY.—When on a cold day you put your fingers into your armpits to warm them, and press your arms to your side, you can feel an artery

FIG. 13.—Compression of the artery behind the collar-bone to stop bleeding from the armpits.

beating against the back of your fingers—that is the axillary artery.

The axillary artery leaves the armpit and enters the inside of the arm, where it is called **the artery of the arm,** or

THE BRACHIAL.—The guide to this vessel is the inside seam of the coat or jacket. Catch hold of your own left coat or dress sleeve at the wrist with your left hand, placing your left forefinger upon the seam. Now look up the seam, and you will see that

it comes from the armpit along the inside of the arm, and finally on to the front of the elbow-joint. That is exactly the course of the artery, and your finger placed upon the seam anywhere will feel the artery beat. Supposing the coat is off, the general idea of the course of the artery is gathered from what has been said, but its actual course is found on the hollow along the inside of the biceps muscle, which forms the swelling and prominence in front of the arm. This vessel may be compressed by the

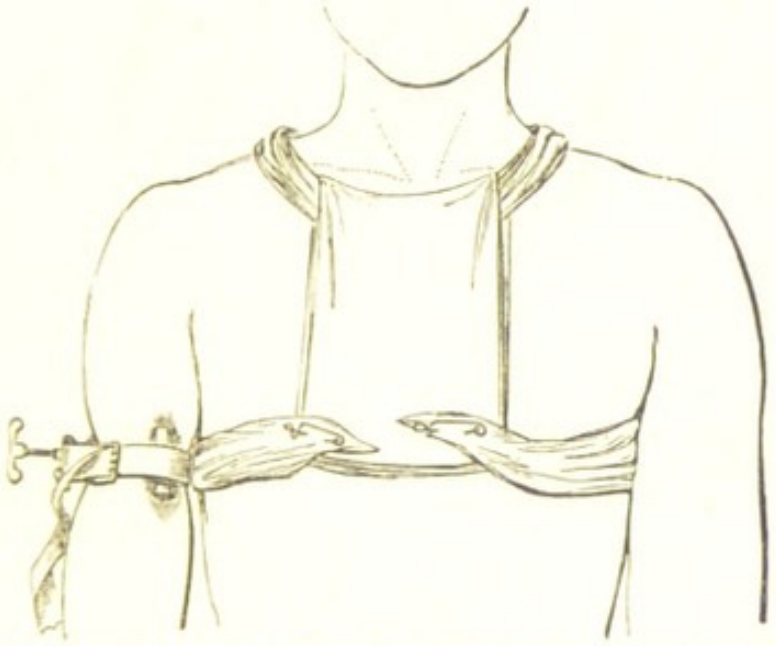

FIG. 14.—On the right arm is a Petit's tourniquet applied. On the chest are bandages applied to keep on a dressing or poultice.

fingers—digital compression—in the middle of the arm. (See Fig. 15.)

To compress the artery in the left arm. Stand behind the left arm, and pass the fingers of your right hand in front of the arm until the finger-points are well to the inside of the biceps muscle; then grasp the limb firmly. The artery will be felt beating, and if the forefinger of the left hand be applied to the pulse at the wrist (see next page) it will be felt that the pulsation ceases, or goes on, according as you tighten or relax the right hand, which grasps the arm and commands the artery. The

artery in the right side may be controlled in a like manner. Instead of passing the fingers in front, they may be passed behind the limb, and the artery

FIG. 15.—Compression of the artery in the arm by the fingers passing over the front of the arm.

FIG. 16.—Application of digital pressure to the artery in the arm, the fingers passing behind the arm.

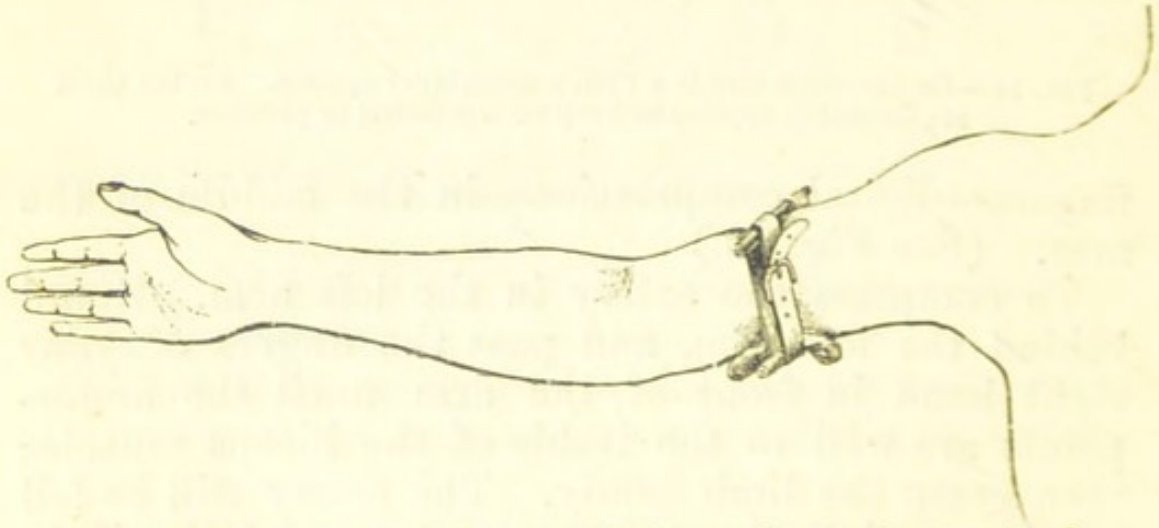

FIG. 17.—Compression of the artery in the arm by a pad—a couple of sticks tied together at their ends.

grasped from the back of the arm, as it were. This is the best plan in a very muscular arm.

The artery now passes from the front of the elbow

to **the forearm,** where it immediately divides into two vessels of nearly the same size. The vessels in the forearm, as in other parts, pass along the protected side of the limb so that both come to be in front. When any danger approaches, one naturally throws up the forearm to ward off the blow; were the blood-vessels on the back of the forearm the blow would endanger them, hence nature has placed them in front, where we have two vessels corresponding to the two bones. The bones are nearly of a size, hence they claim and baptize an artery each, —one the ULNAR artery, in front of the ulna; the other the RADIAL, in front of the radius. The vessels are about the size of goose-quills.

The outer artery, the radial, is the one in which the pulse is felt. THE PULSE is the beat of the artery felt at the pulse hollow of the wrist, which is placed one inch above the wrist and half an inch from its outside—that is, the thumb side of the forearm.

The arteries at the wrist behave differently in regard to the way they enter the hand. The one on the inner side, *i.e.* the little-finger side—*the ulnar*—passes on to the front of the wrist, and runs along the "line of life" at the ball of the thumb. The other, on the outside or thumb side—*the radial*—passes on to the outside, then on to the back of the wrist, and disappears deeply between the thumb and forefinger to reach the palm of the hand.

It is considered very dangerous to cut one's self between the thumb and forefinger; so it is, if the cut is deep enough, because the artery might be cut as it passes from the back of the hand to the palm of the hand.

In the palm of the hand the two arteries form *arches*—one immediately below the skin, the other deeply on the bones; and both arteries help to form each arch. From the arches branches are continued forwards along the sides of the fingers, and are thus

out of the way of danger and compression as much as possible.

We are now in a position to know *what to do should severe arterial bleeding take place anywhere in the upper limb.*

I. Supposing severe bleeding were to take place from a *wound in the hand*, say from one of the palmar arches—

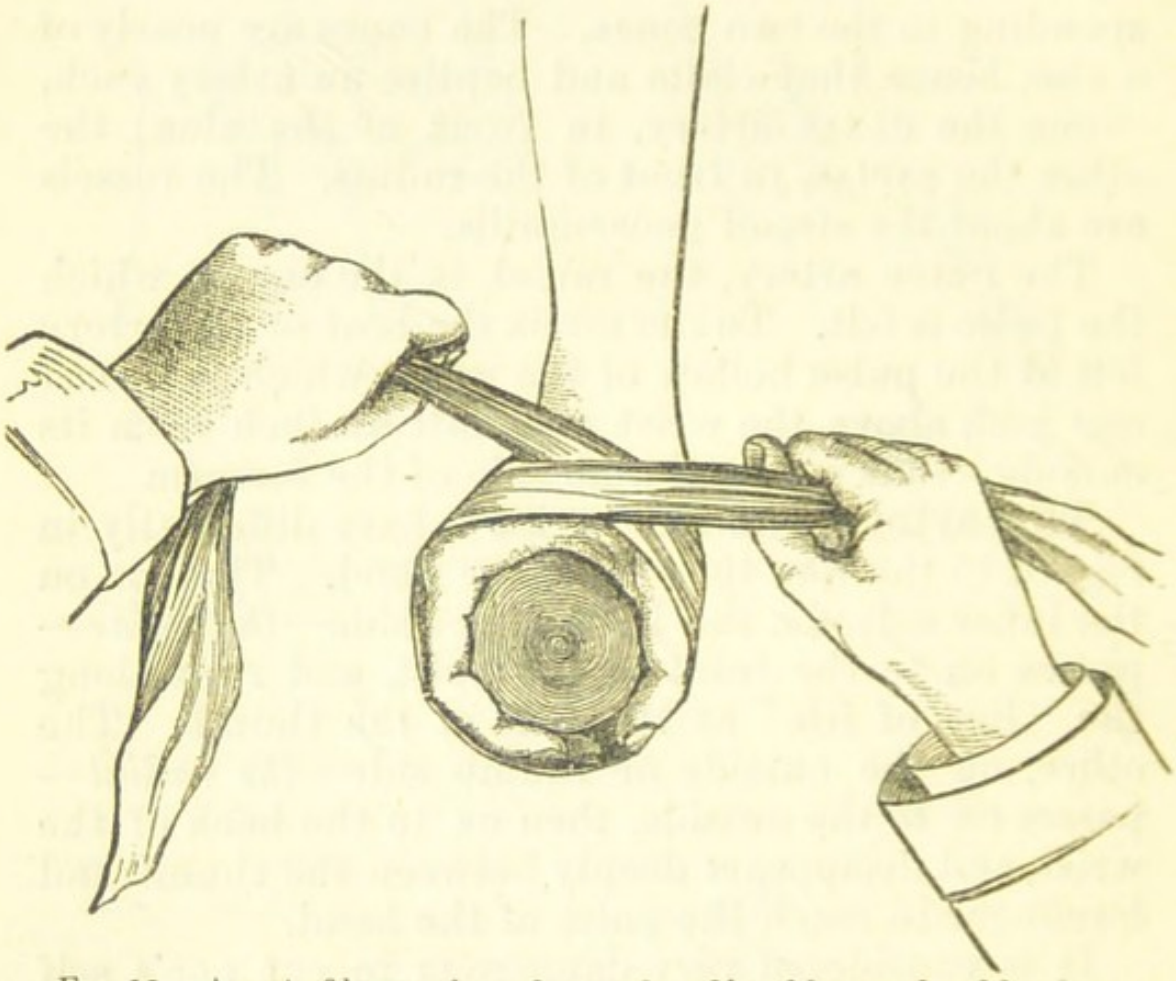

FIG. 18.—Arrest of hæmorrhage from palm of hand by a pad and bandage.

(*a.*) Apply the thumb on the bleeding point at once; if the doctor lives near, keep the thumb there till he comes. Should he live at a distance—

(*b.*) Apply a stout pad so as to fill the palm of the hand, and, doubling the fingers over the pad, tie the whole tightly with a handkerchief or triangular bandage. Apply a sling, and take the patient to the doctor.

Supposing this is not sufficient—

(*c.*) Take a cork, cut it lengthwise, and apply one

FIG. 19.—Compression of the arteries at the wrist—the radial and ulnar—by the thumb, to stop bleeding from the hand.

half on the thumb side of the wrist, the other on the little-finger side, at the spots indicated on Fig. 19. Lay the corks lengthwise to the wrist, and place them with their rounded surfaces on the skin. Fix the pads in position with a bandage. Apply a sling.

(*d.*) Another method is to put a pad on the front of the elbow, and double up the forearm on the arm, and tie the two together; then tie the limb to the side. (See Fig. 20.)

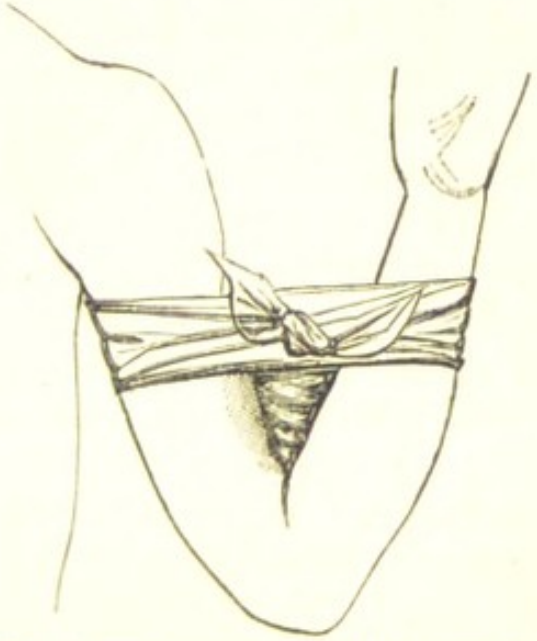

FIG. 20.—Compression of the artery at the bend of the elbow to stop bleeding from the forearm or hand.

(*e.*) Instead of using pads the arteries at the wrist may be compressed by the thumbs, as at Fig. 19. The thumbs are to be

placed one inch above the wrist and one inch apart.

(*f.*) An improvised tourniquet or digital compression may be applied to the artery in the arm. (See p. 36.)

II. *Arterial bleeding in the forearm* may be stopped by—

(*a.*) Doubling up the forearm on the pad (Fig. 20); or

(*b.*) Compressing the artery in the middle of the arm by a field or improvised tourniquet, or by the fingers.

III. *Arterial bleeding at the elbow or lower end of arm* may be stopped by compressing the artery in the middle of the arm by a field or improvised tourniquet, or by the fingers.

IV. *Arterial bleeding from the armpit* may be stopped by compressing the artery behind the collar-bone (see p. 44), by applying the thumb in the "bird's-nest" just above the collar-bone, and pressing down with all your might (Fig. 13, p. 44). The pressure is directed against the first rib. Instead of the thumb, a key wrapped in a fold of the handkerchief may be applied.

The only arteries that remain to be followed are the **carotids.** They arise as shown in Fig. 12, p. 43. Ascending, as the *common* carotid arteries, on either side of the windpipe, they reach the skull. Their pulsation or beat can easily be felt on one's self, by placing the fingers on either side the windpipe. Each artery divides into two—one, the *external* carotid, to supply the outer parts of the head, the larynx, tongue, face, nose, scalp, and back of head; the other, the *internal* carotid, to supply the parts inside the cranium, and chiefly the brain.

When wounds of the carotid arteries occur, as in cut throat, pressure is to be applied by the thumb

below the wound on that side of the windpipe on which the wound is. No tourniquet can be applied here; the thumb alone must be trusted to. (See Fig. 21.) After stopping the bleeding, the head is to be bent forwards towards the chest and fixed there by bandages and pillows, to prevent the wound being torn open by movement.

Almost any one of the branches of the external carotid may be wounded:—

FIG. 21.—Compression of common carotid artery to stop bleeding from wounds of the arteries higher up.

1. *Bleeding from the tongue* may generally be stopped by giving ice to suck, if it can be got; if it cannot, washing the mouth with cold water, loosening tight clothing about the neck, opening the windows and doors so as to get cold air to breathe, and causing the patient to breathe through the mouth.

If the wound is far back, it may be necessary to compress the carotid artery in the neck on one or both sides until the doctor comes.

2. *Bleeding from the lips* may be very severe; it may be stopped by compressing the lip between the forefinger inside the lip and the thumb outside, on one or both sides of the wound.

3. *Bleeding from the nose* may come from a fall or blow, or it may be the result of constitutional dis-

FIG. 22.—Bandage applied to keep the head forward and steady after wounds of the throat and neck.

turbance, and the sign of disease. From whatever cause, it must, when excessive, be stopped. A doctor should be sent for if the bleeding is very severe; but whilst he is being fetched, attempt some of the following restoratives:—Open the windows, and undo tight clothing about the neck. Do not let the patient hang the head over a basin, but place the patient on a chair or couch in a position

of repose; raise the arms, stretched to their full extent, above and rather behind the head. Apply a *cold* wet sponge, towel, or lump of ice to the back of the neck, turning down the collar of the coat, vest, and shirt to reach the proper spot, which is just at the top of the back, between the shoulders; a large key, or a bunch of keys, are the popular remedies, and they are as effectual as anything else, provided they are kept cold. Over the forehead, just at the root of the nose, a cold sponge, or a piece of ice in flannel, or an ice-bag, may be applied. If the bleeding still continue, syringe the nose with cold water; or a strong solution of alum and water or strong cold tea may stop it. If all these efforts are of no avail, pinch the nose just where the bones and the gristle (cartilage) join (that is, about half-way up the nose) between the finger and thumb, at the same time allowing air to enter through the lower part of the nostrils. If this does not stop the bleeding, and the doctor has not arrived, take a piece of handkerchief or soft rag of sufficient size, and, wrapping it up tightly, push it into the bleeding nostril.

It may be impossible by all these means to stop the bleeding, and it will require medical skill to plug the nostrils front and back.

4. *Bleeding from the face*, below the eyes, may be stopped by grasping the whole cheek as far out as the wound, with the finger inside the cheek and the thumb outside; or by applying pressure on the edge of the jaw, two fingers' breadths in front of the angle, with the finger laid lengthwise, because there the artery to the face comes over the jaw from the neck (Figs. 1 and 10). Instead of the finger, a long stout pad may be so tied on as to stop the bleeding. The bandage or scarf used must pass below the chin, then upwards to the top of the head, where the ends are crossed, not tied, but brought down below the

chin and tied there, pulling tightly—in fact, tight enough to stop the bleeding.

5. *Arterial bleeding from the front of the head, temple, top or back of the head*, may be stopped, when from a small wound, in this way:—Apply a pad, of about one inch in thickness, and in the form of a cone. Make the pad of pledgets of lint, folded tightly and laid one on the top of the other, a penny piece being folded up in the last pledget. The point of the cone is to be applied on the wound, and a bandage carried round tightly. The way to apply this bandage is represented in Fig. 23, where it is applied to keep a pad on a bleeding artery in the *temple*. First, the pad is placed on the wound; then a scarf or triangular bandage, folded narrowly, is placed with its centre on the opposite side of the head; the ends are next brought round and twisted once, twice, or thrice firmly and decidedly immediately over the pad; the ends are then either carried round the head (or one end passed over the top of the head, the other one beneath the chin), and tied on the opposite side, or where they happen to meet.

FIG. 23.—Stoppage of bleeding from the temple by a pad and twisted bandage.

The same method may be followed with bleeding at the *top of the head*, viz. a pad over the wounded vessel, a scarf or folded triangular bandage with its centre applied below the chin, the ends twisted on the top of the head over the pad, and brought down again and tied below the chin. The same principle may be followed with bleeding from the *forehead*. Apply a conical pad over the wound; fix it with a scarf or folded triangular bandage, applying the

centre of the bandage at the back of the head, bringing the ends forward and twisting them over the pad, and tying them at the back of the head. The same method may be adopted, but with exactly reverse steps, for the *back of the head.* Some prefer to make the twists of the compressing bandage, not over the pad, but on the opposite side of the head from the wound and pad.

Bleeding from Veins.—The veins which are most likely to give rise to dangerous bleeding are the veins of the legs, and these chiefly when they become varicose or dilated. Still it does occur that venous blood is lost in quantity in other parts of the body where veins coming near the surface are cut, as in the neck or at the bend of the elbow. Blood coming from a vein can be easily recognized—

1. By the dark colour; it is purple, or bluish-purple, or bluish-black in appearance.

2. The blood comes in a thick, black, uniform stream when a large vein is wounded, or simply wells up in a dark oozing flow when a smaller vein is wounded. There are no jets.

3. The blood comes from that end of the cut vein which is away from, or most distant from, the heart. In varicose veins, however, the blood comes in huge quantity from the end nearest the heart, as well as in smaller quantity from the end farthest away.

To stop bleeding from a vein—

1. Apply the thumb immediately on the bleeding point; moderate pressure will be sufficient to stop the flow of blood from even a large vein.

2. If it is in the limbs, a pad made of some hard substance is to be applied *on* the wound, and tightly fastened with a bandage, handkerchief, or scarf. If the wound is a large one, pressure might have to be applied, immediately *below* the wound, in the course of the vein, *i.e.* on the side of the wound distant from the heart. If it is a varicose vein, pressure *on*

the wound may suffice; but if it is a large wound opening up a varicose vein, pressure *above and below* the wound would be necessary. In all cases elevate the limb.

A vein bleeding in the neck must be stopped by the pressure of the thumb, until a doctor sees it. Pressure may be made directly on the bleeding point, or above it.

Capillary Hæmorrhage is the hæmorrhage which occurs when the skin is cut. The capillaries are everywhere, are in large numbers, are microscopic, and when even a moderate or small sized cut is made they bleed by hundreds. The bleeding from a capillary is recognized from the facts that—

1. The blood is red in colour. Arterial blood we saw to be scarlet, venous blood to be dark purple, but the blood from a capillary is red.

2. The blood comes from all parts of the cut surface; this is evidently what must occur, as the capillaries are everywhere.

3. The blood comes in a brisk, smart, free stream, different from the sluggish flow of venous blood on the one hand, and the jets of an artery on the other.

To stop capillary hæmorrhage many manipulations and remedies are employed:—

1. Compress the bleeding point with the thumb; you may keep it compressed, if your own finger is cut, for five or ten minutes. This may stop it altogether.

2. Instead of the finger, a pad of lint rolled up firmly may be applied and bandaged tightly to the wound.

3. Styptics (these are means of causing the blood to clot or coagulate) may be applied; they are:—

(*a.*) Cold, in the form of cold air, cold water, or ice. Waving the cut finger above the head may help to cause the blood to clot; cold water, although it seems at first to favour the flow of blood, aids in

stopping it; a piece of ice is invaluable, especially in internal hæmorrhages.

(*b.*) A piece of wool, a cobweb, a piece of tobacco-leaf, cold tea, etc., are all of them household remedies, and at the same time their action is capable of scientific explanation. The first two mentioned present a meshwork in which the blood is caught, and has an opportunity of coagulating. The last two contain specific substances which tend to cause blood to coagulate: tobacco-leaf contains nicotine and other substances which cause a painful nipping sensation in the wound; whilst tea contains tannin, especially when drawn for a long time, and is a strong styptic.

(*c.*) Iron drops. The perchloride of iron applied on a minute pledget of lint and pressed into the wound is a pretty sure and safe styptic.

(*d.*) If the wound is small but pretty deep, and capillary hæmorrhage active as after a leech-bite, and the doctor is a long way off, or you are on board ship, summon up courage to pass an ordinary sewing needle through the skin, transfixing the wound; over this apply a thread (reel cotton will do) figure-of-eight method, which, when pulled tightly, will stop the bleeding.

WOUNDS.

I. *Incised* wounds are such as are produced by a cut with a knife. Treatment: Wash the part, and stop the bleeding by pressure or cold. If the wound gapes, pull the edges together neatly with ordinary diachylon plaster. To heal the wound and keep it clean, apply cold-water dressings or Friar's balsam.

II. *Contused* wounds are bruises or contusions of a part with a tear of the skin, as are inflicted by a blow with a club. Treatment: Do not bring the edges together by strapping plaster, but soak a piece

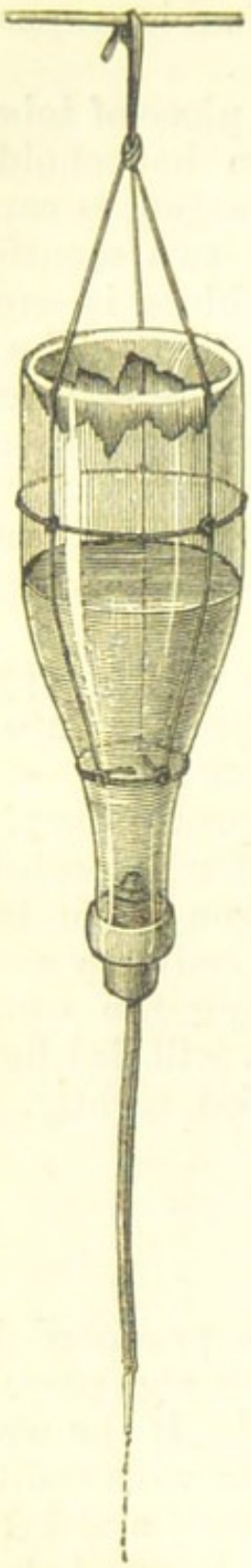

FIG. 24.—Champagne bottle, inverted, broken at the bottom and suspended, with quill passed through the cork and a piece of tubing fitted to the quill.

of lint or soft rag in a spirit lotion made of one-third spirits of wine and two-thirds water, or whisky one-third and two-thirds water, and lay it lightly on the wounded part. Change or wet the dressing frequently. For *severe bruises*, use either flannels wrung out of hot water, or apply cold lotions,—either simple water, or whisky-and-water, or arnica lotion. Use whichever is most agreeable to the patient. If the bruise is near a joint put on a splint so as to prevent movement of the joint.

III. *Lacerated* wounds are such as are produced by a piece being torn off the body, as happens in accidents from machinery. Treatment: There is usually no bleeding to stop. Wrap the part up in flannels wrung out of hot water, and treat the patient for shock (see p. 119).

IV. *Punctured* wounds or stabs are made by knives, bayonets, swords, lancets, stakes, and the like. They are, of all forms of wounds, the most dangerous, although at the moment they may give rise to no very apparent local mischief. Treatment: Should bleeding occur arrest it in the usual way. In all cases cover

the part with such dressings as that recommended for contused wounds.

V. *Poisoned* wounds are discussed hereafter.

No plan of treatment—especially for extensive bruises or lacerated wounds—that has been devised, is more simple and rational than the plentiful application of cold water. Cold-water rags applied to a part soon, however, become warm, and instead of staying the passage of blood to the part, encourage it. Therefore it is necessary to be continually re-applying the rags, thereby disturbing the injured parts and causing pain. To avoid this, various plans have been hit upon—squeezing cold water from a sponge and allowing it to fall on the rag, or some such plan. This, however, demands constant attention, and is apt to be irregular. To avoid this, water may be allowed to drip upon a piece of rag laid over the injured surface. The water may be allowed to drip from a bottle suspended as in the diagram.

Instead of plain water, Condy's fluid or carbolic acid solution, etc., may be placed in the bottle. The fluid is taken up by the threads, and by the syphon action set up when the threads are thoroughly wet, a drip is started on to the cloth.

If it is desired to hasten the drip, pull out the threads a little; if it is desired to slow the drip, push the threads further into the bottle; and if it is desired to stop the drip, lay the lower end of the thread over the upper part of the bottle.

When it is intended to apply cold without moisture, it may be done either by placing pounded ice in an ice-bag, *i.e.* a bladder or piece of indiarubber, or by an apparatus which allows of the circulation of ice-cold water, as when water circulates through india-rubber tubing (Fig. 25). This should only be done, however, under medical advice and superintendence.

Fig. 26 represents a crushed and bruised hand, wrist, and forearm submitted to treatment by irriga-

tion. Over the injured parts a wet rag is laid; half a band-box is laid as a protector astride the part, so

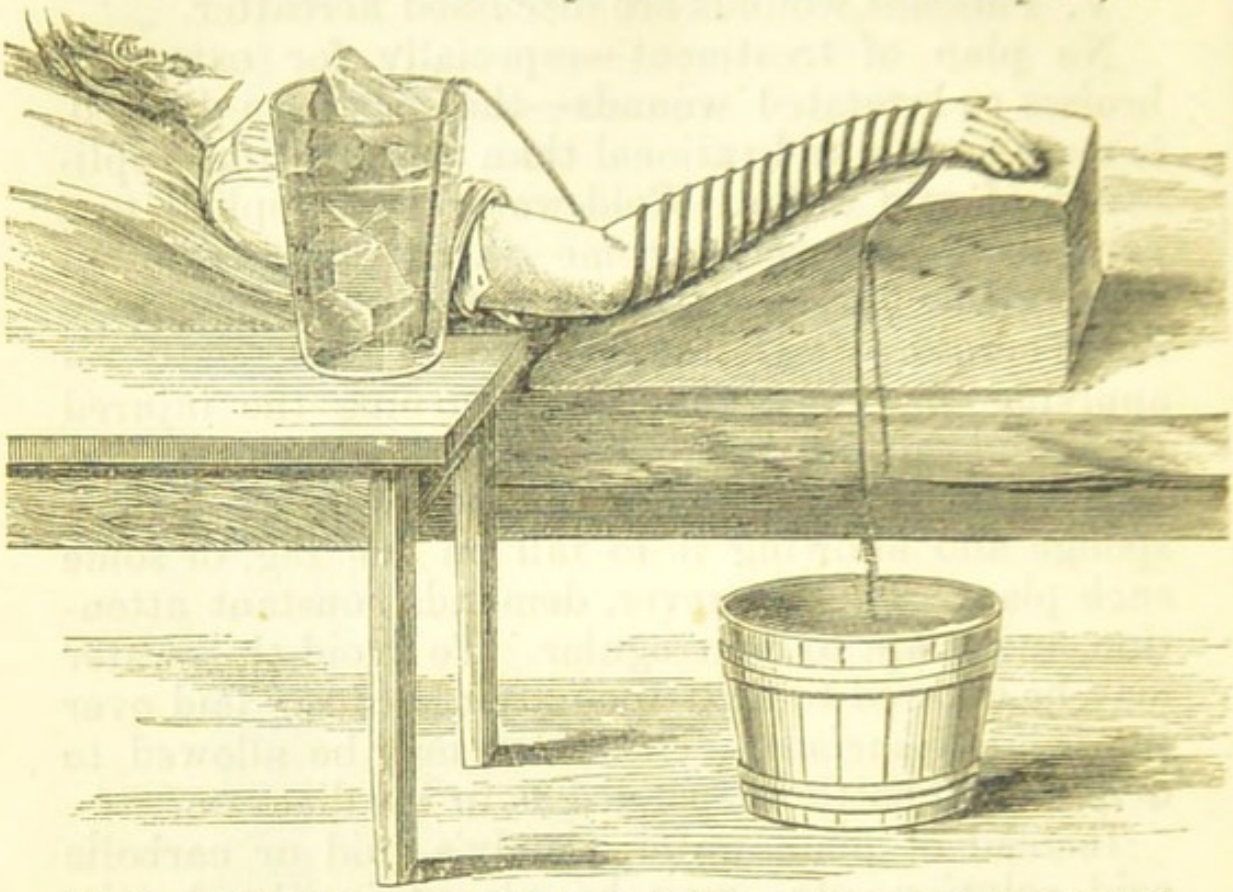

FIG. 25.—Indiarubber tubing coiled round a limb, with water passing through.

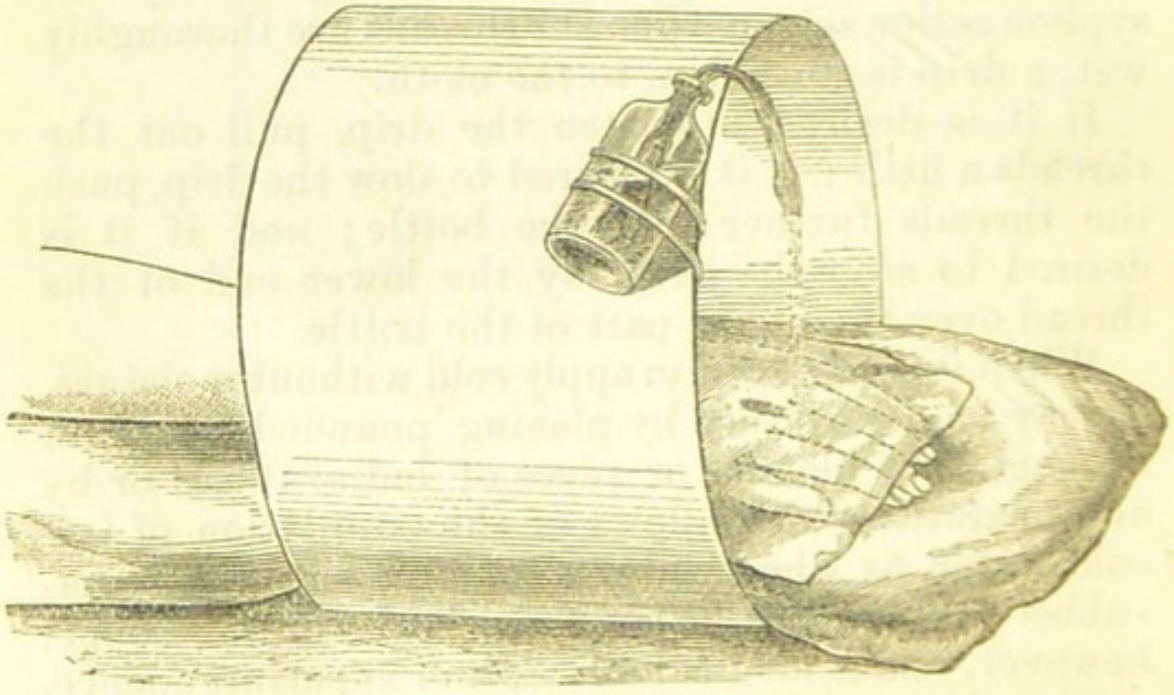

FIG. 26.—Irrigation apparatus.

as to support the bed-clothes, etc., etc. A bottle—

say, a two, four, or six ounce phial—is tied or fixed by strips of plaster to the edge of the band-box, a hole having been made to allow of the plaster or string encircling the phial. The bottle is filled with water, and a few threads of linen, cotton, flax, or a piece of tow, teased lint, or spirit-lamp wick is placed in the bottle, one end in the water, the other hanging out.

THE TRIANGULAR BANDAGE.

In our fathers' days pocket-handkerchiefs were of such ample size that triangular bandages were always at hand. Since, however, handkerchiefs have become reduced in size, and are made of finer materials, they are well-nigh useless as slings or bandages. To replace them for these purposes the triangular bandage has been devised. It is nothing new; our fathers carried them in their pockets, and our mothers on their shoulders in the form of a small shawl, but we have to resort to a special device to supply the place of such materials, as fashion has condemned the use of such articles of apparel.

To make triangular bandages for one's self, secure some yards of unbleached calico; take a piece of this, one yard square—that is, thirty-six inches every side—and cutting from one corner to the opposite corner you will get two triangles. If it is for a big man, you will require the piece to be thirty-eight, forty, or even forty-two inches square.

The named parts of the bandage are seen in Fig. 27: the *apex*, A; the *base*, B; the *ends*, E.

To fold the bandage for application, you should lay the bandage on the table or floor and stand opposite the base; then seizing the apex, A, with the right hand, bring it down to the centre of the base, B; fold again towards yourself, doubling it—this is a *broad-folded bandage;* fold again in the same way—it is now a *narrow-folded bandage.*

To fold the Bandage for Stowage.—Lay it on a flat surface, and bring one end, E, over the other, *i.e.* fold the bandage down the centre. Bring the point A down to B, the centre of the base, and the ends, E, E, to the same spot, thus forming a square. Fold in half, when an oblong figure is obtained, fold the oblong into a square, and, doubling again, it assumes the form of a small packet about six inches by three; a pin inserted will keep it from unfolding and also be ready for use when the bandage is applied.

The methods of application are sufficiently indicated by the diagrams, so that a detailed description of each is useless. As an example of one. TO APPLY

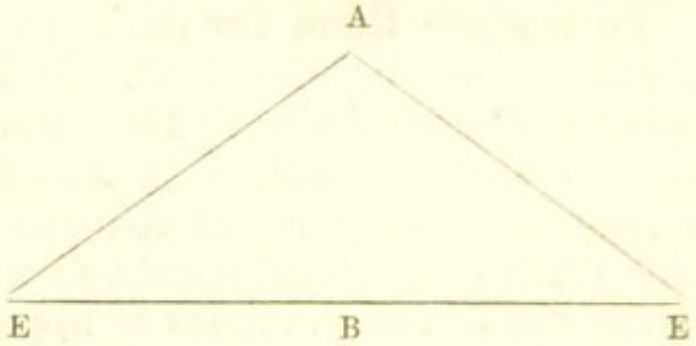

FIG. 27.—Triangular bandage. A, apex; B, base; E, E, ends.

A SLING (p. 64): Stand in front of the person to be bandaged. Place the apex beneath the elbow of the injured limb, and lay the upper end across the top of the opposite shoulder. Lay the forearm across the chest, bring the lower end upwards over the forearm, and tie the ends by a reef-knot on the top of the shoulder. The knot should be on the same side of the neck as the injury and pretty well down towards the front of the shoulder, not in the middle of the back of the neck, so that it will not cause inconvenience by pressing the seam of the coat, or the button of the collar on to the prominent piece of the backbone beneath. The apex projecting behind the elbow is now to be brought forwards and pinned over the arm.

The only points to be sure of are, that the hand does not drop below the level of the forearm, and

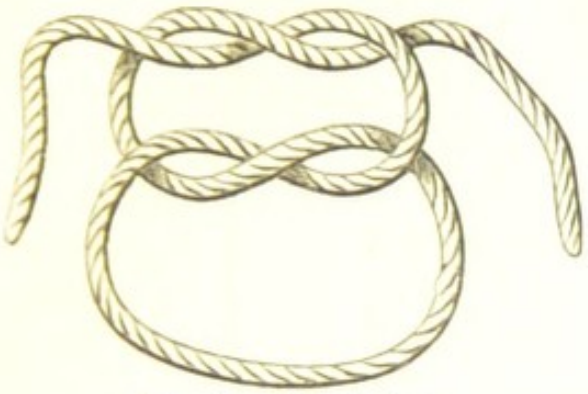

FIG. 28.—A reef-knot.

FIG. 29.—First half of surgeon's knot.

FIG. 30.—Appearance of bandage when tied in a reef-knot.

that the knot is properly placed so as not to hurt. The knot should be a sailor's or reef knot, not a

FIG. 31.—Triangular bandage applied to scalp.

FIG. 32.—Bandage applied to keep a dressing or pad on the eye.

granny (see Figs. 28 and 30). This is to prevent slipping.

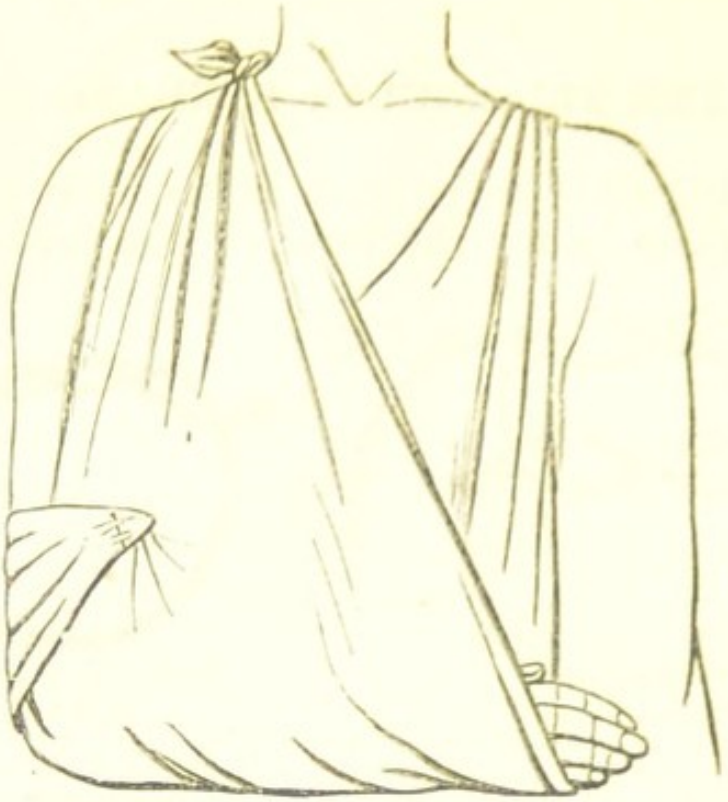

FIG. 33.—Larger arm-sling.

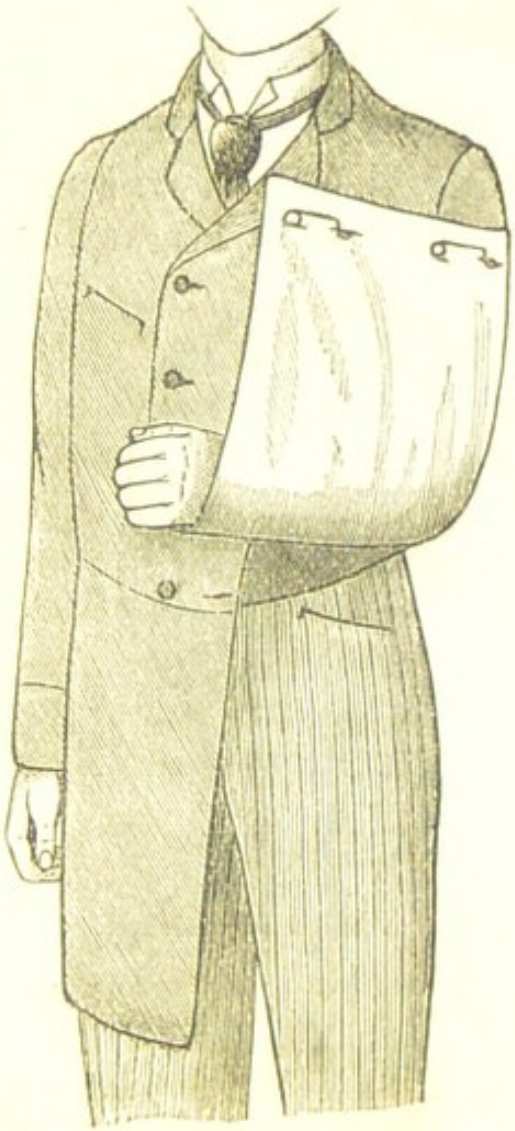

FIG. 34.—Tail of coat used as an improvised sling.

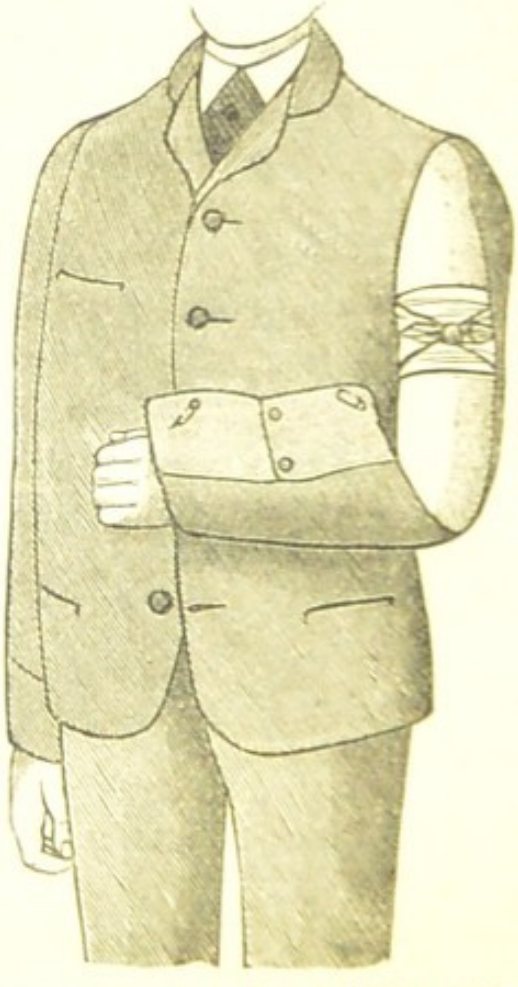

FIG. 35.—Sleeve of coat slit up at the seam, and pinned to the breast of the coat as a sling.

FIG. 36.—Four-tailed bandage for back of head. Triangular bandage applied to chest, showing position of knots.

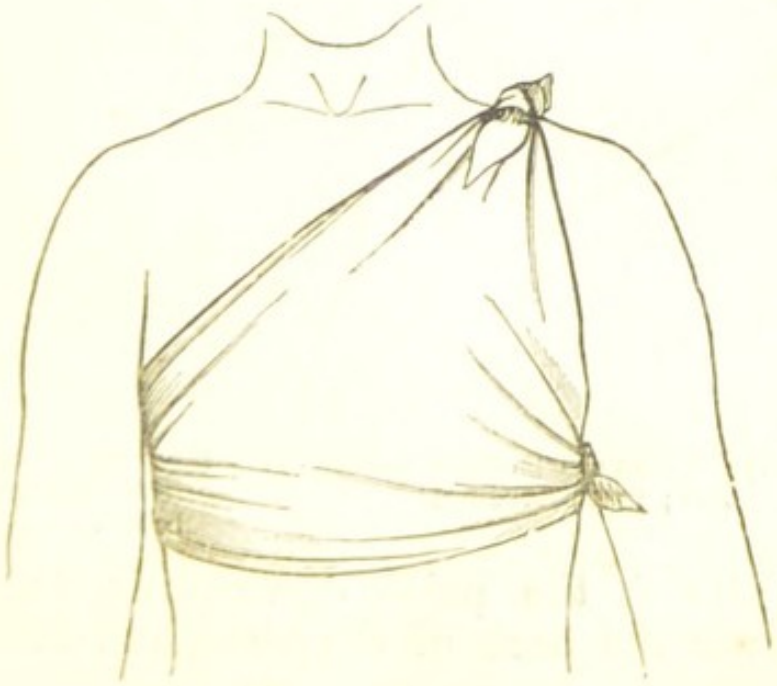

FIG. 37.—Triangular bandage applied to the chest.

To the Chest.—Place the middle of an opened-out bandage on the chest, point over one shoulder; carry the ends under the arms, round the chest, and knot at the opposite side, leaving one end longer than the other; draw the point over the shoulder, and tie it to the longer of the two ends.

To the Top of the Head.—Lay the middle of the opened-out bandage on the top of the head so that the lower border may lie crossways before the forehead, point to hang down over the back of the neck; now taking up the ends, one in each hand, carry them backwards, cross them at the back of the head, bring them forwards again, and tie with a reef-knot on the forehead;

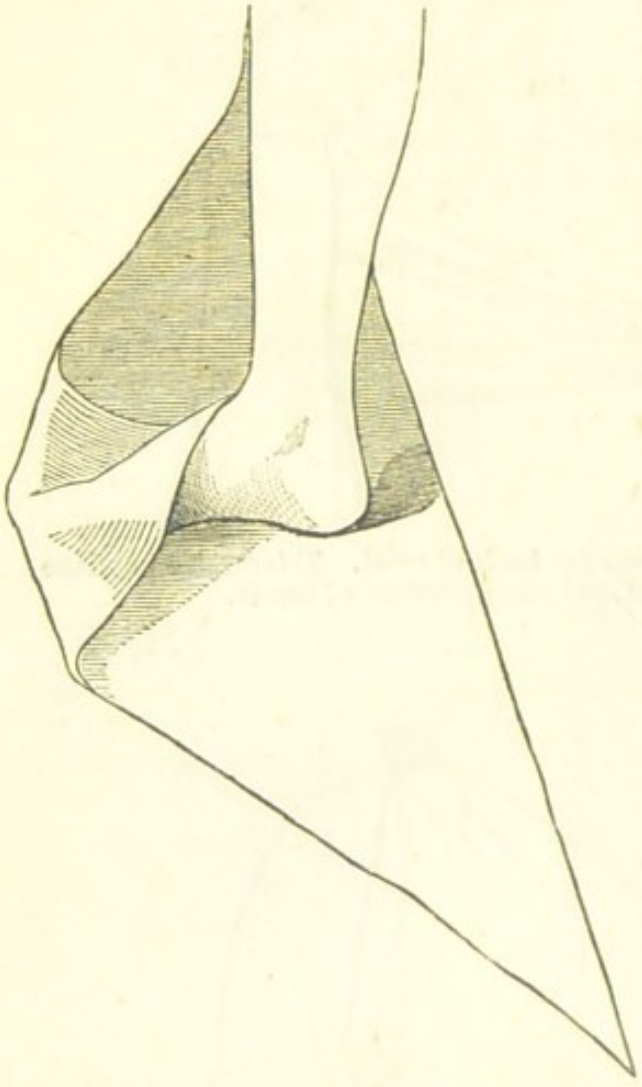

FIG. 38.—Application of triangular bandage to foot; first procedure.

FIG. 39.—Completion of foot bandage, with knot below.

finally, stretch the point downwards, turn it up neatly over the back of the head, and fasten with a pin.

To the Hip.—Make a waist-belt of a narrow-

folded bandage, pass it round the waist, and knot in front. Lay an opened-out bandage on the injured

FIG. 40.—Four-tailed bandage applied for broken lower jaw. Bandage applied to keep a dressing on the shoulder, with smaller arm-sling. Bandage for hand. Bandage for hip.

hip, point in the direction of the waist-belt, pass the ends round the upper part of the thigh, and knot in front, then pass the point under the waist-belt and pin.

To the Foot.—Open out a bandage, place the injured foot in the centre of it, toes directed towards the point; now draw the point upwards over the instep, carry the ends forwards round the ankle, cross them over the instep, pass them downwards, and knot on the sole of the foot.

To the Shoulder.—Lay the centre of a bandage on the point of the shoulder, point spread out on the side of the neck, and lower border across the middle of the arm; now carry the ends round the arm, cross them, and tie on the outer surface of the arm. With a second bandage apply the smaller arm-sling (see next paragraph); having done so, draw the point of the first bandage under the arm-sling, fold it back on itself, and fasten with a pin.

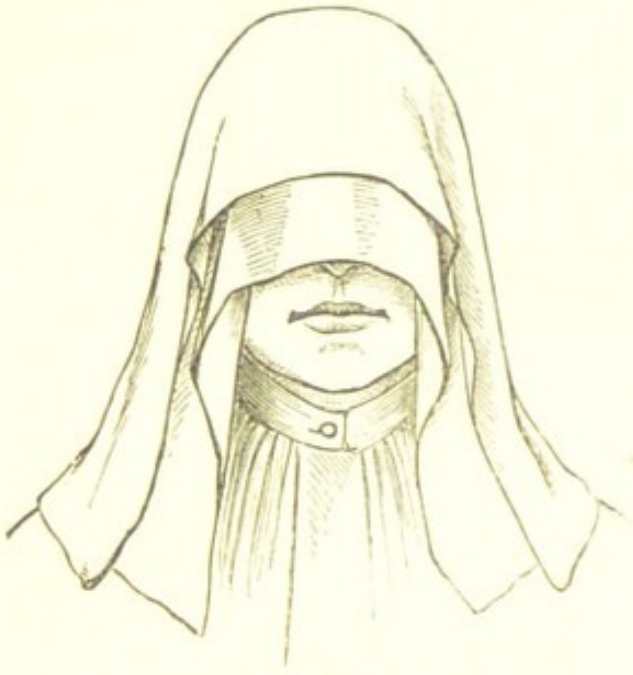

FIG. 41.—First application of quadrangular bandage.

To make the Smaller Arm-Sling. — Take a broad-folded bandage, throw one end over the shoulder at sound side, carry it round the back of the neck so as to be visible at the opposite side, then bend the arm carefully, and carry the wrist across the middle of the bandage as it hangs down in front of the chest. This done, bring up the hanging-down end and knot the two ends together at the side of the neck.

A form of bandage, **the quadrangular,** is here figured. The plates (Figs. 41–43), taken from

FIG. 42.—Outside ends tied in a knot below chin.

Esmarch, explain themselves. To apply the bandage, take an ordinary neckerchief, as used for wrapping round the throat in cold weather when out of doors; fold it so that the borders are as figured in Fig. 41, where the difference between the edges of the bandage corresponds to the length of the person's nose. Apply the bandage as in the diagram, the side of the bandage falling on the shoulders. Take now the two outer corners, pass them below the inner ends, and tie below the chin. The outer ends are then carried back behind

FIG. 43.—Inner ends of bandage tied up at the back of the neck.

the neck and tied, the fold falling over the nose, being at the same time turned back so as to expose the face. This bandage is very useful in everyday life in travelling by the railway, when the hat or bonnet has to be laid aside, and this bandage may be readily applied to one's self when sleep is contemplated.

The *four-tailed bandage* consists of a piece of calico slit at the two ends, thereby giving four ends. It is

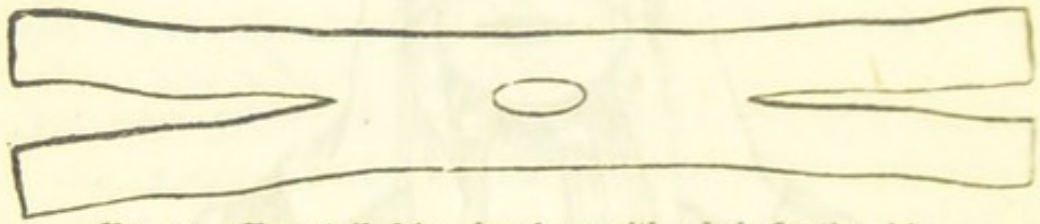

FIG. 44.—Four-tailed jaw bandage with a hole for the chin.

used for the chin, to keep a dressing thereon, or for a broken jaw; it is also used to keep dressings on the top, back, or front of the head, knee, etc.

For the jaw it ought to be three inches wide and three feet long. The ends are split down to within two inches of the centre, and a hole for the chin is cut therein. To apply it, place the chin in

FIG. 45.—Two handkerchiefs used in place of the four-tailed.

FIG. 46. — Four-tailed bandage applied to the top of the head.

FIG. 47. — Four-tailed bandage applied to the back of the head.

the central hole and carry the two upper ends behind the neck and tie them there, and the two lower ends upwards to the top of the head and there secure

them. The four ends are then to be tied together behind the head.

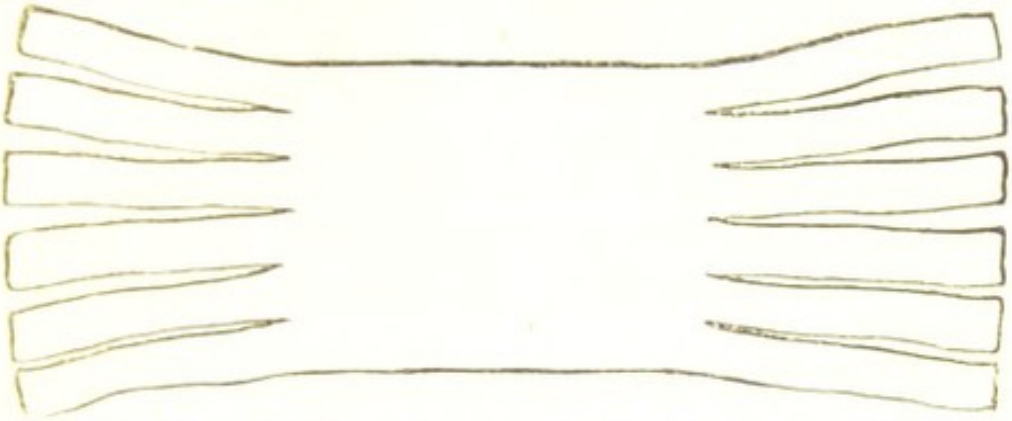

FIG. 48.—Many-tailed bandage as applied to the chest or abdomen.

For the head or knee the bandage must be wider. For the head, six or eight inches wide and

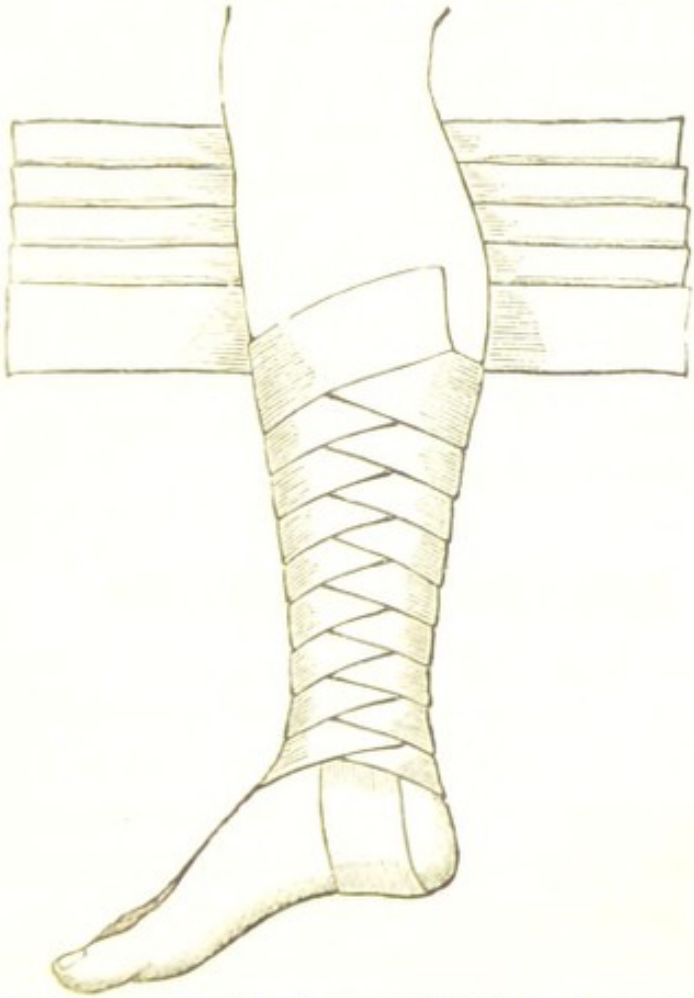

FIG. 49.—Many-tailed bandage applied to the leg and ankle.

two feet long; for the knee, eight or ten inches wide and three feet long. For the head, see Figs. 46 and 47.

For the knee, lay the centre of the four-tailed bandage in front of the patella, cross the ends behind, and bringing them to the front, tie the two upper ones above and the two lower below the patella.

The *many-tailed bandage* of Scultetus is applied to any part which it is advisable to disturb as little as possible. Where movement gives great pain, or may amount to danger, this bandage is peculiarly applicable.

To make the bandage for a limb use the bandage widths generally employed, viz. three and a half inches for the leg, and two and a quarter inches for the arm.

Lay a strip of bandage, the same length as the part or limb to be covered, on a board or flat surface. Lay other strips, each six inches longer than the part to be bandaged, across the perpendicular strip, with the centre of the cross-strip on the perpendicular. Each cross-strip is made to overlap its predecessor by one-third of its breadth. The pieces of bandage so arranged are sewn together and to the perpendicular strip, and applied as appears in Fig. 49. The ends of the last strip, after the bandage is applied, are secured by a pin.

ROLLER BANDAGES.

The roller bandage is usually made of unbleached calico, which is torn or cut into breadths and lengths requisite for the various parts of the body.

In addition to calico, bandages are made of flannel, linen, gauze, elastic cloth, mosquito netting, crinoline, jute, indiarubber, etc.

Each possesses some advantage. Thus flannel secures warmth; linen, lightness and neat appearance; gauze, extreme lightness and a certain amount of transparency; elastic cloth, equable pressure. Bandages may be coloured—mahogany, dark green,

blue, red, etc. That any advantage is derived therefrom is doubtful, except perhaps in the case of red flannel, which when applied to a rheumatic joint is declared by the wearer to give more relief than plain flannel. This may be probably explained by the staining on the skin indicating some ill-understood action.

Bandages are cut, torn, or specially woven of the following lengths and breadths:

Part.	Breadth.	Length.
Single finger	¾ inch	1½ yard.
Arm	2¼ inches	6 yards.
Leg	3½ inches	8 yards.
Body	6 inches	6 to 10 yards.

For children of, say, five years of age, a bandage for the arm should be one and a quarter inches, and for the leg two inches.

All calico should be washed before being cut into bandages.

Bandages have a less fringed edge when they are cut than when torn. Bandages once washed have always a fringed edge.

To roll a bandage various plans are adopted:—

(*a.*) Rolling machines of various kinds are in use. These are only needful in hospital practice.

(*b.*) If a bandage is much creased, a good plan is to pass the ends over and through between the bars on the back of a chair, and to get some one to hold or roll it.

(*c.*) If no one is near to help, press the bandage to the floor with the foot, and roll down towards the floor, until, on getting low down, let another piece slip from below the foot and roll it likewise.

The named parts of a bandage are—

(*a.*) The free or initial end.

(*b.*) The rolled up or terminal end.

(*c.*) The body of the bandage is the part between the ends.

d. The roller bandage is said to have two surfaces, the outer and inner.

It is needless to say that there is no difference in appearance or texture between the ends and surfaces, they being identical.

Bandages are "single-head" rollers when rolled from one end only—this is the usual bandage; "double-headed" rollers, when rolled from both ends. Various names are given to the different forms, as we shall find as we go on.

It is essential to know first the uses of bandages.

Firstly, they are used as a means of retaining dressings in their places.

Secondly, they are applied to obtain pressure effects, as in stopping bleeding, or for varicose veins.

Thirdly, they are used for both of these purposes conjointly, viz. to retain dressings and at the same time to exercise gentle and equable pressure.

Rules to be observed in the Application of Limb Bandages:—

1. Stand in front of the limb to be bandaged, and place the limb in the exact position in which it is to be kept after the application of the bandage; thus for the upper limb the hand is to be placed midway between pronation and supination, and the elbow bent.

2. Never commence by taking a straight circular turn round the wrist or ankle before applying the bandage to the hand or foot. Never take a circular turn *straight* round a limb at any time.

3. Commence the bandage by placing *the outside of the bandage to the inside of the limb*, and passing first across the front of the limb, thus secure the exemplification of the law, that the limbs should be bandaged from within outwards. Thus standing in front of the limb, it follows that when, say, the right arm is to be bandaged, the surgeon holds the

bandage in his left hand and applies it passing from his own right to his own left side; but when the left arm is being bandaged, the surgeon holds the bandage in his right hand, and unrolls it from his own left to his own right side.

4. Always bandage from below upwards, except in the case of the trunk.

The **Circular** bandage consists of turns being made round a part such as the head. The turns exactly overlap each other.

The **Spiral** bandage is applicable to the trunk, or to a part of a limb which varies but little in size, as at the wrist; each turn ascends gradually, leaving one-third of the width of the previous turn exposed.

The **Oblique** bandage is only used to retain dressings on a limb, as for instance a hot fomentation. By this method the edges of the bandage do not overlap, hence it is useless and hurtful to place on the skin except to retain loose dressings.

The **Figure-of-Eight** form of bandage is used principally when it is necessary to carry a bandage across a joint. Thus at the elbow, which is usually bent at a right angle, it is the only method of crossing the joint. First a turn is made immediately above the joint, then crossed in front, and carried below the joint around the forearm. The process is repeated usually thrice, or until the parts are sufficiently supported. The figure-of-eight form of bandage can also be used to cover the entire limb with what is called *the recurrent spiral*. The bandage must be very narrow, not more than two and a half inches wide for the lower limb, and one and a half inches wide for the upper. Instead of making a reverse, the bandage is continued around the limb, one turn being carried obliquely upwards and the next obliquely downwards, and the two made to cross over the fleshy part of the limb. The disadvantage of this form is that the lower border of the recurrent

turn cannot be made to lie smoothly to the limb, especially if the limb is fully developed. It is an excellent plan whereby to fix splints on a limb. The figure-of-eight bandage used to be employed in fractured clavicle, but is now obsolete for that purpose. It may, however, be applied to keep the shoulders back, or to keep a dressing on the inter-scapular region. Lay the initial end of the bandage on the back (or fix it around the upper arm of one side), then carry the bandage beneath one armpit, around the shoulder, and down to the back to embrace the opposite shoulder in like manner. The bandage may be made to gradually ascend or descend, as required. Both armpits are to be protected from excoriations by pads of cotton-wool placed beneath the bandage.

By bringing the crossings of the bandage to the front of the chest instead of behind the shoulders, a figure-of-eight bandage may be made to retain dressings on the front of the upper sternal region.

The **Spica** (spike of barley) bandage resembles a figure-of-eight. It is applied to the groin, shoulder, etc.; one loop, the small one, being made to embrace either the arm or thigh; and the other the upper part of the thorax or lower part of the abdomen. The bandage is employed to retain dressings and to keep up pressure upon a part.

To apply a spica for the shoulder select an ordinary leg bandage, three and a half inches wide, and ten yards long. Stand opposite the shoulder to be bandaged. Apply the outside of the bandage to the inside of the upper third of the arm, say the left, and carry the bandage across the front of the arm, and around the limb in an ordinary circular turn. Ascend, now, by reverse spiral turns until the shoulder is reached; when, a little cotton-wool having been placed in both axillæ, the bandage is carried behind the shoulder, down the back, towards the opposite,

i.e. the right, armpit and across the front of the chest, well up towards the top of the sternum, so as not to interfere with breathing. The bandage is now carried across the shoulder, forming a neat crossing, and in a line with the reverses upon the bandage on the arm, and passed below the right shoulder, from behind forwards, to again ascend in front, and be ready to once more encircle the body. Three or four such turns are taken, each being carried higher and higher, until the side of the neck is reached.

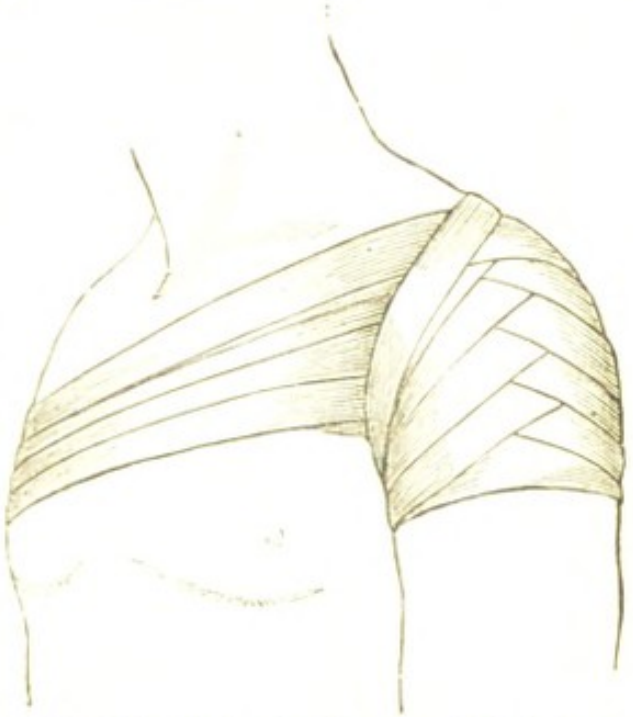

FIG. 50.—Spica bandage applied to the shoulder.

The spica bandage for the shoulder may be, by a slight modification, applied to keep a dressing tightly in the axilla, thus:—

First take the usual reverse spiral turns round the upper arm; then, instead of going over the outside of the shoulder, carry the bandage under the armpit and encircle the body, passing beneath the opposite armpit, as directed for the spica bandage for the outside of the shoulder.

To apply a spica to the groin, use an ordinary leg bandage of the width and length indicated for the shoulder. Commence by a circular turn round the upper fourth of the thigh on the side of the affected groin—say, the *left*. Then apply the bandage in the usual way by reverses, until the groin is reached, when the bandage is carried round the body, first on the left side between the iliac crest

and the great trochanter, then round the back and round the right hip on the same level as indicated upon the left. Then bringing the bandage across to the left groin above the pubes, carry it around the left thigh, passing first to the outside, then round the back of the thigh to the inside and over the groin, when the bandage is made once more to encircle the body. Each turn goes higher than its predecessor, namely, one-third of the bandage width. In this way, by three or four turns, the dressing or pad is retained on the groin or inguinal ring.

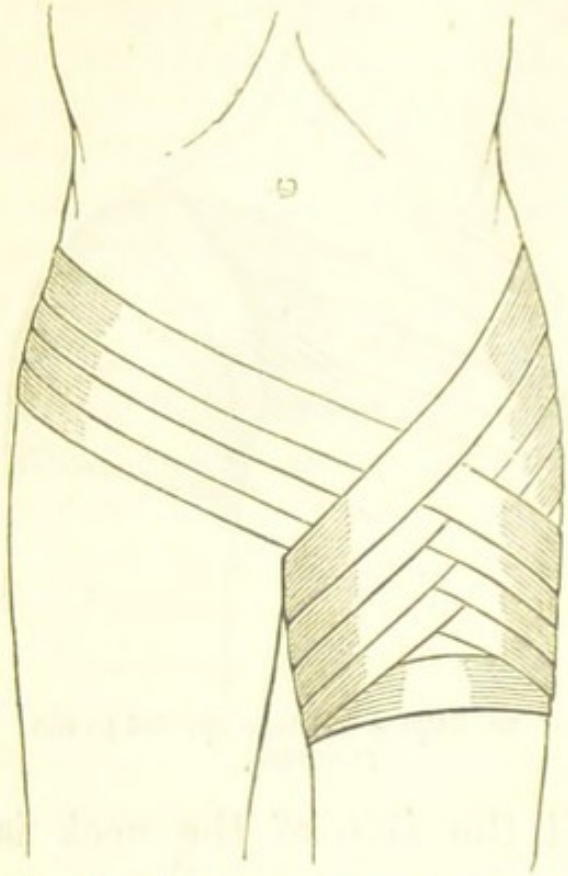

FIG. 51.—Spica bandage applied to the groin.

The **Reverse Spiral** bandage is, of all forms of bandaging, the one which requires most care in application. It is the most troublesome to learn, but it is the form one is most frequently called upon to apply.

It is employed to cover any part of the limb where the circumference increases as the bandage is carried higher up, and the manipulation of reversing is necessary to allow the bandage to follow the varying size. *A reverse is performed thus*:— Suppose the right forearm is being bandaged, the surgeon, standing in front with the bandage in his left hand, and supporting the limb in his right, makes two or three spiral turns around the forearm, just above the wrist. The fact of the increased

circumference of the forearm will soon become apparent from the bandage not lying smoothly, when a reverse is made as follows:—Place the thumb of the right hand—that is, the disengaged hand—on the upper border of the bandage, and unrolling three inches of the bandage beyond that point, allow it to become slack and fall over directly towards the surgeon, his left hand coming from the position of supination to that of pronation. Now pull the bandage tight before raising the thumb, and, finally carrying it circumferentially around the outside of the limb, and changing it first to the right and then to the left hand, perform the same manipula-

FIG. 52.—Showing how to commence the bandage for the hand.

FIG. 53. — Showing completion of figure-of-eight bandage applied to the hand.

tion again and again, until in fact the circumference of the limb diminishes towards the elbow. Every succeeding turn, in this, as in the circular method, must overlap two-thirds of that previously applied, *i.e.* one-third of each turn must be exposed. By this plan the bandage is applied threefold to every part.

To bandage special parts by a combination of these just described, namely, figure-of-eight, circular, and reverse spiral, proceed as follows:—

To apply a roller bandage *to the hand, wrist, forearm, elbow, and arm*, commence—following the rules in regard to position and method of holding the bandage—by placing the outside of the bandage

over the back of the metacarpal bone of the thumb, and roll first obliquely round the back of the hand. Take next one turn round the fingers, leaving the tips free, and then make what is called a figure-of-eight around the wrist and hand. This is repeated two, three, or four times, when a few spiral turns are made around the lower end of the forearm, until in fact the muscular prominence of the forearm will not allow of the bandage lying evenly. The bandage must then be applied as a reverse spiral, so as thereby to fit the forearm exactly. The roller is now continued in this reverse spiral manner,

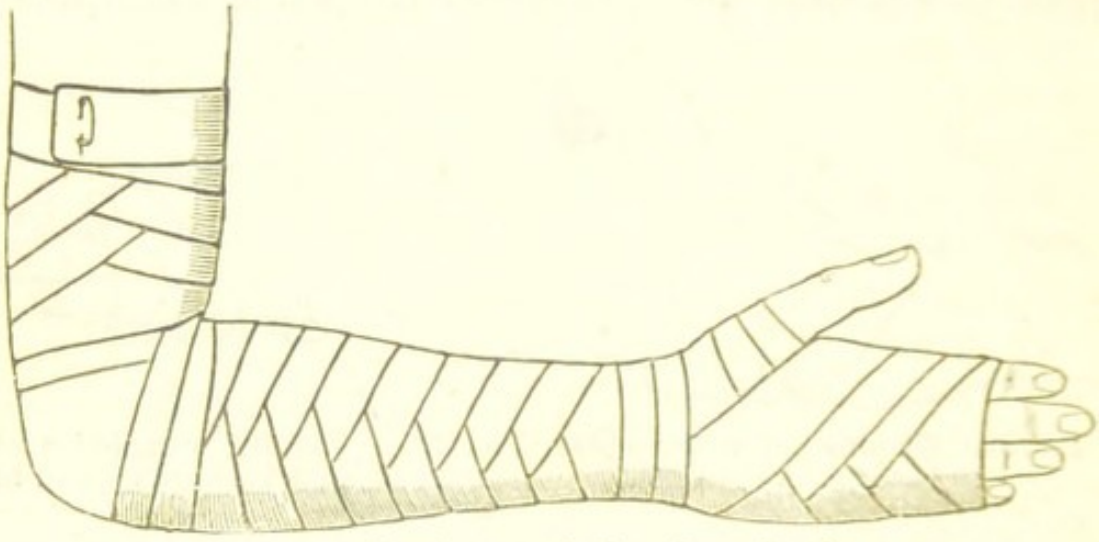

FIG. 54.—Showing completion of arm bandage.

until the bulging of the limb begins to diminish at the elbow. The elbow is now bent, and a figure-of-eight is made over it; the point of the elbow, unless injured, being left free. Above the elbow, a circular turn or two is made, and if it is necessary to go higher, the reverse spiral is continued up to the armpit. The bandage should now be secured with a safety-pin, or sewn with a needle and thread, or, in the absence of any of these, the bandage may be torn up for eight or ten inches, and the ends, knotted at their base, are tied around the limb. The chief danger of this bandage lies at the elbow, where if the bandage is applied with the limb in

the straight position, and the elbow afterwards flexed, compression of the veins, leading to blueness of the nails, coldness of the fingers, then swelling and it may be œdema and gangrene, not only of the fingers, but of any part or parts of the limb below the elbow, will result.

Finger Bandages.—The *continuous finger* bandage is a bandage employed to enclose the fingers individually. It is used to prevent œdema when splints or dressings are applied to the forearm; in fact, it should always be applied before any other bandage is put on higher up. In case of burn or scald of the fingers it is also of great service.

The bandage required should be three-quarters, or still better two-thirds, of an inch in width, and four yards long.

Commence by a turn round the wrist, leaving six inches of the initial end free, and carry the bandage over the back of the hand to the inner side of the little finger. With a single turn round the finger reach the level of the nail, and then proceed to bandage the finger from the nail to the root by circular turns. Reaching the root of the finger at the outer side (*i.e.* the thumb side), advance down the back of the hand, then around the wrist along the back of the hand to the ring-finger, repeating the manœuvre until all are covered. The nail is left bare, so that the condition of the circulation may be accurately observed. Notice also the bandage comes wholly over the back of the hand, not the palm, as œdematous swelling can take place only on the back.

To *bandage one finger*, use a bandage three-quarters of an inch broad, and one and a half feet long. Commence by a turn round the wrist, leaving a free end, whereby it may be readily tied at the finish, then up the back of the hand to the ailing finger, and by a spiral turn or two, rapidly reach the point. Holding

up now the finger-tip, carry the bandage backwards and forwards in loops over it, first in the centre, then on either side, fixing the loop front and back meantime by the finger and thumb. When the point is so covered, a circular turn over the loops will fix them all, and then the bandage is to be carried up the finger to the root, crossed on the back of the hand, carried round the wrist, and fastened off.

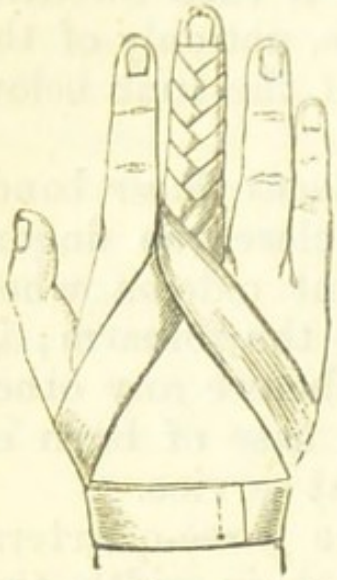

FIG. 55.—Figure-of-eight bandage applied to the finger.

FIG. 56.—Spica bandage applied to the thumb.

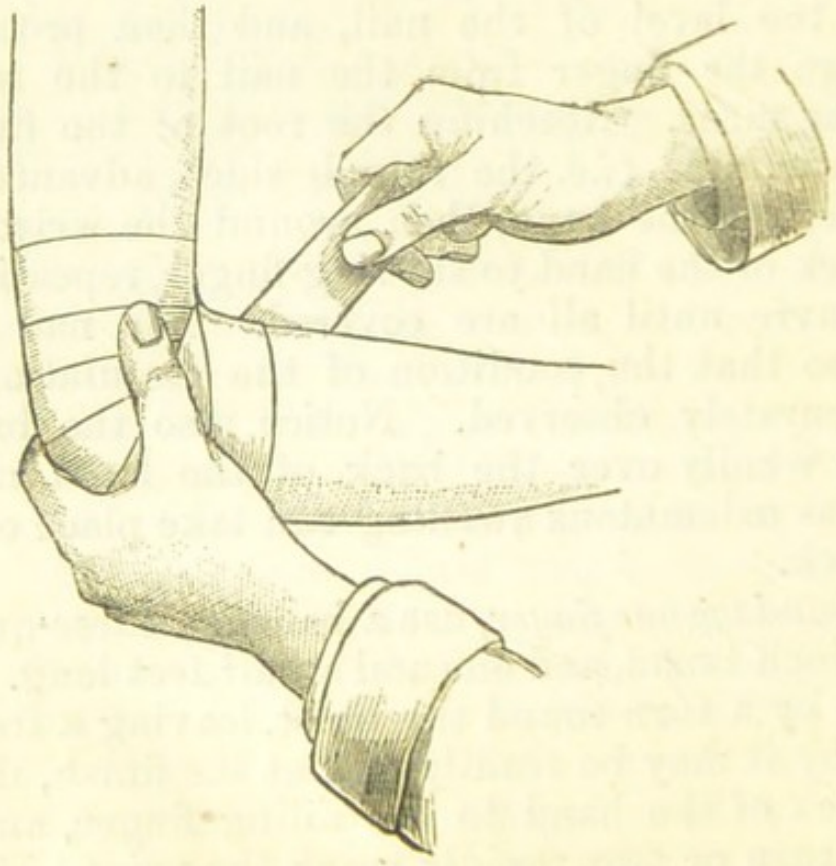

FIG. 57.—Bandage to cover the elbow-tip.

It is best to carry both ends over the back of the band, as thereby the finger is kept up from the others and out of the way.

A Bandage to cover the Elbow-Tip.—Commence by taking a turn straight over the elbow, then a turn below, a second above, and so by a figure-of-eight the elbow and the parts adjacent are covered. This

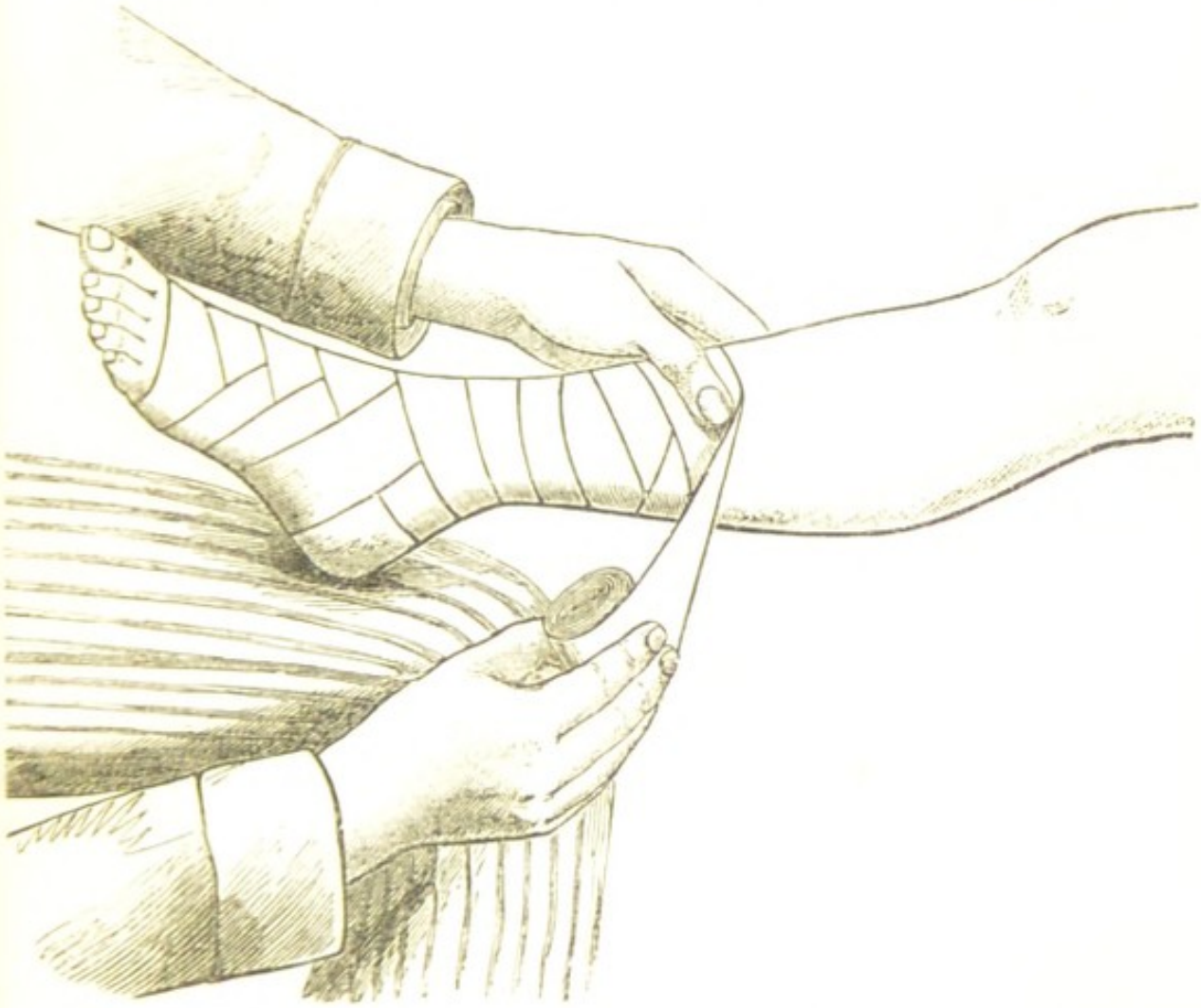

FIG. 58.—Bandaging foot, ankle, and leg—applying the reverse spiral to the left leg.

may be done *de novo*, or applied in the course of applying a bandage to the upper limb in the ordinary way.

Bandages applied to the Lower Limb.—Never commence applying a bandage round and round the ankle as a starting-point, otherwise the foot, and toes more especially will swell up and become

painful. The bandage used for an adult is that recommended above, viz., three and a half inches wide and six to eight yards long. Wash the limb first. Should the patient not be in bed, place two chairs opposite each other at a convenient distance apart, the patient sitting on one chair, the surgeon on the other. If it is the patient's *right* limb which

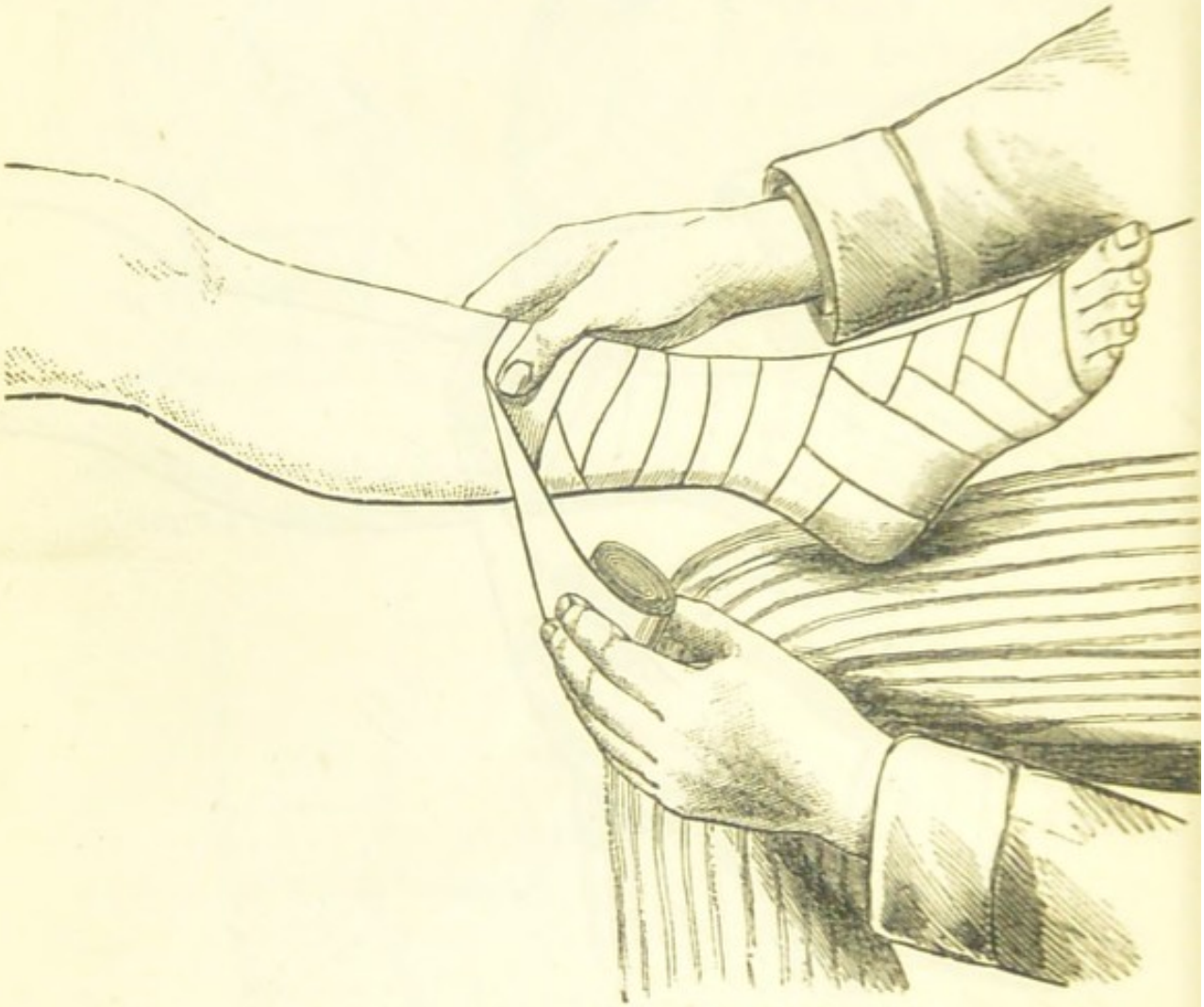

FIG. 59.—Applying reverse spiral to the right leg.

requires bandaging, the surgeon places a towel on his left knee and then places the patient's right heel over the towel on the tip of his left knee. Make the patient lie back in the chair so as to gain a perfectly easy position, so that the muscles of the leg may be relaxed. Place the foot at a right angle to the leg. The surgeon, holding the bandage in his left hand,

lays the outside of the bandage across the inside of the ankle, and, carrying the bandage across the dorsum of the foot, gains the outer side. A circular turn is now taken round the roots of the toes. Reverse spirals are made over the metatarsal bones, the reverses being opposite the middle of the dorsal

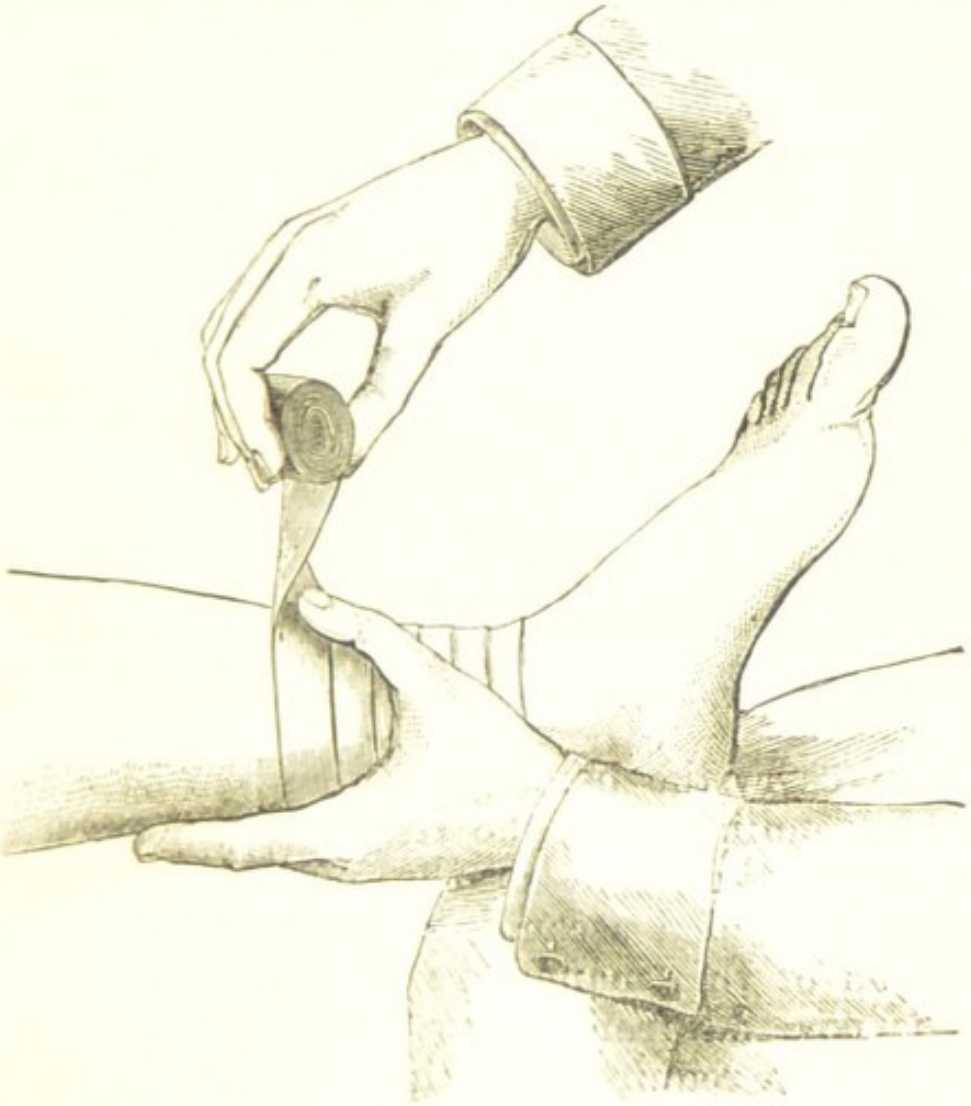

FIG. 60.—Showing how the reverse ought *not* to be done, namely, over the front of the shin.

region. Approaching the tarsus, the bandage is then carried behind the ankle, passing round from the outside about one and a quarter inches above the heel. Across the dorsum the bandage is again carried, and made to encircle first the foot and then the ankle in a figure-of-eight fashion. Two reverses are usually all that are required over the metatarsus,

and two turns of the figure-of-eight round the ankle. Three spiral turns are then carried around the ankle, and an ordinary reverse spiral carried up the leg. The spot where the reverses are to be made must be at least two and a half inches to the outer side of the anterior border of the tibia. As the knee-joint is approached, spiral turns must be reverted to. The knee-joint itself is covered by a figure-of-eight, thus: carry the bandage across the patella from within, out, and below upwards. Encircle the thigh by a circular turn passing behind

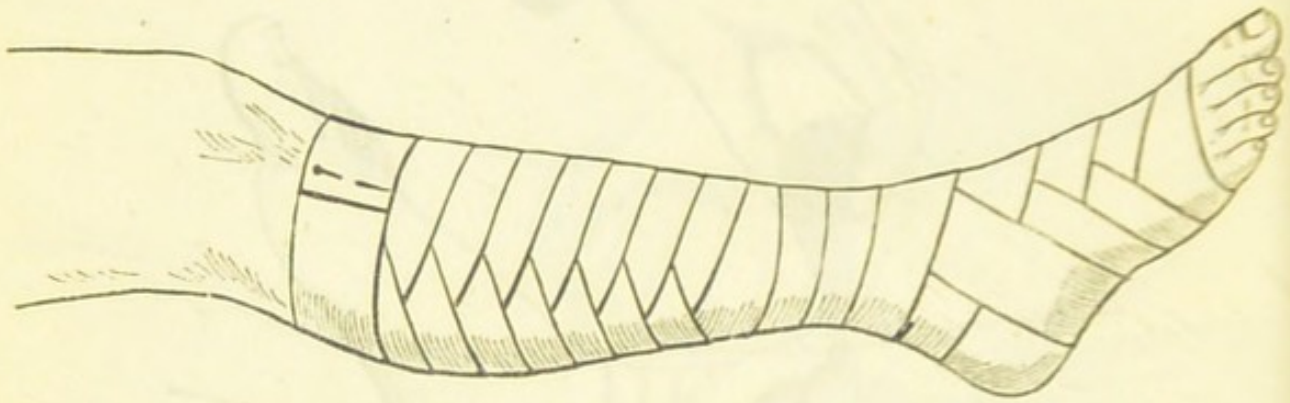

FIG. 61.—Showing completion of leg bandage.

the ham, carry the bandage behind the ham again, then, descending from the region of the inner condyle across the front of the patella, overlap the previously applied ascending piece of bandage. A repetition of this manœuvre is continued until the knee is covered from below upwards. A reverse spiral will be required for the thigh, to be carried as high as the groin if required, over which the bandage may be applied in the form of a spica (see Fig. 51).

A *toe* is bandaged like a finger (see Fig. 55), the fixed point being taken from around the foot behind the toes. According as it is desired to keep the toe up or down, so is the bandage carried along the dorsal or plantar aspects of the foot.

To *bandage the heel*, commence in the same way as for the elbow (see Fig. 57).

Bandages for the Head.—The DOUBLE-HEADED ROLLER may be made by pinning or sewing two roller bandages together, or by rolling a bandage from both ends, the centre being marked by a pin. See that the ends are rolled with the same surface outwards. When two bandages are used to make the double-headed roller, it is more convenient to have one bandage two inches wide, the other one and a

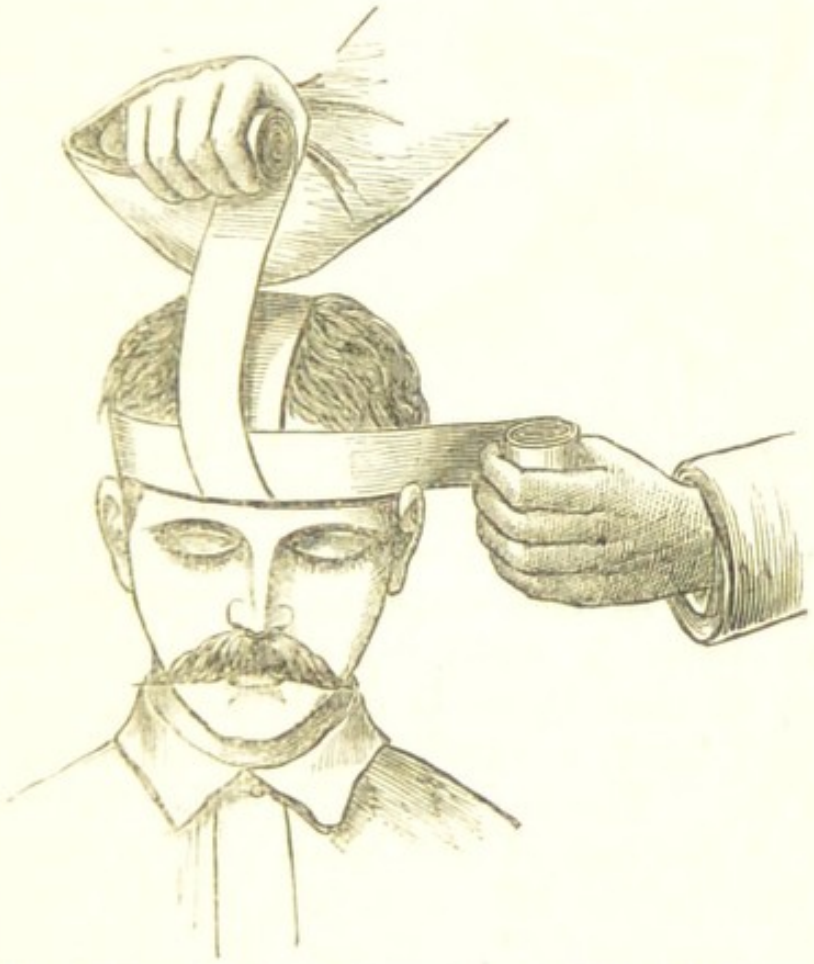

FIG. 62.—Showing commencement of capelline bandage.

half inches. The larger-sized head is carried round and round the head, the smaller is made to traverse the head from front to back. When one bandage is used it is to be two inches in width. Each head of the bandage ought to be at least six yards long. The bandage is employed to retain dressings on the scalp; it is especially useful in the case of delirious patients and for eczema of the scalp.

To apply the "CAPELLINE" or "RECURRENT HEAD" bandage, seat the patient on a low chair; the surgeon with a rolled end in each hand stands behind, and placing the middle of the bandage against the centre of the forehead, carries the rollers one on each side, above the ears and below and behind the occiput. The roller ends are there crossed, and one, the upper, continued straight round the head; the other, the under, brought forwards over the centre of the top of the head. In front the circular turn around the head is made to cross the other just above the nose, as in the diagram, by which means the vertical turn is fixed. Behind the same plan obtains, so that there is established a focal point, front and back, towards which the bandage passes to and fro. The vertical fold, after traversing the centre of the top of the head, passes alternately a little first to the left and then to the right of the centrally applied fold. Notice that the rolled ends must be changed from one hand to the other at the back of the head.

FIG. 63.—Showing completion of capelline bandage.

Bandage for the Mammary Gland.—Use an ordinary leg bandage eight to ten yards long. To bandage the *left* breast, lay the outside of the roller bandage three inches below the diseased breast, and carry the bandage round the body, passing at first toward the sound or left side, and as the initial end is crossed the bandage is thereby fixed. The bandage is again carried round the body, beneath

the sound left breast, until it appears beneath the diseased (right) breast, when it is made to ascend between the breasts over the opposite (left) shoulder and down the back, and onwards beneath the right armpit. Round the body it is now conducted once more, until appearing beneath the diseased breast it is again passed over the opposite shoulder as before. These turns are repeated again and again, each spiral turn round the body, and each oblique turn beneath the diseased breast, being made to advance higher and higher, presenting a sort of cup for the breast to rest in.

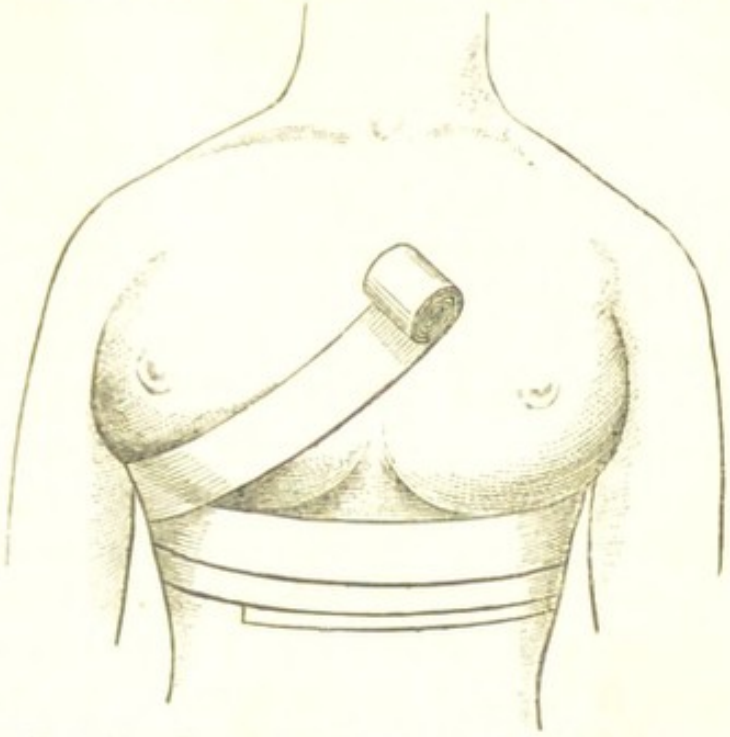

FIG. 64.—Showing commencement of bandage for mamma.

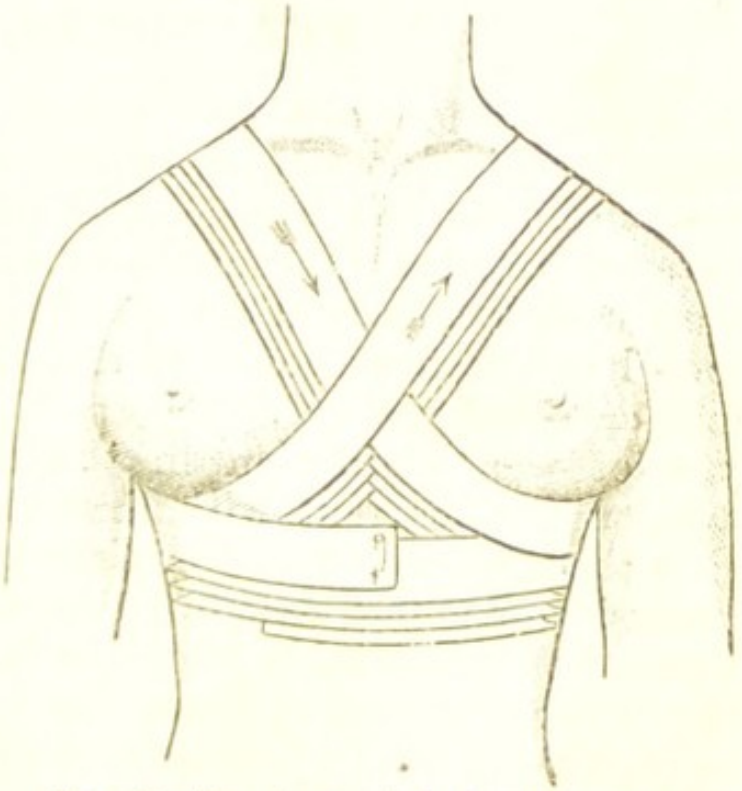

FIG. 65.—Showing method of application to both mammæ.

To support both mammæ begin as before, passing from right to left below the mamma and

around the body; after supporting the right breast in the same way as before, carry the bandage over the left shoulder down the back, round below the right mamma, across the front of the body below the left mamma, and then up the back across the right shoulder, down over the front of the chest below the left breast, and onwards round the back. The bandage is now carried round the body and the right breast, and is supported by another turn as before. The turns are continued alternately over the right and left breasts, the right being supported from below upwards, the left from above downwards in succession. The breast, say the left, may also be supported by an *oblique* bandage, the roller being carried beneath the diseased breast up over the opposite shoulder, down the back and below the left armpit to pass upwards over the chest again beneath the left breast.

FRACTURES.

Broken bones are occurrences of an everyday experience in the streets, mines, on board ship, and even in house and home. The regulation of traffic in our crowded thoroughfares has done much to stop such accidents in our streets; and since policemen have been stationed at the crossings of streets and crowded places, any hospital surgeon will tell you of the diminution in the number of street accidents concurrent with that change. On board ship their frequency is diminished from the lessened necessity of going aloft in modern times. Still the number of preventable fractures is immense. But it is not our province to teach the policeman his duty in regulating traffic, but to relieve pain and suffering when the accident has occurred.

Bones are broken in many ways, but amongst the legion of causes, it is possible to classify them under

two heads: *Direct* fractures, as when a cart-wheel goes across the leg and breaks the bone or bones at the part where it crossed; *Indirect* fractures, as when, lighting on the hands, in trying to save one's self when falling from a height, the collar-bone is broken.

A variety to be mentioned, also, is when bones break by the force of *the action of muscles*, as when the knee-cap is broken in attempting to jump, or on missing a step on the stair. Now, when a fracture has occurred, no power on earth can by immediate treatment join the bones together at once; but by immediate action and treatment on the part of the bystanders or friends, a fracture which is simple at first may become in unskilled hands a much more dangerous accident, whereas in skilled hands it may be prevented from becoming worse. That is all that it is necessary for you to know, viz. *how to prevent a broken bone giving rise to more serious trouble*, it may be loss of limb or loss of life.

Of course a doctor cannot be at the patient's side immediately—that is, in half a minute—however close he live, and it may be hours before a medical man can reach the patient. It matters not whether it be five minutes or hours; it is the duty of every humane person to know what to do during these five minutes, because all the damage may be done, and generally is done, within that time.

To understand the preventable occurrences that may follow on a bone being broken, it is necessary to know the different kinds of fractures:—

1. A *simple* fracture is one in which a bone is simply broken into two pieces; no joint is injured, no vessel torn, nothing is injured except the bone or bones and the immediate surroundings.

2. A *comminuted* fracture is one in which the bone is broken into several pieces—smashed, in fact. The injury is also in this case confined to the bone.

3. A *complicated* fracture is a broken bone complicated by an injury to the surrounding structures. In the case of the limb-bones it may be an artery, vein, or nerve that is torn, or a joint that is opened; in the case of the ribs the lungs may be torn, in the case of the pelvis it may be the bladder, and in the case of the cranium it will be the brain which sustains the injury.

4. A *compound* fracture is one in which there is a broken bone compounded with an injury to the skin. This differs from all the previously mentioned fractures, as in it the skin is torn and the air communicates with the ends of the bone.

It is the complicated and compound fractures which are preventable, as the general cause of their occurrence is from careless movement on the part of kind but ignorant bystanders or friends. The willing friend may, by his proffered help and kindness, be the means of sacrificing limb or life through ignorance. A simple fracture may be so unskilfully handled that it may become complicated or compound, involving weeks longer of confinement to bed, not to speak of the dangers to limb or life that ensue from tearing the main artery or vein of a limb, or sending the end of the bone through the skin.

How can you tell when a bone is broken? To illustrate this we shall imagine the thigh-bone broken about its middle. As there is only one bone in the thigh, we shall therefore have the full effect of a broken limb-bone made evident.

You can tell the thigh-bone is broken from the following signs and symptoms :—

1. The patient will have fallen down and be unable to rise.

2. The broken limb will be motionless.

3. You may see the mark on the skin or clothing where the cab-wheel ran over the patient.

4. You will observe that the foot is in some

unnatural position, being flat upon its outside, or in some position it could not be in unless the bone were broken.

5. The limb of the broken side will be shorter than its fellow, as seen by looking at the feet.

6. Could you see or feel the seat of the fracture you could both see and feel that there is a swelling at the seat of the fracture, caused by the broken ends of the bone overriding each other.

7. The patient can refer you to the broken spot by the pain felt there.

8. When you get your hand on the part, and should the patient move the limb, you may feel grating or *crepitus* of a nature peculiar to fracture. Crepitation is caused by the rough ends of the bones moving one against another.

9. The patient may tell you of a snap or crack felt at the time of the accident.

In the case of a broken thigh-bone all of these signs and symptoms may be made out, but in the case of other bones only a few such may be present. Thus in the case of fracture of one leg-bone, there would not be so much shortening, and the foot might be only slightly misplaced; again, the cause might be an indirect fracture, as on alighting on the feet, when there would be no marks on the skin or clothing, and so on. Still, it is but seldom that the signs of fracture are not apparent.

There is a variety of fracture I must tell you of, just to teach you the true nature of a bone. It is what is called *green-stick* fracture. It occurs in children; their bones are soft like gristle, and they bend considerably before they break, and they differ as much from the bones of old people as does a dried stick or withered twig of a tree from a green branch. A dried branch snaps straight across, but a green twig bends and gives or cracks along one face, and may require to be cut through

before the ends can be severed. So it happens with children—the bone may crack along one side, but not completely through. A nurse carrying a child in her arms, and looking one way whilst the child looks another, the child overbalances, falls back, and the nurse to save it grasps its lower limbs to her side. The weight of the child's body snaps the thigh-bone, or bones it may be, across her forearm. It is generally a green-stick fracture that occurs on these occasions, and it shows you how elastic a thing a bone is, and how it will bend before it breaks.

Another variety is what is called an *impacted* fracture. It will be described when speaking of the forearm.

The next thing to know is—

What to do when a Broken Bone occurs.—Well, first and foremost, and I should like it printed in large letters and sent about the country, *attend to the patient at the spot where the accident occurs.* The patient must not be moved from the centre of the street to the pavement, but attended in the middle of the street; it matters not if it is at the crossing of the most crowded thoroughfare, it is there where you must render aid. You must not move the patient out of the way of cabs and vehicles. No one was ever run over twice, and if *you* kneel down to attend to the injury you are in no danger of being run over. Is it never right to move the patient? Would it not be right to move the patient from the foot of the stair where he has fallen to a comfortable couch before attending to the injury? No. Would it not be right to move the patient from where he lies in the middle of a football field with a broken thigh? No. There is no departure from the rule when any bone in the lower extremity is broken; it must be attended to *before* the patient is moved.

Why is it dangerous to move a patient before fixing the limb? Because a simple fracture might be made into a complicated or compound one. The artery of the thigh lies close against the thigh-bone; the jagged edge of the bone is quite near the tender vessel; and any further movement might easily send the broken end through the vessel. Again, the shin-bone, if broken, may be with but little motion sent through the skin immediately beneath which it lies. What is the usual course of events? A child's leg is run over by a cab; any one seeing the accident runs forward, and, lifting the child, carries it to the pavement, and then to the hospital or to its home. In the process, the child's legs are dangling over the "good Samaritan's" forearm, and the weight of the foot has caused the ends of the bone to come through the skin. Pour oil into the wounds first, and *then* set him upon the beast, is the Scripture teaching, and you cannot do better than follow that; *apply a splint first*, and *then* put your patient on a stretcher.

Supposing, then, you find a man lying in the street with A BROKEN THIGH-BONE (and you can tell it is broken by some of the common-sense symptoms and signs I have told you), what would you do?

1. Grasp the foot firmly to prevent it moving about, or to prevent the patient moving it, which he will do if intoxicated.

2. Pull the foot down until the limb is the same length as the other, and hold the two feet firmly together.

3. Do not let go, to go in search of a splint or help. If there is no one by to help you, as in a country lane, grasp the feet with one hand and get out your handkerchief or scarf with the other, and tie the feet together. You may then let go, and proceed to apply a splint. This would, in the house, be a broom-handle; in the football field, a goal-pole;

at military exercises, a rifle; in a country lane, your own or the patient's umbrella or walking-stick; or anything that is stiff and long enough. Properly speaking, for the thigh the splint ought to go all the way from the armpit to beyond the boot; hence a musket, broom-handle, goal-pole, or the like, is better than an umbrella or walking-stick, except in the case of a child, where the latter would be long enough. But it may be you have no walking-stick, not to speak of the other appliances; what is to be done then? Tie the two limbs together tightly. Nature you see has provided a splint, namely, the other limb, which is always there; but it is only a few years since it was discovered to be of use as a splint, although it has been available all these

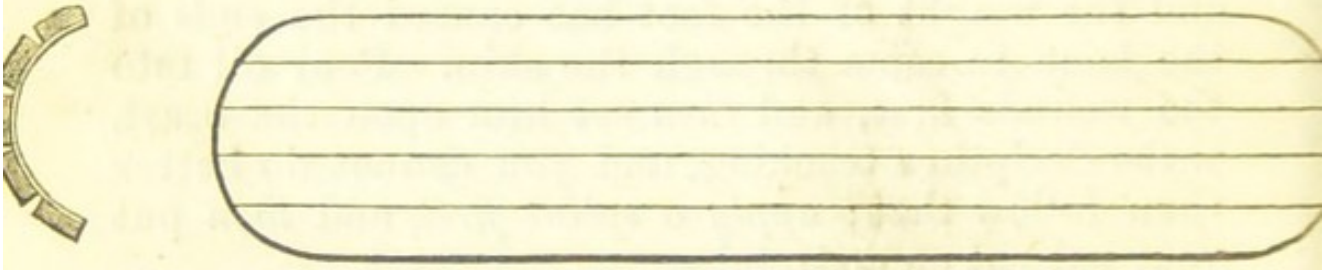

FIG. 66.—Flexible wooden splints of thin strips of lath fastened on leather. Left-hand diagram shows the same bent, and in section.

thousands of years. It was a great discovery that, and one likely to be of great benefit now that it is published to the world. Supposing, however, the accident occurs in the street and not in the country lane, you will get plenty of people willing to assist, it may be misdirect and provoke you with their ignorant officiousness. Every one prides him- or herself on his or her knowledge of "these things," and curtails many a life by the belief. You must, if you have hold of the feet, not let go, but make other people fetch and carry; fetch a broom-handle from the nearest house, or apply umbrellas or walking-sticks if that cannot be got, and after that is fixed, and not till then, will the patient be in a fit state to be carried.

To fix a broom-handle, or the like, to a broken limb:—

(*a*) Apply it along the outside of the limb, from the armpit to beyond the feet.

(*b*) Tie the feet, including the splint, together as in Fig. 67. There is a hollow above the heels and behind the ankles where you can slip a bandage through without moving the limbs.

(*c*) Pass a handkerchief, scarf, or triangular bandage behind the hollow of the knees, and tie the two limbs and the splint together tightly.

(*d*) In like manner pass a bandage below (not beneath) the hips, where there is a hollow between the hip and the top of the thigh. Tie it firmly.

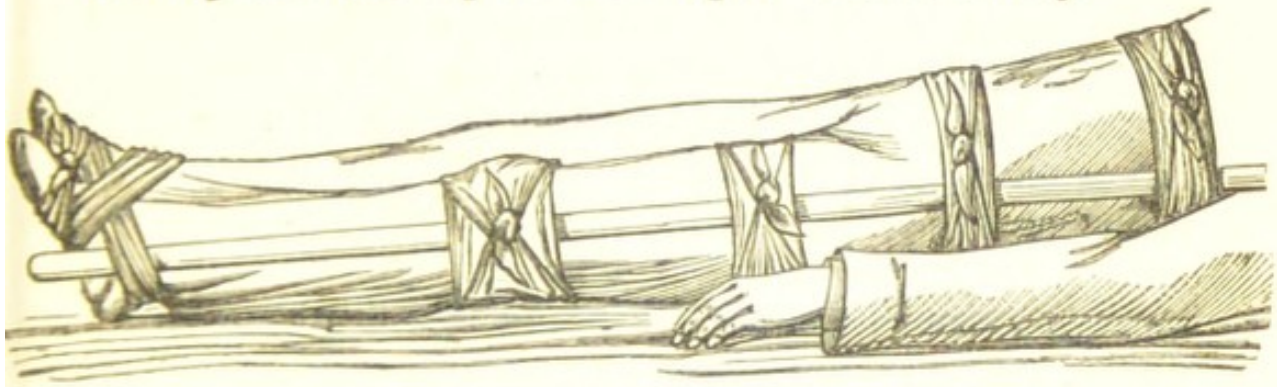

FIG. 67.—Broom-handle applied for fractured thigh.
(Another bandage round both knees should also have been figured.)

Never bandage over the spot where the bone is actually broken, if you know where that is, or can avoid it.

(*e*) Round the body pass two bandages, one just above the hips, tying the pole to the haunch-bone, or pelvis, and finally pass a bandage round the chest just below the armpits and including the top of the splint. Do not tie your bandage round the belly, or abdomen; a compression here, with no bone resisting, may cause inconvenience or even damage.

In addition to the long outside splint, it is recommended that a splint of wood, cardboard, stiff paper, etc., be laid along the inside of the fractured thigh. The bandages over the thigh must then include

the broken limb and the two splints only; but after that is secured the two limbs ought to be tied firmly together.

The patient is now rigid and stiff from the neck to the heels, and as the bandages are tied over the ankle, knee, and hip-joints, there is no danger of movement. In this state the patient is now safe to be carried on a stretcher to his home, or a hospital, or placed in a van, waggon, or cart in which he can lie full length.

When the **bones of the legs** are broken, most of the signs and symptoms are present as enumerated at pp. 92 and 93. The danger varies directly according as both bones or only one bone is broken. When both bones are broken, the fracture is generally the result of direct violence, such as the wheel of a vehicle, or of severe indirect violence, such as alighting from a great height on the feet. In either case both bones of both legs may be broken. Fortunately only one bone is usually broken, and that bone is generally the outside small splint-bone, the fibula. Even supposing the shin-bone, or tibia, is broken alone, it is easy to see the advantage accruing from having even the small bone of the leg unbroken, as it prevents much displacement, prevents the bones twisting or falling backwards or forwards, inwards or outwards, and thereby endangering the blood-vessels. You know, or ought to know, had you read carefully at p. 94, the danger of allowing the patient with a simple fracture to move; and here the same troubles may ensue, only ten times more likely is a simple fracture to become a complicated or compound if both bones are broken in place of one. The sound bone acts as a splint to its fellow, and prevents so much mischief resulting. The most commonly broken bone in the leg is the *fibula*, and it is broken usually about four inches above its lower end. Its lower end is easily recog-

nized just beneath the outside elastic of the boot, and the bone can be traced upwards until it disappears in the calf of the leg.

This fracture goes by the name of Pott's fracture. The story is told of how Percival Pott, a surgeon to St. Bartholomew's Hospital, fell on London Bridge. He felt he had broken his leg, and, knowing the consequence of allowing the unskilful to touch it, he placed his back against the parapet of the bridge, and with his stick kept the "good Samaritans" off, until a stretcher and skilled hands were brought from the hospital. Whilst lying up with this accident, his attention was directed to the exact nature of the

FIG. 68.—Improvised splint of two bundles of straw or twigs rolled in cloth, canvas, or the like.

fracture, and from his time the fracture has been called Pott's. It is frequently mistaken for a sprained ankle, and very often is it the case that the doctor is not called in until after a week or fortnight, when poulticing or arnica lotion has had its try.

To make out—diagnose—the fracture, apply the rules laid down in pp. 92 and 93 as guides, and especially notice that the foot is misplaced and twisted outwards. The toe is not in a line with the kneecap and shin, as it naturally is. It requires no training in anatomy to know the appearance of a sound limb, and the least suspicion of any change of shape becomes immediately apparent.

What is to be done with a broken leg-bone or bones? Follow the lines of treatment laid down on p. 95 :—

1. Secure the feet; get them in apposition; and tie them together.

2. Apply a splint, *i.e.* an umbrella (Fig. 69), a walking-stick, a piece of matting, a folded coat, a policeman's truncheon, the sheath of a sword, a bayonet, a bundle of straw rolled up as in Fig. 68, a goal-pole, or a broom-handle broken to a convenient length.

3. Bandages must be applied, one round the feet and ankles, another above the fracture, a third around, and a fourth above, the knee to check movement.

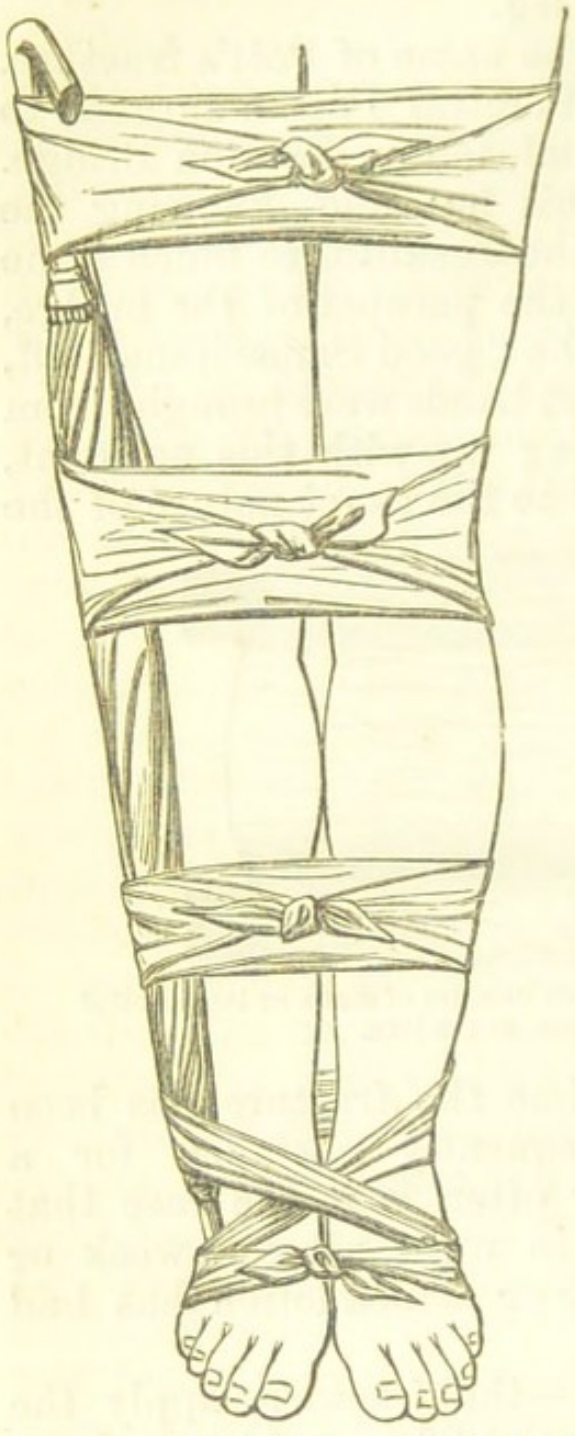

FIG. 69.—Umbrella employed as an improvised splint in broken leg. (The body is in the recumbent position.)

The splint for a broken leg should be long enough to go from above the knee to beyond the foot. When only one umbrella can be had, apply that along the outside and lash the other leg to the inside (as in Fig. 69), where all are tied together; where two umbrellas can be had, put one inside, the other outside, and tie them to the injured leg, finally end off by tying the two legs together at the

feet and knees. Policemen carry with them the means of rendering first aid in such cases; two truncheons are placed, one on one side of the limb, one on the other; the band they wear on the left coat-sleeve just above the wrist, when on duty, is long enough to pass round the limb and fix the truncheons —one band fastened just below the knee, the other at the ankle; finally, the two limbs are strapped together by the stout leather belt the police wear round the body.

A broken Kneecap (patella) is a very common accident, and until the last few years one from which there was no perfect recovery. The patella forms the front boundary of the knee, and consequently when it is broken the knee-joint is involved. As already explained (p. 91), it usually takes place from muscular violence, *e.g.* in the act of jumping, when the muscles, proving too strong for the bone, snap it across its centre. The limb becomes helpless; there will be no shortening, but the gap can be felt with the finger, and the joint will swell up almost at once. Motion must be prevented, and this is to be done by simply applying a splint, *e.g.* umbrella, along the back of the limb, or a couple of umbrellas, one outside, the other inside the limb. If nothing is procurable in the way of a splint, the two limbs tied together will prevent mischief.

We must now briefly consider fractures of the bones of the trunk.

A broken Haunch-bone (pelvis) is a fairly common accident, but it is at times very difficult to make out, even for medical men; and it is beyond my power to make the subject plain enough to you for it to be worth our while discussing. Suffice it to relate: that the patient complains of great pain in the region of the haunch-bone; that he cannot get up; that his lower limbs on examination prove all

right; and that he is suffering from much shock (see p. 118); then give the patient the benefit of the doubt, and treat him as though his pelvis were broken. Of course, if on applying your hand on the bone you made out grating, or crepitus, you would at once know that a fracture had taken place. Do not, however, move a broken bone about in search for crepitus. In this particular part the organs within the pelvis are vital, a tear or bruise of one or other of them by the jagged edge of the broken bone might lead to fatal consequences. Give the patient the benefit of the doubt, and keep him rigid by long splints (and you know now what I mean by these) applied along both sides of the body from the armpit to the heels. These are to be tied firmly to the body and lower limbs by numerous bandages, and in this state the patient can with more safety be removed.

Broken Ribs are of frequent occurrence, and require "first aid" to be skilfully rendered, just as do other bones. Broken ribs are not of so much consequence of themselves, but it is the tender and vital organs with which they are in contact that render them dangerous to life. A rib, when broken, is in the very best condition as regards itself, for has it not a rib above and another below to act as splints and keep it in its place? But with all that a broken rib has a drawback which no other bone has, and that is, you cannot keep it quite quiet. The patient must breathe to live, and the ribs must consequently move with the motions of the chest. Now, the organs which may be injured when a rib, or rather ribs, are broken, are the lungs, the liver, the spleen, and even the stomach or heart; in fact, all those organs (see pp. 11 and 12) which nestle for protection under the cover of the ribs. All these organs are vital, but injury to the lung, which is the most frequently injured, is fortunately the least dangerous. When the lung is

torn there may occur INTERNAL BLEEDING, with or without the coughing-up of blood. Blood brought up by the mouth may come from either the stomach or lungs; when blood comes *from the lungs*, it is coughed up in mouthfuls, it is scarlet in colour, and frothy from admixture with the air and fluid in the air passages; when the blood comes *from the stomach*, it is vomited up in quantity, it is dark in colour, it is not frothy but thick and lumpy from the action of the juice of the stomach—the gastric juice.

To treat bleeding from the lung:—

1. Open the window so as to allow the patient fresh cold air to breathe.

2. Keep the patient absolutely quiet in the position of repose.

3. Give ice to suck if it can be procured; if not, let the patient sip cold water, vinegar and cold water, or better still a strong solution of alum and water or strong cold tea; the latter with a lump of ice in it, if it is to be had, is an excellent and fairly efficacious remedy.

It may happen that bleeding occurs internally after any injury, with no evident signs except those due to loss of blood. This may arise from a broken blood-vessel in the chest or abdomen, the result of disease, a broken bone, a stab or bullet-wound. That some serious internal injury has taken place may be judged from the giddiness and pallor which speedily supervene, and the faintness which comes on when the patient attempts to stand up, or is propped up in the sitting position. The breathing becomes short, and the heart fluttering. Nothing will save the patient if a large vessel has burst, but if it is one of secondary size (and you cannot tell which it is), keep the patient almost flat, absolutely quiet, and give some of the simple remedies recommended at p. 121. When a rib is broken it is essential, of course, to attend to the bleeding first

and foremost; you do this whether the blood is coughed up or whether you suspect from the symptoms that bleeding is going on into the cavity of the chest.

To keep the rib quiet would mean binding the chest so tightly as to impede breathing, and to force the end of the rib further into the lung, and thus to cause evil instead of good. **What you do is this**: You take a broad bandage,—for instance, a triangular bandage folded twice,—and, applying the centre of the bandage over the spot the patient complains of (and that is the injured spot), pass the ends round to the opposite side of the body and tie them there so as to give support and comfort to the patient. Ask the patient as you gradually tighten the bandage if it is comfortable, and the sigh of relief the patient gives when the bandage is sufficiently tight indicates at once when to stop and complete the knot.

The same purpose is answered by swathing the chest tightly in a jack-towel, and fixing it firmly by sewing. It is safer to take a piece of plaster—diachylon plaster, if you can get it—and strap it round one side of the chest. The piece of plaster should be long enough to reach from the spine to the breast-bone, and as broad as the palm of the hand of the patient on whom it is to be applied. Warm the strapping-plaster before the fire, and, fixing it at the backbone behind firmly to begin with, pull steadily and gradually, applying the plaster over the painful part, *i.e.* the broken rib, and finally end it off at the middle line in front. You will at once understand the advantage of this when you consider that only one side is bound up; the other, the sound side, is allowed freedom to move with the breathing.

The Bones of the Upper Extremity which are most frequently broken are the collar-bone, the

bone of the arm, and the bones of the forearm—more especially the radius.

Fracture of the Collar-bone, or clavicle, is an accident of everyday occurrence, and one to which it is essential to know how to render first aid.

For an account of the collar-bone, its S-shaped curve, its position, and its likelihood of being fractured, see p. 13.

It is a frequent accident in the football field and in the hunting field, whilst in the nursery it is not an uncommon occurrence when children are learning to walk.

The bone has to sustain the whole weight of the body when one falls on the hand; it may happen that both collar-bones are broken at once.

When fracture does take place, it can be made out by applying the rules and tests laid down in pp. 92 and 93. Especially marked is the helplessness of the limb, the patient generally supporting the injured limb at the elbow with the other hand; deformity can be seen when the collar-bone is looked at and compared with its fellow; and the gap or crack may be felt with the finger. On pushing up the elbow much of the deformity will disappear.

To allay pain and to prevent the end of the bone coming through the skin, *i.e.* compound fracture, or going into a blood-vessel, *i.e.* complicated fracture, it is necessary to fix the limb quickly and firmly. To effect this there are well-nigh as many means as there are doctors in the country; for "first aid" purposes, however, a speedy, sure, and safe method is the following:—Place a pad in the armpit of the injured side; the pad may be a newspaper folded firmly, a handkerchief with a ball of worsted in it, a tennis-ball wrapped in a scarf, a lady's shoulder-wrap, a waistcoat folded to a square shape, and so forth. Place this in the armpit, pushing it gently but firmly upwards. Whilst this is held, apply a

FIG. 70.—Bandage for broken collar-bone. After Esmarch.

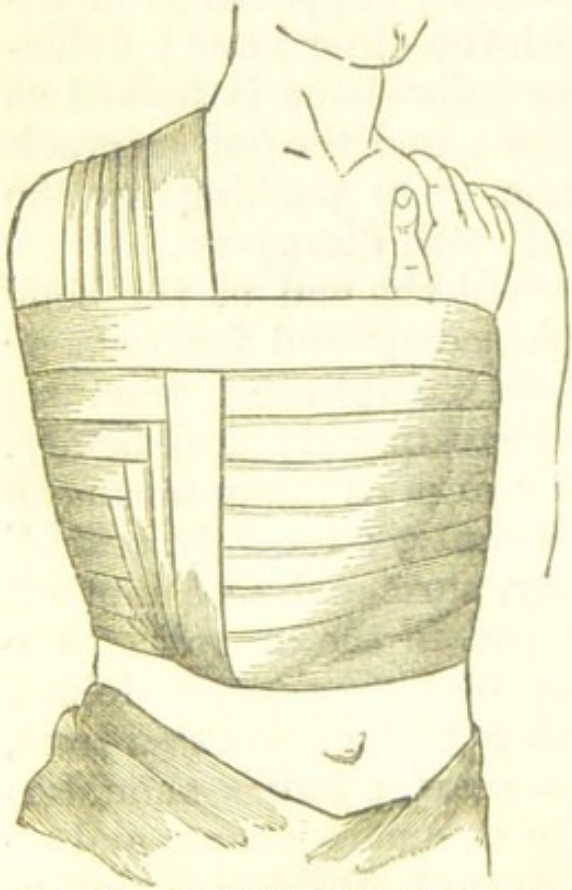

FIG. 71.—Roller bandage applied for broken collar-bone.

larger arm-sling (see p. 64), and finally tie the limb to the side as represented at Fig. 70. Were I to tell you other methods, it would only confuse you when the time comes for application in real injury.

But, one naturally asks, Where is one to get triangular bandages on the hunting field? Well, a large handkerchief or neckerchief will do as well; but if that is not to be had, fix the arm to the side by a couple of handkerchiefs knotted together and tied round the body, including the arm; and turn up the tail of the coat or jacket over the forearm and pin it to the breast of the coat, or simply pin the coat-sleeve to the breast of the coat (see Figs. 34 and 35). Thus is a sling improvised which will serve to keep the limb quiet until you get something better. If

the accident happens on the hunting field, the patient should not be allowed to ride home, especially if it is the left clavicle which is broken. The patient should be taken to the nearest doctor in all cases, and most certainly should "his own doctor" be sent for when he gets home. You must not think, when you have rendered "first aid" in a case of fracture, that you can dispense with the doctor. Be as clever as you may at fixing a bone according to the instructions given you, and even should the doctor not want to touch it, which he will not if you remember and act upon the rules I have told you; still, for all that, there are other things to consider when a bone is broken. The shock to the system will require attention; from this upset the patient may become the subject of any latent disease, such as gout, rheumatism, kidney disease and numerous other ailments, which are much more likely to lead to serious trouble than the simple break of the bone. It is not knowledge, but ignorance, that makes people doctor themselves; and the most ignorant are in this, as in other things, the most ready to take upon themselves the management of even human lives. A man may ruin his own health—there is no law to stop him; but he ought not to be allowed to inflict hopeless ruin upon the health of others by his ignorant help.

The Bladebone (the scapula) is but seldom broken; when it is, it generally happens from a crush or hit, as by the buffer of a railway-carriage; it is not an uncommon accident amongst railway-servants. When it does happen, fix a bandage round the chest, just below the armpits, so as to embrace the bladebone, and apply a sling to support the arm.

The Arm-bone (the humerus) is frequently broken, and by a multiplicity of causes. The fact of its being broken can be established by the usual

signs and symptoms of fracture. When broken at its upper end the signs may be obscure; but if, after a fall, the limb hangs helpless, and the patient complains of great pain on movement, then treat it as in fractured clavicle, by placing a pad in the armpit, tying the arm to the side, and putting on a smaller (not a larger) arm-sling, *i.e.* one folded thrice.

When the arm-bone is broken near its lower end, the fracture is usually perfectly apparent, and for this, as in the case of fracture of the elbow or forearm, make a splint of two pieces of stick crossed and tied together by a handkerchief, as represented below. This splint is to be applied to the inside of the limb, and tied on with one handkerchief round the arm, another one, or two, round the forearm; and the limb is to be supported in a sling. Such a splint as this may be made of two pieces of wood—be they flat or round; of two pieces of cardboard; of two pieces cut off a bonnet-box; or of folded newspapers with pieces of wood, such as those used for lighting the fire, wrapped up in them to give fixity.

When the arm-bone is broken, and such a splint as this (Fig. 72) is to be applied, enclose the front, back, and outside of the arm as well, in a piece of stiffly folded newspaper, or, instead of newspaper, a notebook applied open, or the straw casing used to pack bottles, such as champagne bottles, a piece of cardboard, or anything that comes handy. Supposing one is

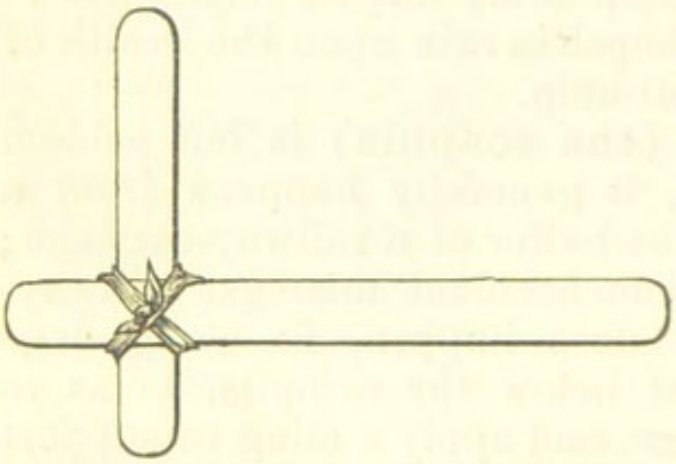

FIG. 72.—Improved angular splint for fractures of upper limb (Author).

some distance away from assistance, a walking-stick may be broken in two, the ends crossed, as in Fig. 72, and tied together with a handkerchief, and applied to the inside of the arm as a splint; the coat-sleeve may then be pinned to the breast of the coat or dress, or the tail of the coat or jacket turned up and fixed as described at p. 106. The bough of a tree may supply the place of a stick; two bayonets crossed, or the sheath and the bayonet crossed, may be tied together as in Fig. 72. That person must be stupid indeed who cannot in an open field, and away from everything, as the saying is, find a means of fixing a broken limb. If you can do nothing else, you can tie the arm to the side with handkerchiefs; and if even these are wanting, you can pin the coat-sleeve to the side—it is better than letting the arm dangle.

When a **fracture of both bones of the forearm**—the radius and ulna—occurs, there is usually not much difficulty in making out that the bones are broken. Almost all the signs and symptoms mentioned at pp. 92 and 93 are present.

To fix the limb, apply the splint delineated at Fig. 72, along the inside of the limb; in addition place a piece of stiff substance, such as a newspaper, matting, the straw casing of a bottle, a book with soft covers, or a piece of wood, along the outside of the forearm; and support by a sling.

Attend to the following injunctions when either the bone of the arm or the bone of the forearm is broken:—

1. Keep the elbow bent at a right angle.
2. Keep the thumb upwards towards the ceiling.
3. Fix in splints and support in a larger arm-sling.

The rule in the upper extremity is to keep the elbow bent, in the lower to keep the knee straight. The objects are obvious. Should the patient recover with a stiff knee, the limb when in a straight position

would be useful for progression, whereas a bent position would necessitate the use of a wooden pin to walk on. So with the upper limb: should the elbow recover fixed in a straight line after an accident, the hand could not be brought near the mouth; whereas in a bent position, with the thumb upwards, the hand can be used for feeding and for writing purposes, etc.

There is a special, very common fracture which occurs at the lower end of the forearm, in the bone that supports the hand, *i.e.* the outside bone, or radius (see p. 17). It is one of the most common fractures in the body, and goes by the name of Colles's fracture. It is peculiar inasmuch as it does not belong to any of the varieties of fracture previously mentioned. The cause of its occurrence is simple enough: a fall on the hand; and the bone which supports the hand—the radius—may snap through just above the wrist. Before the broken ends of the bone can escape from each other they are driven the one into the other, so that they are firmly fixed or impacted. This is called an *impacted* fracture. It may occur in other parts of the body, notably the neck of the thigh bone. It is evident that all the signs given at pp. 92 and 93 will not be present in this form of injury. When it occurs, there will be pain and some deformity, but it will require skilled medical examination before it can be made out. The treatment is to fix the limb as comfortably as possible in splints, as described for the arm and forearm, apply a larger arm sling, and take the patient to the nearest doctor. When a **finger-bone** is broken, apply a stick, or a piece of kamptulicon, along the palmar or front face of the finger, and bind it to the finger with strips of your handkerchief or a piece of plaster.

Still another fracture of importance to be mentioned is—

Fracture of the Lower Jaw.—The lower jaw-bone is apt to get broken by a blow, a kick from a horse, a fall on the chin, etc. When it is broken the fact is easily ascertained, as the signs of fracture (see pp. 92 and 93) are evident. The mouth cannot be closed, the teeth are uneven, blood escapes into the mouth, the gap in the bone can be felt outside, and the grating, crackling, or crepitus can be felt on the least motion. Nature has provided a splint to which to bandage it, namely, the upper jaw, against which it naturally lies. To fix it, tie a handkerchief round below the jaw, cross the ends on the top of the head, and tie below the chin; a second handkerchief carried round the front of the chin to the back of the neck and there tied will secure the jaw firmly (see p. 67, Fig. 40). Consult the doctor as to the means of feeding the patient and further treatment.

The Management of the Clothing in Street Accidents.—Your greatest difficulty in street accidents of the nature of broken bones or cut arteries is to know what to do with the clothing. Authorities on "first aid" say you are to rip up the clothing. Now this takes time; even with a sharp knife or scissors it takes you more time than you would care to spend, if it is a case of bleeding from the top of the thigh or armpit. The rule is, when you can make out what is the matter—say a broken leg or arm, or even have strong conviction that a bone is broken—do not pull the leg about by ripping up the clothing, and perhaps making the accident compound, but fix your splint outside the clothing, and *proceed as if the clothing were off.*

In the case of bleeding you can compress all the vessels above the clothing easily, except the artery behind the collar-bone and the artery at the fold of the groin. Unfortunately, it is when these two have to be compressed that most speed is required, owing to the large size of the vessels wounded. If

you wait until the clothing is slit up, the patient will have likely bled to death, so you should proceed as follows:—For the artery of the thigh press your thumbs at once (as directed, p. 37, Fig. 7) on the region of the artery above the clothing, and let others slit it up. In a man or boy the compression can be done above the clothing when the patient is laid down flat. In the case of a female it is impossible, but a wound of the artery high up in the thigh in a female is an extremely rare accident.

To compress the artery behind the collar-bone, for a wound of the artery in the armpit, at once tear off the collar and scarf, and get your thumb in "the bird's-nest," over or under the shirt, according as you can get it off or not. Let others then slip the clothing off.

Broken Back.—If the spine is broken, say in the middle of the back, the spinal cord (see p. 21) is apt to get torn. The consequence is easily understood now that you know the relation of the spinal cord and nerves to the motion and sensation of the body, and to the backbone itself. In the case we have cited all sensation and motion would be lost below the spot where the rent of the cord has taken place—that is, the part below would be paralyzed. The danger from the backbone being broken is not so much on account of the mishap to the actual bones as it is to the parts contained within. When the patient cannot move the lower limbs after a cart-wheel has gone across his back, you may come to a pretty safe conclusion as to the real facts. If, then, it be important to attend to a person where he falls in other cases of fracture, it is more important a hundredfold in such an accident as this. In fact, the patient should not be moved, if you can help it, until a doctor is fetched; but if it is impossible to get a doctor within a reasonable time, you must take great care to keep the patient's body

rigid by poles, broom-handles, rifles, and such-like, fastened on either side of the body. Beneath him a blanket or sheet should be half slipped, half dragged, so as to be spread beneath him from shoulders to heels without moving his body.

When raised on the blanket or sheet by four people lifting at the four corners, pass a shutter (or stretcher, if you can get one from the police or hospital or ambulance station) under the patient, laying blanket and all on the stretcher. He can then be carried in safety. When the fracture is high up in the neck, the patient dies at once from a broken neck, as it is called. This is because the nerves to the midriff, or diaphragm, the muscle essential to breathing and consequently to life, receives its nerve supply by two nerves, the phrenics, which come off high up in the neck. Their influence is stopped; hence the diaphragm ceases to act, and death instantly ensues.

Having told you the meaning and nature of an injury to the spinal cord by a broken backbone, I must now explain

INJURIES TO THE BRAIN.

The limits of the brain have already been given at p. 19. It is there stated that the position of the brain is limited by a line drawn from where the hair joins the nape of the neck, forwards and along the side of the head, and across the ears to the eye-brows. Above that line lies the brain, contained in its bony case or cranium. Any fall or blow on the cranium, whether front, back, top, sides, or base, is apt to cause injury to the brain and blood-vessels within.

Compression of the Brain.—A piece of *bone* broken and pressed on to the brain will give rise

to a train of symptoms known as those of compression.

Compression may also come from *blood* pressing on the brain, and this condition arises thus. When a severe blow on the head is received, the rupture of a blood-vessel within the cranium may occur. The blood escapes from the artery and gradually accumulates between the bone and the brain. It may accumulate in such quantity—after, say, twenty minutes or half an hour—that it will press upon the brain, and cause compression just as surely as does a piece of bone. Compression may thus arise in two ways: the one, from bone, comes on immediately; the other, from blood, comes on after the blood has had sufficient time to collect, say twenty minutes, during part of which time the patient may have been stunned. How to recognize compression of the brain :—

1. The patient is *insensible.*

2. There is loud *snoring*, called stertorous breathing —this is caused by the soft palate being relaxed and flapping backwards and forwards in the throat; the muscles of the larynx are relaxed; the cheeks are puffed out and dragged in between the jaws during expiration and inspiration respectively.

3. The eyeballs are insensible to touch. This marks deep insensibility, as you might expect, when the tender eye, in which a speck of dust cannot alight without your becoming aware of it, allows you to touch it.

4. The pupils of the eyes become insensible to light. The pupil of the eye is the black circle in the centre of the eye, situated in the middle of the blue, grey, brown, or black iris. The pupil in health is contracted when in a bright, and dilated in a shaded, light. The degree of insensibility can be partially judged when, by holding a candle before the eyes, or opening the eyelids in bright sunlight, it

is observed whether the pupil contracts or not. If it does not, or but slowly and imperfectly, then is the injury to the brain great and the insensibility deep.

5. The hand placed over the heart, or the finger placed upon the pulse at the wrist (p. 45), will indicate a *slow* action and a threatening to stop.

This condition might be mistaken for apoplexy or drunkenness. The mistaking it for apoplexy would not signify, as the treatment of the two conditions is well-nigh the same, and the history of the fall would settle the question (see Apoplexy). The mistaking it for drunkenness may be more serious (see Drunkenness). When there is any doubt, give the patient the benefit of it, and treat him, not as a drunken man, but as one having met with an accident.

What is to be done in compression? Send for a doctor at once. In the mean time—

(*a.*) Place the patient in such a position that the air may readily enter his nose or mouth, and wipe the mud, or froth, or blood from off his nose and mouth.

(*b.*) Undo all tight clothing about the neck; undo the neck-cloth, shirt-stud, braces, waistcoat, and anything too tight around the waist.

(*c.*) Keep the head up in a line with the neck and shoulders, in the position of repose. You must beware how you hold an insensible person's head up; unless you notice what you are doing, you will find that the head is bent so that the chin is on the chest, and the patient well-nigh, or actually, suffocated from your want of attention. Again, you may, by passing your hand behind the lower part of the neck, in the endeavour to raise the shoulders, allow the head to fall back, and your attention is recalled by the gurgling sound in the patient's throat. The patient must be in a position to breathe easily.

(*d.*) Keep the windows open, if it is in the house you are attending to an insensible patient; if in the

street, or in a crowded meeting, endeavour—but you won't succeed—to keep the people away, so that the patient may have more air to breathe.

(*e.*) Apply cold water, or ice if you can get it, on a handkerchief or sponge to the head. This is most likely to do good when blood is escaping; but do it in any case, as you cannot be quite sure as to what has happened.

When the patient is taken within doors, take off the boots and apply mustard leaves or a mustard-plaster to the soles of the feet.

Concussion.—A common accident to the brain is one in which the patient is **stunned** or **concussed.** This is brought about by a severe blow on the head, causing the brain to be so shaken that its workings stop, and the patient becomes insensible. As when you drop your watch, sometimes the glass is broken, at other times the works stop; so with the brain and skull, sometimes the bone is cracked, at other times the works stop. In simple concussion no real injury may have been done to the brain. There is only temporary derangement; the brain will resume work by-and-by.

How to recognize concussion.

(*a.*) There is the fact of *a blow*—a fact made evident, it may be, by a bruise or cut.

(*b.*) The patient is *insensible.*

(*c.*) The breathing is so *quiet* that you have to listen carefully, or put your hand on the chest to make out the rise and fall of the chest. This is very different from the loud snoring in compression.

(*d.*) The heart and pulse are disturbed, so that you get *a flickering*, fluttering beat.

(*e.*) The pupils may, on pulling the eyelids up, be seen to contract to light, or remain fixed, according to the depth of the insensibility.

The unconscious state may last from a few seconds to many minutes, or even hours.

Of course, in all injuries to the head, such as compression from bone, or rupture of an artery leading to effusion of blood, concussion will play a part—that is, the brain will be shaken. When the insensibility is from depressed bone, the symptoms of compression will come on at once, and drown those of concussion.

When, on the other hand, the injury results in effusion of blood, at first there are symptons of concussion, which after a few minutes may disappear, consciousness may return, the patient be able to tell his name, and whilst he is speaking and insisting on going home, the blood, which all the time has been slowly accumulating, may have gathered in such quantity as at the end of twenty minutes to press on the brain and cause compression. The train of symptoms from first to last would be—(1) insensibility, with placid breathing—concussion; (2) consciousness; (3) insensibility, with loud snoring—compression.

The above paragraph will require reading again, as it is a summary of the facts of the few previous pages.

What is to be done when a person is stunned or concussed?

Send for a doctor—but in the mean time—

(1.) Place the patient in an easy position to breathe.

(2.) Undo all tight clothing everywhere.

(3.) Keep the windows open, if in the house.

(4.) Attempt to keep the crowd off, if out of doors.

(5.) Smelling-salts to the nose will do no harm, nor tickling the nose with a feather; but the brain will not go on working again until it has settled down from its shake. The application of cold water to the head may be advantageous.

Shock.—By shock to the system is meant the physical condition that a person is thrown into after a severe accident. It matters not how slight the

accident, it causes a slight shock to the system; a rap on the knuckles, a barked shin, burning the finger whilst lighting a match, will each and all give rise to slight shock. If, on the other hand, the injury be severe, then is the shock great; a broken leg, a severe burn, a blow on the abdomen, will one and all give rise to severe shock.

Supposing a man pitched off his van, and you find him in the street or the side of the road with a broken leg. The first thing you will notice is, that he is shivering, and seems cold, even although it be twelve o'clock on a hot day in July. You will also find that a man is sensible; he can tell you how the accident happened, and he *tells* you he is cold; you know, therefore, nothing is wrong with his brain; it is his leg that is injured, not his brain. When you put your hand upon him, his skin feels cold. This is, then, a characteristic feature in shock, namely, a lowering of temperature. The temperature of the body in health remains pretty constant, falling a little in the early morning, rising a little in the early evening, but practically it is at what you see marked on the ordinary wall thermometer as "blood heat." When you read off the number on the thermometer scale, you will see that blood heat stands opposite 98°, and that is about the average temperature. The temperature of the body is taken by a special (clinical) thermometer. The bulb of the instrument is placed either below the tongue for five minutes, the lips being kept close; or in the armpit for ten minutes, the arm being brought close to the side. In fevers the temperature goes up to, say, 105°, or even 110°; but in the condition we are speaking of, shock, it falls to, say, 95°, or even 92°.

Here, then, is the indication of your treatment of shock, *viz.* to prevent the man dying of cold. In all accidents, therefore, your attention must be directed not only to fixing the broken leg, but also

to keeping the patient warm. To do this, throw any wrap you have with you, or can obtain from the bystanders, over the patient. Get a blanket from the nearest house, if you can; but if nothing else is available, divest yourself of your coat or shawl, and throw that over the patient.

When you get the patient under shelter, throw a warm blanket or blankets over him. He will stand two or three. Give him some hot tea, coffee, or milk, or a small quantity of hot whisky-and-water. Get ready hot bottles to apply to the feet, and in every way you can, consistent with common sense, keep the patient warm. You will in this way prevent the body heat falling too low, and so render recovery possible.

Fits.—It may be impossible to prevent fits coming on, but it is possible, once they have come on, by intelligent and common-sense rules, to prevent more serious consequences ensuing.

There are many forms and varieties of such diseases, but only the more common will I tell you of. There are three chief forms:—

I. **Epileptic Fits.**—The disease, which in ancient times was called being possessed by a devil, is in modern times called epilepsy. It is characterized by a sudden seizure, in which the patient gives usually a cry or shriek, and, falling down, goes through a series of twitchings and contortions of limbs, body, and features, caused by muscular spasm. The muscles move the jaw and the tongue, but these do not keep time in their actions, and the tongue gets caught between the teeth and bitten. It is not that the patient bites the tongue in agony, it is only that the tongue gets as it were accidentally caught between the teeth.

Treatment: You cannot shake the patient out of the fit; you can only, *whilst the fit is on*—

1. Undo all tight clothing about the neck.

2. Place the patient in the position of repose, so that the breathing is in nowise hampered.

3. Prevent the tongue being bitten by placing a cork, the handle of a pocket-knife, a pencil, a piece of indiarubber, or your handkerchief twisted, between the teeth.

4. Restrain the struggles, but do not tie the patient down or put heavy weights on his limbs, so as to violently oppose the spasm, and thereby injure the muscles.

5. Take care that the patient does not hurt you or him- or herself whilst struggling.

After the fit allow of two or three hours' sleep. The fit is only the expression of the diseased condition; medical advice will have to be sought, and that too for a lengthened period, if any permanent good is to be done.

Every one subject to epileptic fits ought to avoid alcohol, to shun dangerous places, such as the edges of pits, cliffs, and so forth, and should never be alone.

II. **Fainting Fits** come from the effects of a close room; tight lacing; fright, as at the sight of blood; good or bad news of an affecting nature, and so on. The fit comes on generally with a feeling of giddiness and fluttering at the heart; the face becomes deadly pale; the blood deserts the lips; the patient becomes insensible and tumbles down. Supposing you are sitting in church, and you find the person next you *going off* into a fit, or suppose the person has gone off into a dead faint, and the first thing you hear is the head thump against the pew, then lay the patient down *flat* on the seat. When I say *flat*, I mean flat; so make no mistake. Do not raise the head, but rather let the head be below the level of the body over the end of the seat. Fussy people will raise the head, it is in human nature to do so; but instead, raise the *heels*, it will do some good. Now, the object of laying the patient down

flat, or even with the head below the level of the body, is to get the blood to go to the brain; and so by getting the head on to a level with or even below the heart, it is fairly to be expected that the blood will circulate more freely in the brain. When the circulation is restored, the patient will recover affrighted, but not seriously worse for the short spell of insensibility. The patient should, when sensibility is restored, be removed into the open air—at any rate out of the place where the faint occurred; otherwise, the same conditions obtaining, the faint may come on again. Smelling-salts applied to the nose may ward off a faint, or may help to bring the patient round when insensible. A draught of cold air in the face, or smart sprinkling with cold water, may cause the patient to breathe, and so cause the blood to circulate freely. Cold air is very likely to do good by causing the patient to take a breath; it was coming suddenly into contact with cold air which made us take our first breath. An impractical and pernicious practice in vogue to promote recovery from a faint has got abroad, namely, bending the head forward between the knees. Let the reader try the position as he reads this, and consider whether it is one likely to promote breathing or circulation. For children it may be all right—so also would be complete inversion; but for persons with tight clothing or weak hearts, and these are generally the subjects of fainting fits, it might mean death from asphyxia.

III. **Hysterical Fits.**—Hysteria is a disease which exhibits itself in the form of more or less frequent fits. These fits are peculiar: the patient (a girl generally) never faints by herself; she never falls to hurt herself; and she can have these fits when she pleases. The fit is known by its violence—by kicking, screaming, howling, tearing, biting, and such-like acts. The eyelids twitter and blinter,

and parents of an hysterical girl generally regard this as a sign of fearful import. She is blintering to see what the bystander means to do; if it happens that the bystander knows what to do, the girl will soon recover when she finds the necessary steps are being taken. The steps are, pouring a jugful of cold water slowly on the head, or dashing a tumblerful of cold water sharply in the face. This, with an *un*sympathetic talking to, will likely suffice to bring her round. Not a bad plan is to go out of the room, slam the door, and make the patient believe you are gone away. Quietness will soon ensue, and the fit will go off if you make no noise whilst outside the door; but if the patient knows you are there, the fit will not stop, but only continue in its intensity. Medical advice must be sought before the disease is cured.

Bite from an Animal.—We are more often in this country bitten by dogs than by other animals, but it matters not what animal bites one, be it a horse, a snake, or a man, the same rules apply in every case. It matters not whether the dog is known to be mad—that is, rabid—or not, you are to proceed as if it were. It is most dangerous to get bitten on the hand and face—not that there is anything peculiar about these parts, but they are the only parts not covered by clothing. The dog's teeth are not the poison, it is the fluid, the saliva, which is on the dog's teeth, which when it gets into the blood may set up hydrophobia. The teeth, in other parts than the face and hand, get wiped as they pass through the clothing and go in clean and possibly freed from the rabid poison.

Supposing the finger bit at its point, proceed as follows:—(1) At once grasp the finger above the wound, encircling it by the forefinger and thumb of the other hand; (2) suck the wound; (3) rush to the water-tap and let water flow over the wound,

but *do not relax your grasp on the finger;* alternately suck and wash for five or ten minutes, or, better still, dip the finger in warm water instead of cold—it will encourage bleeding and thus help to expel the poison out of the wound. (4) If you know the dog to be mad, you should tie a string round the finger above the wound, *i.e.* between the wound and the heart, when you can relax your grasp with your finger. Go to a doctor and get him to cauterize it for you, and then act afterwards as he directs. Supposing one is far away from a doctor or chemist, one may scarify or cut the part with a knife so as to make it bleed freely, or cauterize by a red-hot wire, or by pushing a lit fusee or vesuvian into it. Sportsmen in India have been known, when bitten by a snake, to pour gunpowder on the part and explode it.

THE STING from a bee or a wasp is to be treated in the same manner. You pick out the sting when you see it.

Notice that any of these poisons may be sucked with impunity, if you have no crack or abraded part about the mouth; besides, one does not swallow the poison after sucking it out of the wound.

Of course, if one is bitten or stung in other parts besides the finger—if it is the hand that is bitten, tie a handkerchief tightly round the wrist, and then proceed as before; if it is the face, you must dispense with the bandage and trust to sucking, etc. Whenever you can, tie a ligature between the wound and the heart, suck, wash, and cauterize, and go to a doctor speedily. The object, instantaneously it must be, of tying a band between the heart and the wound is to stop the passage of the blood in the part, and so prevent the veins carrying away the poison into the circulation.

A mad or RABID dog suffers from a disease called RABIES. The poison is present in the saliva, which

when it finds its way into the blood of man causes the disease called hydrophobia. A rabid dog is a diseased animal, and looks and behaves as though he felt ill and nervous; his coat is out of condition; his ears hang flabbily; his eyes are red; he has a slouching gait; his tail has a droop instead of a curl upwards; he is nervous about crossing the street, and hesitates to leave the railings and the doorways; he avoids sunlight, and gets into the dark places in a room. The saliva dribbles from his mouth, and he has a spasmodic action in the muscles of his jaw. This causes him to snap at things without meaning harm, as it may even be a door-scraper he gets hold of; and if you put down your hand to pat him he may, instead of licking, bite it. A friend attempting to pacify the animal gets served likewise; this will cause an alarm to be raised, the neighbours will collect, the dog becomes scared, frightened, and provoked, is hunted with brooms and pitchforks, and is driven raving mad. This is the state we read of in the newspapers, and people imagine that all mad dogs behave like the "newspaper dog." The above description will show that far other is the case, and that a rabid dog may be quite quiet or quite harmless if not tormented or tampered with. Beware of dogs then which, in the hot weather, look out of condition and have a frothy saliva dribbling from their mouths; do nothing to provoke them, otherwise serious consequences may ensue.

Apoplexy.—This is a disease much dreaded and often talked of, and one which seems now to occur in younger people than formerly. So far as we are concerned it is only with the apoplectic fit or seizure we have to do. The disease consists in the escape of blood on the brain from a broken blood-vessel. As we get older our blood-vessels, instead of remaining the soft elastic tubes they were in youth,

become more brittle from lime-salts deposited in their walls; they are said to become bony. This inelastic narrowed condition of the vessels gives a great deal more work to the heart; consequently the heart, being a muscle, gets bigger, as other muscles do when much used. This big heart, thumping away against a diseased vessel, may, when extra work is thrown on it, as in running, cause the vessel to crack and allow of the escape of blood. This may occur anywhere in the body, but when it does so in the brain it causes apoplexy.

In a well-marked apoplectic fit you would expect to find the symptoms of compression (p. 114). There would be—(1) Insensibility beyond the power of rousing. (2) Loud snoring respirations—stertorous breathing. (3) The face would be flushed and congested. (4) The pupils possibly unequal, not responding to light. (5) The heart would be beating pretty strongly; it is part of the cause of the trouble that the heart is too strong. (6) The limbs upon one side of the trunk would be more limp than the other, pointing to which side is affected. (7) It may be also that the temperature of the body is higher. (8) Usually the person is getting on in years.

Treatment: (*a*) Undo all tight clothing everywhere; (*b*) place the patient in an easy position to breathe; (*c*) open the windows, and pull the curtains of the window or bed well back if it is in the house, if in the street keep the crowd away; (*d*) keep the head up, with the precautions given at p. 115; (*e*) apply cold water to the head on handkerchiefs, flannels, or sponges, or tie an ice-bag on the head. (*f*) Put hot-water bottles, mustard leaves, or a mustard-plaster, to the soles of the feet. If the doctor is far off, put one drop of croton oil, if you can get it, on a small lump of sugar and insert it between the teeth. This may, by causing purga-

tion, do some good. *Never give any fluid by the mouth when a patient is insensible* from whatever cause; in particular, guard against stimulants being given in apoplexy. For the differences between alcoholic poisoning and apoplexy, see p. 139.

BURNS AND SCALDS.

Burns are caused by hot solid substances, or by flames; scalds are caused by hot fluids. A burn or scald may vary between a slight redness of the skin and complete charring of the tissues. Supposing a kettleful of boiling water to tumble over a child's foot, you would get off the shoe or boot as quickly as possible, cutting the elastic and leather, or cutting the lace and leather, if need be. You would then cut off the stocking along a dry part if there is one, so as to avoid sending your scissors or knife into the burned part. You must on no account *drag* the boot or stocking off, otherwise you will strip bare the injured part. When you see the part, there may be a big bleb or blister there; do not prick it, leave the doctor to be the judge of whether this should be done or not; but immediately place the limb in *warm* water, that is, water of the temperature of your own hand, or elbow. I tell you warm water, because that will be likely the fluid most quickly obtainable, especially if, as in this instance, there be any left in the kettle; the water excludes the air, is comforting if it is warm, and takes the pain away better than anything.

Now get some oil—linseed oil, olive or salad oil, cod-liver oil, almond oil, *not* mineral oils such as naphtha or paraffin; and if you or your neighbours have any lime-water, take equal parts of oil—say linseed oil—and lime-water, and mixing these together you will get a thick honey-looking fluid, called carron oil. Into the oil, either plain or with

lime-water, dip strips of soft rag or lint, and taking the limb out of the warm water apply the rags so as to completely cover the burnt part. Over this apply a thick layer of cotton wool, if you have got it, or flannel if you have not, and secure by gentle and even pressure with a bandage or handkerchiefs. Place the patient, with the burnt part in an easy position, on a bed or couch, and send for the doctor, if you have not already done so. Instead of oil, one may use flour, common kitchen whiting, prepared chalk as used for tooth-powder, either dusted on, or better still made into a paste, and then gently applied with a brush or feathers, making a covering about a quarter of an inch thick. If the pain is great, a strong solution of carbonate of soda in water may relieve it. Do not administer opiates if you can get a doctor within a reasonable time; but you should give the patient hot fluids to drink as he is suffering from shock, and requires in addition to the relief of the burnt part to be treated for shock (p. 119). A person when burnt suffers not from high temperature, but from cold and chill—shock in fact—hence the necessity of immediately applying heat internally and warm covering without.

If it is a burn and part of the clothing is charred and stuck to the skin, do not drag it off, but take a scissors and cut the clothing off, leaving the part adherent to come off as it will. Otherwise the treatment for burns and scalds is practically the same. Take particular care of even slight burns on the throat and below the chin, such as occur when the clothes catch fire. Scalded throat: see page 133.

When the lower part of a woman's dress catches fire proceed as follows:—Lay the patient down flat on the floor at once. If it is the front part of the dress which has caught, lay the patient on her back; if the back of the dress, on her face; if one side, lay her on the other. The reason of this

is easily understood when it is remembered that flames ascend perpendicularly. Should the patient be allowed to stand the flames will quickly ascend and envelop the face and neck, when dreadful consequences may ensue. Hence the treatment is—(1) prevent the person rushing about; (2) lay her flat on the floor; (3) smother the flames by a coat, mat, blanket, shawl, piece of carpet, or anything that is handy.

THE APPARENTLY DROWNED OR SUFFOCATED.

When a man—of course it may be a woman or child—who cannot swim, falls into deep water, he generally rises once, twice, or thrice to the surface, and struggles to get a gasp of air or a grasp of anything near. The state of intense alarm causes forgetfulness, and an attempt is made to breathe below the water; the consequence is, water gets into the air passages and he becomes asphyxiated and insensible. Should he be pulled out of the water in time he may be restored by some one of the methods of artificial restoration. What do you mean by "in time"? In the first place, it will be impossible to get a correct notion of the time he has been in the water from the bystanders; to some it will appear a long time—say, twenty minutes; to others it may seem only five; so that people may differ as much as fifteen minutes as to the time any person has been in the water. If it is a long time—say, over half an hour—it would be useless to attempt to restore life; but if there is a difference of opinion as to whether it was five minutes or fifteen minutes, begin to try to restore life at once. The directions given by the Royal Humane Society are here incorporated under the heading of the "Sylvester Method

of Restoring the Apparently Dead." There are other excellent methods, and chief among them, and by many preferred to the Sylvester method, is that of Dr. Marshall Hall. This is the best method if no assistant is at hand. It is performed by alternately rolling the body on its face to compress the chest, and on its back to allow the elasticity of the ribs free movement to draw air into the lungs. The pressure of the hand over the lower ribs whilst the body is on the face, helps the process of expiration. Another excellent method is that of Howard; but I am afraid that by telling you too many methods you will get confused by their complexity.

THE SYLVESTER METHOD OF RESTORING THE APPARENTLY DEAD.

Recommended by the Royal Humane Society.

If from drowning, suffocation, or narcotic poisoning:

Send for medical assistance, blankets, and dry clothing, but proceed to treat the patient *instantly*.

The points to be aimed at are—first, and immediately, the restoration of breathing; secondly, after breathing is restored, the promotion of warmth and circulation.

The efforts to restore life must be persevered in until the arrival of medical assistance, or should no signs of life appear after, say, an hour and a half.

DR. H. R. SYLVESTER'S METHOD OF RESTORING NATURAL BREATHING.

Rule I.—To adjust the patient's position. Place the patient on his back on a flat surface, inclined a little from the feet upwards; raise and support the head and shoulders on a small firm cushion or folded

article of dress placed under the shoulder-blades. Remove all tight clothing from about the neck and chest.

Rule II.—To maintain a free entrance of air into the windpipe. Cleanse the mouth and nostrils, open the mouth; draw forward the patient's tongue, and keep it forward. An elastic band over the tongue and under the chin will answer this purpose.

Rule III.—To imitate the movements of breathing:

First. Induce inspiration. Place yourself at the head of the patient, grasp his arms, raise them upwards by the sides of his head, stretch them steadily but gently upwards, for two seconds.

[By this means fresh air is drawn into the lungs by raising the ribs.]

Secondly. Induce expiration. Immediately turn down the patient's arms, and press them firmly but gently downwards against the sides of his chest for two seconds.

[By this means foul air is expelled from the lungs by depressing the ribs.]

Thirdly. Continue these movements. Repeat these measures alternately, deliberately, and perseveringly, fifteen times in a minute, until a spontaneous effort to respire be perceived.

[By this means an exchange of air is produced in the lungs, similar to that effected by natural respiration.]

When a spontaneous effort to respire is perceived, cease to imitate the movements of breathing, and proceed to induce circulation and warmth (as below).

Rule IV.—To excite respiration. During the employment of the above method, excite the nostrils with snuff or smelling-salts, or tickle the throat with a feather. Rub the chest and face briskly, and dash cold and hot water alternately on them

FIG. 73.—Inducing inspiration.

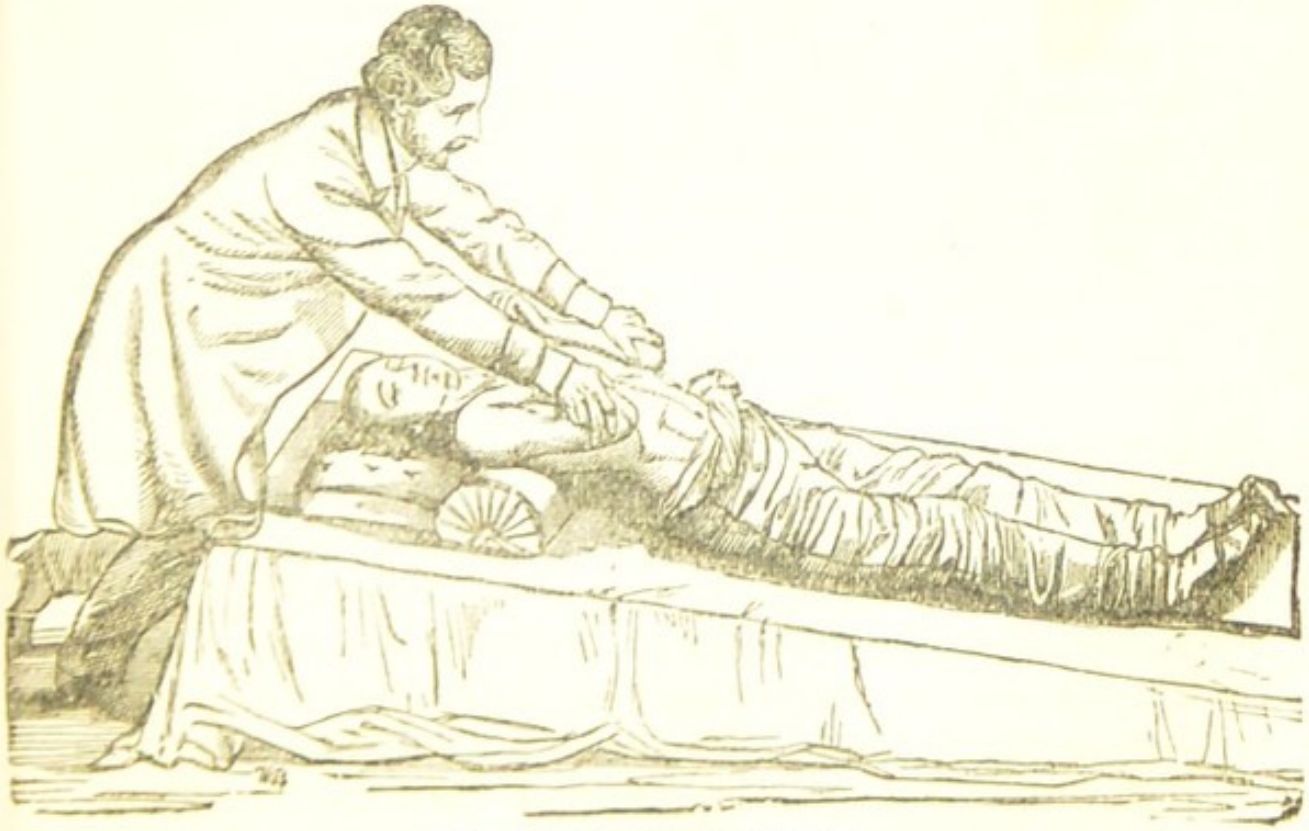

FIG. 74.—Inducing expiration.

Friction of the limbs and body with dry flannels or cloths should be had recourse to. When there is proof of returning respiration, the individual may be placed in a warm bath, the movements of the arms above described being continued until respiration is fully restored. Raise the body in twenty seconds to a sitting position, dash cold water against the chest and face, and pass ammonia under the nose. Should a galvanic apparatus be at hand, apply the sponges to the region of the diaphragm and heart.

Treatment after Natural Breathing has been restored. — *To induce Circulation and Warmth.* Wrap the patient in dry blankets, and rub the limbs upwards energetically. Promote the warmth of the body by hot flannels, bottles or bladders of hot water, heated bricks, etc., applied to the pit of the stomach, the armpits, and the soles of the feet. On the restoration of breathing, when the power of swallowing has returned, a teaspoonful of warm water, small quantities of wine, warm brandy-and-water, or coffee, should be given. The patient should be kept in bed, and a disposition to sleep encouraged. During reaction large mustard-plasters to the chest and below the shoulders will greatly relieve the distressed breathing.

Note.—In all cases of prolonged immersion in cold water, when the breathing continues, a warm bath should be employed to restore the temperature. An emetic will do good.

Suffocation, or Asphyxia, comes about in various ways: choking on a piece of meat; inhalation of smoke, as in a burning house; inhalation of poisonous gas, as from a charcoal fire with insufficient ventilation, or escape of coal-gas; swallowing irritating fluids, such as caustics or boiling water; attempts at hanging. This is also the condition induced in drowning.

When suffocation takes place by a piece of *meat* filling up the air passages, the patient, whilst laughing or busily talking when the mouth is full, starts up from the table, turns blue in the face, attempts to pass the fingers to the back of the throat, and then drops down insensible. The bystander should at once open the mouth, pass the forefinger down behind the tongue, and attempt to dislodge the particle of meat. No half-measures will do; this must be done at once, and decidedly. If the piece of meat is removed, but the patient does not come to, perform artificial respiration (see p. 130). If the piece of meat does not completely obstruct the air passages, there will be probably violent spasmodic cough, with much difficulty in breathing, and the patient points to the throat. Here also open the mouth and remove anything you can see or feel with the finger. Thump the back hard, bending the body at the same time well forwards. If it is a child, and death likely to ensue, hold it up by the heels and thump the back hard.

If the suffocation comes from *smoke or gas*, get the patient into fresh air, and perform artificial respiration (p. 130).

A common form of suffocation in children is brought about by their attempting to drink from the spout of a kettle which contains boiling water. The reason of their so drinking is that the kettle is used frequently by the poorer classes to make tea in, and the child, when it gets its mother's back turned, wants to get a drink of tea. It is not likely that any of the water is actually swallowed, but enough is taken to cause choking, cough, and suffocation from the swelling at the back of the throat and in the windpipe.

Treatment: Send at once for the doctor, and whilst he is being fetched, wrap the child in a blanket, apply hot sponges or hot flannels, dry or

moist, to the throat, and set in an armchair before the fire. As in scalds elsewhere, oil—linseed, salad, or cod-liver oil—may be given in dessert-spoonful doses. If one can get ice, give the patient small pieces to suck.

Sunstroke comes on suddenly whilst exposed to the direct rays of a hot sun, but heatstroke may come on at night. In the first place, take all sensible precautions against these, by wearing a good thick felt hat with a wide brim, or a pith helmet, such as our soldiers now wear in India, with a good broad flap of linen hanging down behind so as to guard the nape of the neck. Cover the hat too with white calico, and do not, if you can help it, expose the nape of the neck to the rays of a tropical sun.

In case you are anywhere where you cannot get medical aid, act as follows:—Strip the patient of his outer clothes; lay him down with his head and shoulders a little raised, and give him a cold douche, and plenty of it, by pouring jug after jug of cold water, from the height of three or four feet, on the top of his head and down his spine; or better, apply an ice-bag, if you can get it, to the head. Sponge also his hands, feet, and chest with cold water. Keep him in a darkened room, and where, if it is to be had, there is a nice cool draught, and let him lie perfectly quiet and undisturbed. If he seems likely to sink altogether, put a blister or a mustard poultice on the nape of the neck.

Frost-bite.—Take great care not to bring the patient into a warm room or near a fire; or the most dreadful consequences may ensue, such as the loss of a limb, mortification, and so on. Rub the part affected, with snow in a cold room, and then bathe with ice-cold water, or lay bits of linen on the part soaked in ice-cold water; thus let the circulation be slowly restored. After a time give a little cold weak brandy-and-water.

How to remove a Foreign Body from the Eye.—Do not rub the part; you will only press the substance, if it be sharp and hard, into the eyeball, and thereby do much damage.

Take hold of the upper lid and pull it forwards, and at the same time push up the lower lid inwards beneath the upper; let both go and allow them to rearrange themselves; the hair of the lower lid will brush the back of the upper lid, and may thus remove the foreign body. Do this once, twice, or thrice. This will usually remove the annoying smuts which find their way into the eye in a railway carriage. You can do it to yourself or others.

If you can get a basin of water, put your face into it and open and shut your eyes. Take a pinch of snuff if it can be got; the sneezing may help dislodgment. If none of these are of any use, pull down the lower lid and examine for the irritating particle on its inner side; if not there, examine the upper eyelid. To do this get the patient to sit down, put a towel over the head, place the head back against your chest as you stand behind him; now press a penholder, or fine stick, or stout wire on the skin three-fourths of an inch above the edge of the upper eyelid, and, pushing it back, seize the eyelashes of the upper lid between the finger and thumb, and pull them forwards and upwards, everting the lid by pulling it back over the penholder. You can thus examine for the foreign body and remove it if it is there. If you can see a piece of steel *fixed* into the clear part of the eye, drop in a few drops of olive oil, apply a lump of cotton-wool or sheep's-wool on the closed eyelid, and tie up with a handkerchief, exercising slight pressure on the eyeball so as to keep it quiet, and take the patient at once to the doctor. Bandage the eye as shown at p. 63.

To remove a Foreign Body, such as a Pea or Bead, from the Ear.—In the first place, if there is

a doctor within twenty miles, procure his help; meanwhile, do not touch the pea, nor allow the child to push its fingers into its ear, even tying its hands down to prevent it so doing.

If on board ship, with no doctor, pass the narrow blade of a pocket-knife above the foreign body, taking care not to press upon it whilst so doing; rather wound the ear than touch the pea or bead. You should make up your mind to extract it at the first try, as each successive attempt further removes the possibility of getting it out. Instead of, and better than a knife, a wire with its extreme end slightly bent so as to make a tiny hook, or if available a Waverley pen with its bent-back tip, will suit admirably. The hook is to be passed above the pea or bead with the point of the hook towards it; and when once passed over the foreign body it is simple enough to extract by tilting it out. Why you must be careful about this apparently little operation is that, if once the foreign body gets far in, inflammation of the ear or brain may ensue.

To remove a Foreign Body from the Nostril.—Give a pinch of snuff or of pepper, so as to cause sneezing. Let the patient blow the nose violently; or, blocking up the side where the foreign body is not, let the air escape forcibly by fits and starts from the nostril containing the body. A fine hair-pin curved at the bent end is sometimes successful in dislodging button or pea.

WHEN A NEEDLE BREAKS OFF after penetrating the skin, the patient must be taken at once to a doctor to have it extracted. If on board ship, with no surgeon, cut down with a razor or sharp knife on the needle, and remove it with sugar-tongs if you have no other forceps.

POISONING.

The subject of poisons is so large that it is possible to tell you only the most meagre details as to symptoms. The treatment I shall make as general as possible, so that you will have a simple, sufficient, and safe guide.

Some poisons induce sleep; others cause delirium; whilst a third class cause destruction of the tender lining of the mouth, throat, and stomach. This classification, although not technically correct, will be sufficient to guide you in your treatment until medical aid arrives.

I. The poisons which induce sleep, called *narcotics*, contain opium in some form. Laudanum, morphia lozenges, many cough lozenges, and a few of the better-known children's elixirs, such as paregoric, Godfrey's cordial, and Mrs. Winslow's soothing syrup, are types of the class.

The **treatment** is, the administration of an emetic (see p. 138), and attempts to keep the patient awake. This is done by walking the patient about, slapping the face and neck or chest with a wet towel, and the administration of strong black coffee. Slapping the soles of the bare feet with a slipper is calculated to keep the patient awake.

II. The poisons which produce destruction of the lining of the mouth, throat, or stomach are the strong acids and alkalies and some metals.

The *acids* most commonly taken as poisons are: (1) oxalic (the salts of sugar, salts of sorrel); (2) carbolic; (3) sulphuric (oil of vitriol); (4) nitric (*aqua fortis*); (5) hydrochloric (spirit of salt).

The *alkalies* most commonly taken as poisons are caustic potash and soda. These poisons are called collectively, *corrosives*. The most evident symptom, of having swallowed a caustic (acid or alkaline) is

the marks on the lips. Wherever the caustic has touched there will be stain.

Treatment.—Send for a doctor. Do *not* give an emetic, when stains are seen on the lips, but administer: (1) linseed or salad oil; (2) demulcent drinks, as barley-water. In acid-poisoning, give alkalies, such as a teaspoonful of magnesia or chalk, if it is to be had; if not, scrape the ceiling, or give common kitchen whiting. In poisoning by alkalies, give acids; the most handy one is vinegar, the acetic acid in it counteracting the action of the alkali.

The **metals** most commonly taken as poisons are: (1) arsenic; (2) mercury (corrosive sublimate); (3) antimony (butter of antimony, or tartar emetic); (4) lead (sugar of lead); (5) phosphorus. These poisons are called, collectively, *irritants.* The symptoms would be metallic taste in the mouth, pain at the pit of the stomach, retching and great dread and alarm.

TREATMENT: Send for the doctor. 1. GIVE AN EMETIC. To do this, adopt one or other of the following methods: (*a*) tickle the throat with the finger or a feather; *b*, give a dessert-spoonful of mustard in a breakfast-cupful of warm water; (*c*) a tablespoonful of salt may be used instead of mustard, but mustard is the better. (*d*) If these have no effect, send to the nearest chemist, if the doctor is not at hand, and tell him to send an emetic.

2. Administer a couple of raw eggs, beat up; if they are not to be had, milk or some strong tea. Do this either before or after the emetic has had effect.

3. It is safe to give oils in all cases except phosphorus poisoning.

III. To the third class belong those which produce excitement and convulsions; chief amongst these are prussic acid and strychnia. The excitement induced is immediate, and all that can be done is

to try to prevent a fit or convulsion coming on by slapping the face or dashing cold water sharply in the face. Administer an emetic if the condition admits of it, *i.e.* if the patient is not convulsed.

IV. Alcohol is the chief type of the class of inebriants. It is the treatment of collapse from drink only that requires attention. Frequently do we meet with a poor wretch huddled in a heap in a doorway, who is the subject of this condition. The patient will be found speechless, motionless, insensible, and with a pale or bloated countenance. The odour of the breath, the pallor of the face, the weak pulse, the slow snoring respirations, and the dilated pupil, may, collectively, decidedly pronounce this to be what we are discussing; but mistakes are so frequently made between this and other serious conditions, notably apoplexy, that you must always give the patients the benefit of the doubt, and take them to a hospital or a doctor instead of sending them, on your own responsibility, to a police cell.

When you are sure of the condition of your charge, and no medical man at hand, induce vomiting and prevent collapse by applying warmth externally and administer hot drinks of tea, milk, etc.

A Summary of Simple Directions for the Treatment of Poisoning.—*On all occasions send for a doctor at once.*

A. If you do *not* know what the poison is—

Get mustard, eggs, flour, milk, and tea.

1. Administer a dessert-spoonful of mustard in a teacupful of warm water as an emetic. [You may also send to the chemist for an emetic in case the mustard should fail. The chemist will know what to send, either twenty grains sulphate of zinc, or one ounce ipecacuanha wine, for one dose for an adult.]

2. Have the tea being made ready for use.

3. Break two or three eggs into a basin, beat them up, and administer at once; or give a handful of

flour beat up into a cream, with water; a cupful of milk will do some good, if neither of these be handy.

4. Vomiting will probably speedily come on; if it does not do so within ten minutes, repeat the mustard emetic, or give the emetic the chemist has sent, if it has come.

5. When vomiting has ceased give the patient a cupful of strong hot tea and put him to bed.

B. If you do *not* know what the poison taken is, *but find stains on the lips*—

N.B.—Do not give an emetic.

1. Give at once a wine-glassful of olive (salad or sardine) oil, linseed oil, cod-liver oil, castor oil, or almond oil (*not oil of almonds*).

2. Put the patient to bed, apply smelling-salts to the nose, if need be, and hot sponges to the throat if there are signs of choking.

C. If you *do know* what the poison is, I would advise you to proceed with the use of the simple remedies, and do not attempt to remember antidotes. Did I tell you them, you would forget when you came in a hurry to search your memory, say five years hence; and whilst perplexing your brain over, it may be, a useless antidote, the object of your care may have slipped through your fingers for want of a cup of milk.

Remember the following broad facts:—*When a person has swallowed a poison and threatens to go to sleep, keep him awake; when he seems going off into a fit, dash cold water in his face; when there are no stains about the mouth, give an emetic, eggs, milk, or oils (except in phosphorus), and end up with tea; when there are no stains about the mouth, give oils, but no emetic.*

METHODS OF CONVEYING THE SICK AND WOUNDED.

Methods of conveying the sick and wounded are occupying the minds of many at the present time, and it must be allowed that, although some advance has been made, there is yet much to be done. No man has done so much in this, or in any other, country to further (or almost create) the knowledge we have at present as to the means of conveyance in civil life as has Mr. John Furley. Working under the auspices of the St. John's Ambulance Association, he has been the means of teaching how to bring a man along a crowded street, from the bottom of a coal-pit, from the street to the house, from the bed down the narrow staircase to the litter or waggon at the door. Single-handed he has introduced appliance after appliance, improvements one after another, until the fruits of his labours are being completed by the development of what promises to be an available ambulance equipment for London. In this country, at the present moment, there are four systems of ambulance at work, exclusive of the conveyance of infectious cases:—

1. The Medical Staff Corps of the Army, possessing its trained bearers, hospital orderlies, compounders, cooks, etc., etc. Head-quarters: Whitehall Yard, London.

2. The National Aid Society, which possesses no permanent trained staff, but on the occasion of a war breaking out sends medical men to take charge of the sick in the field and in the hospital. Offices: Adelphi, London, W.C.

3. The St. John's Ambulance Association, with the work of which every one is familiar. It has for its object the diffusion of a widespread knowledge amongst the civil population of how to render "first

aid to the injured." Offices: St. John's Gate, Clerkenwell, London, E.C.

4. The Volunteer Medical Staff Corps, a corps formed to supply to the volunteers a body of trained bearers and hospital attendants, bearing the same relation to the volunteers as does the Medical Staff Corps to the regular army. Head-quarters: 26, King William Street, Strand, London, W.C.

Two of these, the first and fourth, are military bodies, and have a special form of drill from which there is no need for departure. No. 2 has no permanent staff. No. 3 has to do with the civil population, has to teach in as few words and as simple a manner as possible, and has a wide scope for teaching, namely, all humane persons.

The less complicated the drill the more likely is it to be learned and remembered, and the more easy is it to tell the uninitiated what to do when one has to give directions in a street accident.

It would be well to dismiss the word "drill" altogether from the St. John's Ambulance Association work, but to allow of teaching some form must be gone through to communicate the facts hereinafter enumerated. The careful training a soldier receives as to bayonet exercises in regard to the exact guards and thrusts of defence and offence seem quite useless before an Arab spearsman, who will not fight according to European usages. But the drill familiarizes the soldier with his weapon, and the guards and thrusts laid down for him are meant chiefly as the means of teaching him how to quickly handle it. So with the ambulance drill—the rules laid down for manipulating a stretcher are only means of familiarizing the bearer with his instrument.

The following plan seems to be the one calculated to set forth the different means of conveyance most clearly. Carriage by hand, by stretcher, by waggons,

by railway, by cacolets and litters give the sum of the means employed in this country.

It is not intended here to describe the apparatus, but simply the means of lifting and carrying employed in the conveyance of the sick. The apparatus is fully described by Surgeon-Major Evatt in his Ambulance Handbook, which forms a companion volume to "Accidental Injuries," and is published by William Clowes and Sons, Limited, 13, Charing Cross, S.W.

CARRIAGE BY HAND.

I. *When only one bearer is available.*—1. In a case, say, of sprained ankle, when the patient can stand and use one of his lower limbs, proceed as follows:—The bearer takes his stand on the patient's injured side—say, the right. The patient then places his right arm around the bearer's neck, the bearer seizing the wrist of the encircling arm with his right hand. The bearer then passes his left hand behind the patient's body, and grasps his left hip. The patient being now told to hop, does so on the left foot, the right (the injured foot) being held up behind. In this way a patient can be conveyed at a good rate for a considerable distance. If the bearer is strong enough he should draw the patient right in to him or herself, and carry the patient bodily.

2. By the fireman's lift. The patient by this plan is thrown across the bearer's back as follows:—The bearer, standing in front of the patient, seizes the patient's right wrist with his left hand. The bearer then bends down in front of the patient until the right shoulder is on a level with the patient's right hip-joint. The bearer then pulls the patient across his shoulders, and, grasping the legs with his right arm, assumes the erect position, and carries the patient well poised on his shoulder.

II. *When two bearers are available.*—N.B. When two persons stand alongside each other, one is, of course, on the other's right hand; in subsequent reference the person on the right of the other is called the right bearer, and naturally the second is called the left bearer.

1. Carriage by the two-handed seat. The bearers face each other; the right bearer presents his right hand for the left bearer to grasp with his left hand, or *vice versâ;* the free hand of each bearer then grasps the clothing over the waist or shoulder of the other, to form thereby a support for the patient's back. Be sure that the palms of the clasped hands are brought closely together. The patient now sits down on the clasped hands of the bearers, which are placed just below the middle of the patient's thighs. The patient, if capable of so doing, encircles the bearers' necks with his arms. The bearers should incline their bodies towards each other behind the patient.

2. Carriage by the three-handed seat. The bearers face each other; the right bearer grasps his own left forearm; the left bearer with his left hand grasps the right bearer's right forearm; the right bearer then with his free (left) hand grasps the left bearer's left forearm. A triangular seat is thus formed. The free (right) arm of the left bearer is placed on the right bearer's shoulder, thereby affording a support to the patient's back. The patient encircles the bearers' necks as before.

This is a much stronger seat than the two-handed, but the patient is much higher up, and, if in a fainting condition, may tumble forwards.

3. Carriage by the four-handed seat. The bearers face each other; each grasps his own left forearm with his right hand, and, approaching hands, each seizes the right forearm of the other with the disengaged hand. A "sedan-chair" is thus formed.

It is necessary that the patient should place his arms around the bearers' necks, as he has no support for his back by this method. The bearers by approaching their rear shoulders (the right bearer's left shoulder, and the left bearer's right shoulder) can carry the patient more easily. The same objection applies to this plan as to the former, namely, that the patient is high above the bearers' heads.

By one or other of the methods given the patient can be carried a short distance from a bed to a chair, from room to room, or placed in a waggon or conveyance.

CARRIAGE BY STRETCHERS.

Stretchers consist essentially of a couple of stout poles about eight feet long, with a piece of canvas or some such stout material stretched between them, and on which the patient lies.

Of the many forms of stretcher only a few will be noticed.

1. The hospital stretcher is the best and most simple of all; it is, however, not suited for a field or street work, as there are no feet to the poles, and the canvas must lie on the ground. The hospital stretcher consists of a piece of stout canvas with a sheath for the poles at either side. The canvas is passed in below the patient whilst he is rolled on his side, the poles are slipped into their sheaths, and a couple of iron rods (traverses) are applied some few inches from the handles at either end to keep the poles apart.

2. Field stretchers. There are three in use:

(*a.*) The army regulation stretcher, devised by Surgeon-Major Faris, has four wooden wheels, so that the patient is raised off the ground, and by which it is possible for the stretcher to be rolled into an ambulance waggon.

(*b.*) Lieutenant Maclure's stretcher is adapted with brass self-adjusting legs with small wheels.

(*c.*) Mr. Furley's stretcher, as used by the St. John's Ambulance Association, has metal arcs as feet, and a self-adjusting pillow.

All the patterns have flexible traverses, which are capable of being straightened or bent by pulling on the traverse rods.

METHODS OF PLACING A PATIENT ON A STRETCHER.

N.B. — Copied by kind permission of the St. John's Ambulance Association from Shepherd's Handbook.

STRETCHER EXERCISE, No. I.

For three Bearers. To be used when space will allow.

1. The instructor selects the bearers and numbers them— 1, 2, 3, at his discretion. Should one man be taller and stronger than the others, he should be styled No. 1, as he will have to bear the heavier part of the burden.

All orders will be given by No. 3.*

2. "PLACE THE STRETCHER."

No. 1, taking the head of the stretcher, and No. 2 the foot, places it in a line with the patient's body, the foot of the stretcher being close to his head.

No. 3 attends to the patient, assisted by Nos. 1 and 2 when necessary.

3. "FALL IN." At this order,

No. 1 places himself at the patient's right side,

No. 2 at his left side, and both bearers face each other.

No. 3 takes position on the injured side in a line with the patient's knees.

Note.—The duty of No. 3 will be entirely to look after the injured part of the patient's body or limbs, to see that no

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* Bearers should be taught to take any of the positions named in the following exercises, whether that of No. 1, 2, 3, or 4 bearer.

bandages or splints become displaced, and also that No. 2 bearer, in lifting or carrying, does not in any way touch the patient's feet.

When everything has been arranged for the removal of the patient, the order will be given—

4. "READY."

Nos. 1 and 2 now each sink down on one knee and grasp each other's hands under the shoulders and thighs of the patient, whilst No. 3 places his hands underneath the lower limbs, always taking care, in case of a fracture, to have one hand on each side of the seat of injury.

5. "LIFT."

All three bearers rise together to their feet, keeping the patient in a horizontal position.

6. "MARCH."

All take short side-paces until the patient's head is over the pillow of the stretcher.

7. "HALT."

All three bearers remain steady, and wait for the next order.

8. "LOWER."

The patient is placed gently on the stretcher, and the bearers then stand up.

9. "FALL IN." On this order being given,

No. 1 places himself at the head of the stretcher with his face towards the patient, No. 2 at the foot with his back to the patient, and No. 3 places himself at the side of the patient.

10. "READY."

Nos. 1 and 2 stoop down and grasp the handles of the stretcher, having previously adjusted their shoulder-straps in case they are used.

No. 3, as soon as he sees all is right, gives the word—

11. "LIFT."

The stretcher is now raised to position ready for moving off.

12. "MARCH." On this word being given,

No. 1 steps off with the left foot, and No. 2 with the right.

The step should be a short one of twenty inches, and taken with bent knees just from the hips.

13. "HALT."

The place of destination being reached, on the word "Halt" being given, the bearers remain steady in position.

14. "LOWER."

At this order the bearers place the stretcher on the ground, and then stand up

15. "UNLOAD STRETCHER—READY."
The bearers prepare to take the patient off the stretcher.

16. "LIFT."
The bearers raise up the patient as before instructed.

17. "LOWER."
The patient is carefully lowered upon the vehicle, bed, or other place to which it has been designed to carry him.

STRETCHER EXERCISE, No. II.

For four Bearers. To be used when there is not sufficient space for carrying out Exercise No. I.

1. The instructor numbers the bearers—1, 2, 3, 4.
All orders will be given by No. 4.

2. "FALL IN."
At the words "Fall in," Nos. 1, 2, and 3 take position on one side of the patient. No. 1 places himself at the patient's shoulder, No. 2 near the middle of the body, No. 3 near the patient's feet. At the same time No. 4 places the stretcher on the ground by the other side of the patient, and remains standing near its centre facing the other bearers.

3. "READY."
Nos. 1, 2, and 3 stoop down, and kneel on the left knee if they are on the left side of the patient, on the right knee if they are on the right side of the patient. They then proceed to take hold of the patient:—No. 1 passing one of his arms beneath the patient's neck and the other under his shoulder-blades; No. 2 passing both arms under the middle of his body, one above, the other below the buttocks; and No. 3 passing both arms under the lower extremities, excepting in case of fracture, when he must place one hand on each side of the broken bone, so as to steady it. No. 4, when the word "Ready" is given, grasps the near pole of the stretcher with his left hand, and the opposite pole with his right hand, near the centre.

4. "LIFT."
On the word "Lift" being given, Nos. 1, 2, and 3 raise the patient up, each at the same time placing on the knee which is not touching the ground his elbow of the same side. While Nos. 1, 2, and 3 are thus raising the patient, No. 4 moves the stretcher into proper position under him and kneels down on one knee by its side.

5. "LOWER."

At the word "Lower," Nos. 1, 2, and 3 carefully lower the patient down to the stretcher, while No. 4 at the same time assists in supporting and placing him on it.

6. "STAND TO STRETCHER."

On this order being given, each bearer stands up:—No. 1 goes to the head of the stretcher with his face towards the patient; No. 2 to the foot, with his back to the patient; while Nos. 3 and 4 remain in position on each side of the stretcher.

7. "READY."

Nos. 1 and 2 grasp the handles of the stretcher, having previously adjusted their shoulder-straps in case they are using them.

8. "LIFT."

At this word, Nos. 1 and 2 bearers raise the stretcher steadily together and stand up.

9. "MARCH."

All being ascertained to be in order, on the word "March" being given, Nos. 1 and 2 bearers move off:—No. 1 stepping off with his left foot and No. 2 with his right foot. Nos. 3 and 4 march on each side of the stretcher. On arriving at the place of destination, the following orders are successively given:—

10. "HALT."

11. "LOWER."

12. "UNLOAD STRETCHER—READY."

13. "LIFT."

14. "LOWER."

N.B.—These orders, viz. Nos. 10 to 14 inclusive, are to be carried out in a similar manner to orders Nos. 13 to 17 in Exercise No. 1.

STRETCHER EXERCISE, No. III.

When only three bearers are available, and the space is limited as before, the following alterations must be made in the foregoing (No. II.) Exercise:—

1. The instructor numbers the bearers—1, 2, 3.

All orders will be given by No. 3.

2. "PLACE STRETCHER."

No. 1 bearer places the stretcher on the ground by the side of the patient and as close to him as practicable.

3. "FALL IN."

The three bearers take the same position on one side of the patient as laid down in Exercise No. II.

4. "READY."

Nos. 1, 2, and 3 kneel down, placing themselves as close to the patient as they conveniently can, and then take hold of him as directed in Exercise No. II.

5. "LIFT."

Nos. 1, 2, and 3 raise the patient as directed in Exercise No. 2.

6. "LOWER."

At the word "Lower," Nos. 1, 2, and 3 lean forward so as to carry the patient over the stretcher, and then carefully lower him down upon it.

7. "STAND TO STRETCHER."

At this direction No. 1 goes to the head of the stretcher, No. 2 to the foot, and No. 3 remains in position at the side of the stretcher.

The remainder of this Exercise will be precisely the same as is given in Exercise No. II., from orders 7 to 14, both included—the instruction for No. 4 bearer to walk by the side of the stretcher being alone omitted.

STRETCHER EXERCISE, No. IV.

For use in Mines and narrow Cuttings where two men only can be engaged.

Necessary first aid having been given, Nos. 1 and 2 will carefully place the stretcher in a line with the injured man's body, the foot of the stretcher being, if possible,* close to his head.

No. 1 will give the word "Ready," when both get into position as follows :—

No. 1 places his feet one on each side of the patient between his body and arms, the toe of each foot as near the armpits as possible, standing over the man. He then stoops down and passes his hands between the sides of the chest and the arms underneath the shoulders, and locks the fingers.

If the patient's arms be uninjured he may put them round

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* It is not advisable to be too particular as to the head or foot of a stretcher in a mine, as it would probably be quite impossible to reverse it, and it is always competent for the bearers to lower the pillow.

the neck of No. 1, and by this means greatly assist him in lifting.

No. 2 at the same time places his right foot between the calves of the injured man's legs, as close to the knees as possible, and his left foot at the injured man's right side, close to the crest of the hip ;* he then kneels down and passes his arms round the outside of the patient's thighs at the lowest part, and locks his fingers behind just at the bend of the knees.

When both are ready, No. 1 will give the order "Lift and move forward." The patient is then to be slowly lifted just sufficient to allow his body to clear the stretcher. Both bearers will slowly and gradually move forward, No. 1 by very short steps, and No. 2 by bending his body forward over his left thigh, by which means he exercises a pushing movement which very greatly assists No. 1. No. 2, when he has bent his body forward as much as he can without moving his feet, advances his right foot to his left, then again advances his left feet and bends his body forward. This movement is to be repeated until the patient is laid on the stretcher.

The bearers will then act in the ordinary manner as far as the nature of the locality will permit.

(Signed) JOHN FURLEY,
Deputy Chairman, S.J.A.A.

Stretcher Exercise No. V., for which the author is responsible, is as follows :—When three bearers are available, place the stretcher in a line with the patient's body, foot of stretcher to the head or feet of the patient. Two bearers now stride across the patient, No. 1 opposite the waist, No. 2 opposite the knees. Both bearers bend down, and seizing the patient, No. 1 round the chest, and No. 2 just above the knees, raise him off the ground for a distance of about six inches, so as to allow the third bearer to push the stretcher between their legs and beneath the patient. The bearers then gently drop their burden on the stretcher.

* When the patient's legs are in splints and tied together, the feet of No. 2 must necessarily be placed outside.

IMPROVISED STRETCHERS.

1. The blanket stretcher. The blanket, rug, horse-cloth, plaid, or such-like, is spread out, and a couple of poles—say broom-handles, pitchforks, or goal-poles—are wrapped up in the blanket, one from each side, until within a foot of the centre. The patient is then laid on the stretcher, and four bearers, one at each corner, grasp the poles where they are wrapped in the blanket with both hands, one near the handle, the other near the centre of the pole. The bearers advance with an almost side step, owing to the awkwardness of walking whilst both hands are employed.

2. Coats are utilized as follows :—Take two coats ; invert the sleeves so that the inverted sleeve lies within the coat ; button each coat ; lay the coats in a line on the floor, the top of one coat touching the tail of the other ; place the back of the coats next the floor. Two long poles, or broom-handles, or the like, are pushed down the sleeves, and as these lie inside the buttoned coats a great deal of strength is given. Any ordinary coat will stand the strain. A couple of walking-sticks tied across the poles a few inches from each end, will keep the poles apart, and such a stretcher can be carried by two men.

3. Captain Russell's stretcher consists of strips of webbing about six inches wide and two feet long, with pole-loops (or sheaths) at either end. Four or six of these strips are passed in beneath the patient, and a couple of poles passed through the loops (or sheaths), one on each side. Traverses are slipped over the pole-ends, or a walking-stick is tied across to keep the poles asunder at each end. This stretcher is chiefly used for moving a patient from off a bed.

4. A stretcher can be improvised also of two poles with walking-sticks tied across at each end, and a rope passed round and round the poles. Instead of a rope, bands, belts, or knapsacks may be used.

5. A hammock slung on a pole, and borne on the shoulders of two bearers, makes a fairly good stretcher.

6. At the four corners of a blanket secure a strong loop; double the blanket and slip one pole through the four loops, and the other within the blanket fold. Four bearers are required as for the ordinary blanket stretcher.

AMBULANCE WAGGONS.

1. The ambulance waggon in use in the army is a huge four-wheeled vehicle drawn by two horses, set on easy springs, and available to carry eight patients, two lying down, three on the tail-board, and three on the front seat. The most seriously wounded are placed on the floor on stretchers.

2. In civil use are many forms of waggons, all excellent in their way. The St. John's Ambulance Association waggon, designed by Mr. Furley, is in general use in the London district in the conveyance of sick.

3. Improvised waggons are made out of country carts and waggons, dog-carts, donkey-carts, and such-like. When used for this purpose, the floors should be well covered with straw, and the stretchers conveying the wounded should be placed thereon. Loading such a waggon must be done by four people, as for the blanket stretcher. On arriving at the tail of the cart the two foremost bearers must get up on the cart, and gently raising the stretcher, carry it forward. It is well to lash the handles of the stretcher to the framework of

the cart to prevent jolting, rolling, or bumping against the tail-board. In many places no stretcher would of course be available; when such is the case, the patient is to be laid on the straw on the floor of the cart. When this happens, four bearers will lift and carry the patient to the waggon (see Stretcher Exercise No. II.). On arriving at the tail of the waggon, No. 4 will jump into the waggon, and, grasping the injured person under both shoulders, lift him in, assisted by the other bearers on the ground. When fairly in, all four bearers get into the cart, and place the patient comfortably.

To prevent the patient slipping down, so that the feet touch the tail-board, place a sack stuffed with straw or oats immediately beneath his hips.

No amount of improvising can ever convert a four-wheeled cab or a hansom into a fit ambulance for a case of broken leg; and it ought to be a punishable offence when any one, more especially a policeman, places a person so suffering therein. If the fracture is not made compound while going into the cab or whilst in the cab, it almost certainly will be when removal is attempted. Were every hospital in large towns to provide a means of conveyance in their immediate neighbourhood much suffering would be spared. Already such a system is in work in London around Charing Cross Hospital.

CARRIAGE BY RAILWAY.

1. Invalid railway-carriages. These are carefully built travelling hospitals with all necessary appliances. There are only three or four, however, in all Britain.

2. Second-class railway-carriage seats, being cushioned but not partitioned, are available for stretchers, two in each compartment. The carriage-door is just wide enough (1 foot 10 inches) to admit a

regulation stretcher with the least bit of tilt. Two cross-pieces of wood, one foot from each door, will give further support to the inner legs or wheels of the stretcher, and afford a seat for the attendant.

3. Goods, waggons, and cattle-trucks can be utilized for the conveyance of the injured. According to the Medical Staff Corps drill, there are two adopted methods, Grund's and Lavodovski's. By Grund's method strings are necessary to support the stretcher-poles. Lavodovski's method, however, is capable of being improvised thus: Into the top of the sides of the waggon insert four strong iron hooks or staples, two hooks being opposite each other. Between each pin, pass a stout rope from side to side of the waggon, lay the stretcher thereon, and lash the stretcher to the floor by ropes passed through a staple in the floor of the waggon, opposite each end of the stretcher, and twisted round the stretcher-handles.

A thick layer of straw, some two feet thick, affords a springy support to injured persons with or without stretchers. Stretchers with wheels or legs may be laid on the floor of a waggon, and fixed by ropes or baggage so as to prevent movement. The stretchers must not touch the waggon-sides.

Cacolets are folding chairs, hooked one on each side of a pack-saddle, carried by a mule or pony. The patients are necessarily in a sitting posture, their faces towards the animal's head. Patients suffering from fractures, or severe injuries to the lower extremities, or who are very weak, must not be put on a cacolet. The cacolet is loaded by two bearers carrying the patient by a hand-seat, back first, towards the chair, on to which he is raised. The feet are placed on the footboard, and the waist-straps buckled to keep the patient on.

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