

The apparatus used by the Greek and Romans in the setting of fractures and the reduction of dislocations.

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THE APPARATUS USED BY THE
GREEKS AND ROMANS IN THE
SETTING OF FRACTURES AND
THE REDUCTION OF DIS-
LOCATIONS.

BY

JOHN S. MILNE,
General Practitioner in Hartlepool (a smoky town
on the Northeast Coast of England).

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Let me point out that the scope of the paper does not cover the whole ground of the wide knowledge possessed by the ancients on the subject of fractures and dislocations. It is merely an enumeration of the apparatus used in the treatment of these, with short extracts indicating the method of employing them. The authorities on the subject are Hippocrates, in his works on Fractures and Articulations, 460 B. C.; Galen in his commentaries on these (130-200 A. D.); Celsus (about 20 A. D.); a chapter by Heliodorus preserved in the works of Oribasius (325 A. D.), and the little encyclopedia of Paulus Ægineta (6th Century A. D.) I have also taken a few illustrations from the *Armamentarium* of Scultetus.

In the treatment of fractures the ancients employed, as we do to-day, splints, pads and bandages.

Hippocrates in his book on *Fractures* gives a very complete account of the method of applying these.

First of all, the limb was smeared with a waxy composition, called cerate, in order to prevent the bandages from slipping. The bones having been got into position by means of extension and other manipulations, a roller bandage soaked in cerate (Fig. 1) was fixed by one or two turns round the seat of the fracture, and then carried upward for several turns. (Fig. 2.)

Next, a second waxed bandage was applied, beginning as before at the fracture, passing downwards for several turns (Fig. 3), and then upwards to end at the same spot as the first bandage.

Next, elongated pads, formed of folded linen and stiffened with cerate, (Fig. 4) were laid along the limb in such a way as to cover it completely, and fixed by the application of roller bandages which had as before been dipped in cerate.

No splints were applied at this time, so that so far, the treatment corresponds in principle to the immovable bandages of gum and chalk or plaster of Paris which we employ to-day. On the third day, the swelling of the part having subsided and the bandaging having become somewhat loose, the whole was removed and the limb bathed with hot water, and the bandages and pads were applied as before.

Three days afterwards, *i. e.*, on the seventh day from the accident, the swelling was expected to be quite gone, and the bandages again



FIG. 1. Waxing a bandage. After Scultetus. Double spatulæ of the form shown are found among ancient Roman instruments from Pompeii.

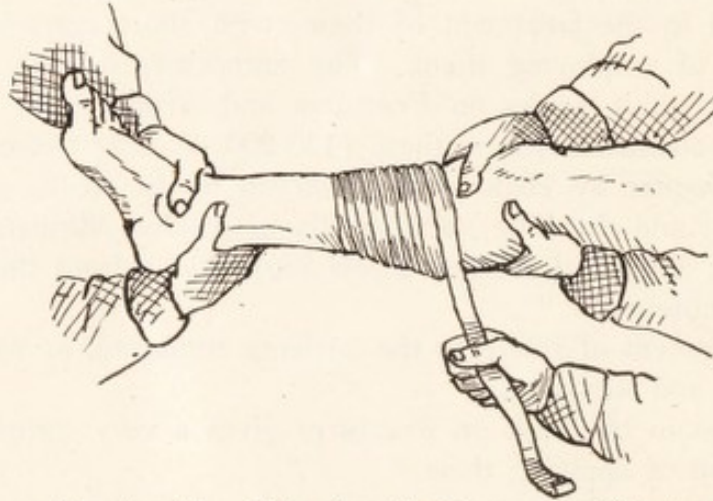


FIG. 2. Waxed bandage fixed over site of fracture and carried upwards for several turns. After Scultetus.

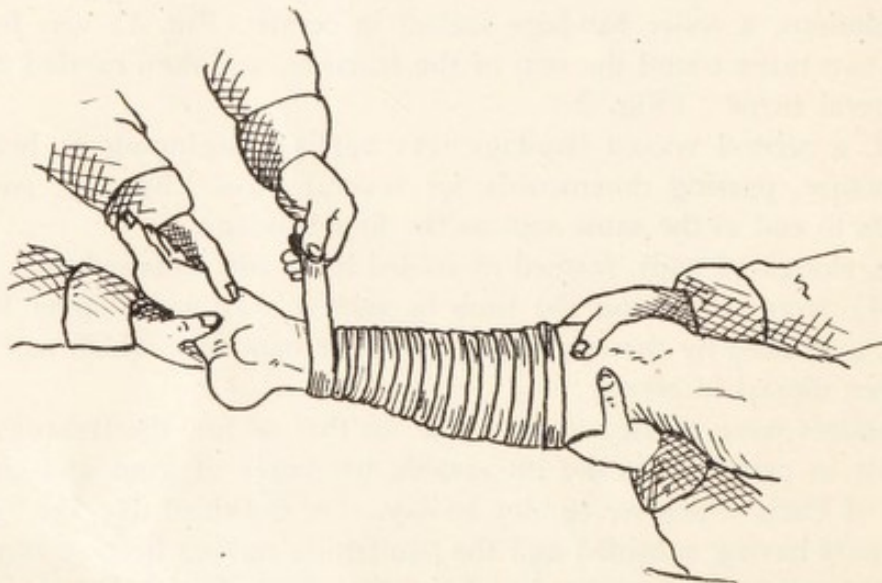


FIG. 3. Second waxed bandage fixed over the site of fracture and carried downwards for several turns, preparing to return upwards and end at the top of the first bandage. After Scultetus.

loosened, and now these having been removed and the limb having been bathed, the pads and bandages were put on as before, but this time splints were applied in addition. (Fig. 5.) These were narrow and rod-like, and were arranged all round the limb, the breadth of a finger intervening between each, and were kept in place by three or four strings tied just tight enough to keep the splints in position without their action contributing at all to the compression of the part. The splints were examined every third day till bony union had taken place, and the whole dressing was reapplied whenever it became loose.

In addition to the fixation by the above methods the part was further put at rest by a sling, in the case of the upper limb, and in that of the lower, by elevating it in bed on a pillow or a box splint.

Compound fractures were not treated with splints until the wound had healed, but were lightly put up in pads and bandages and laid in a box splint and dressed frequently. If there was much discharge, a goat's skin was placed beneath, to catch the discharge and embrocations.

We shall now consider a little more fully each of the materials mentioned above.

Roller Bandages. Hippocrates says that the bandages should be clean, light, soft, thin, and without seams, yet strong enough to bear stretching. Their breadth should be proportionate to the part under treatment. They should be three, four, or five finger breadths broad, and as many cubits in length.

Rolling should be practiced with both hands together, and with either separately, and it should be done quickly, elegantly and without causing discomfort to the patient.

Sometimes the turns were to be made to the right, and sometimes to the left, and sometimes a double headed bandage was to be used and applied crosswise. After the bandage was on, it was to be finished off by stitching with a needle and thread, lest a knot should cause discomfort.

All the methods of applying the roller bandage which we now employ, together with many other complicated methods, are described by the ancients, and will be found described and figured in the works of Oribasius in the edition of Stephanus (*Medicæ Artis Principes*) and also in Scultetus.

Pads (or "Compresses"). These were made of linen folded three or four times. They were three or four fingers in breadth, and their length was proportionate to the part.

They were applied longitudinally in such number as to encircle the limb.

In applying splints extra pads were put on parts where the bone projected, as at the ankle.

Splints. Hippocrates says these should be smooth, even, rounded at the ends, and concave. They should be secured with strings. Those at parts where bone was prominent should be short so as not to press on the part.

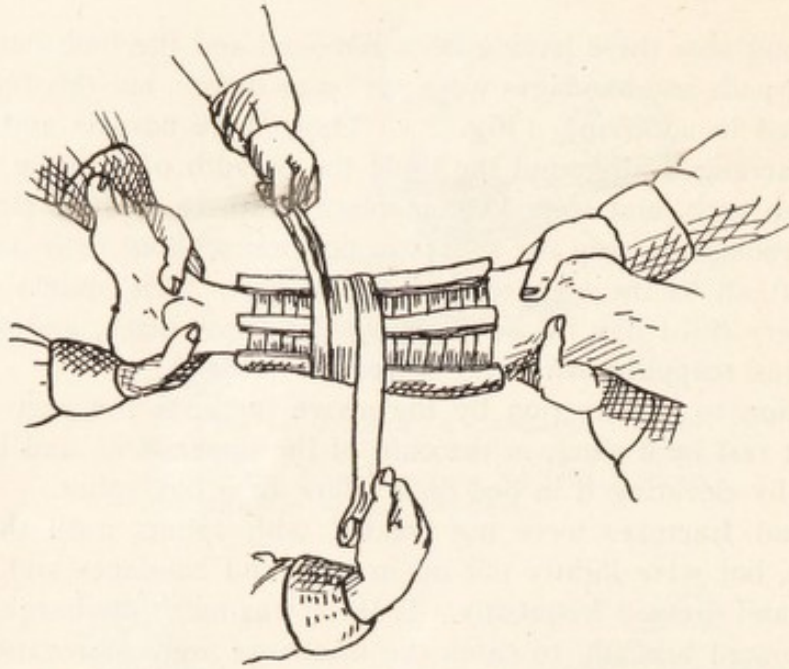


FIG. 4. Applying the waxed compresses over the bandages. After Scultetus, but Hippocrates says the compresses ought to completely surround the limb and not be separated from each other by a space as this figure shows. It makes the pads look like splints.

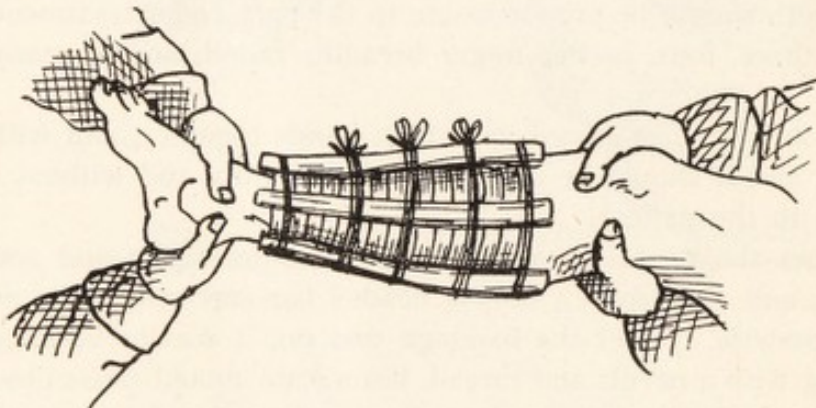


FIG. 5. Applying the splints on the seventh day. After Scultetus. First the two bandages have been put on, then the waxed pads, the bandaging to fix which can be seen under the splints.

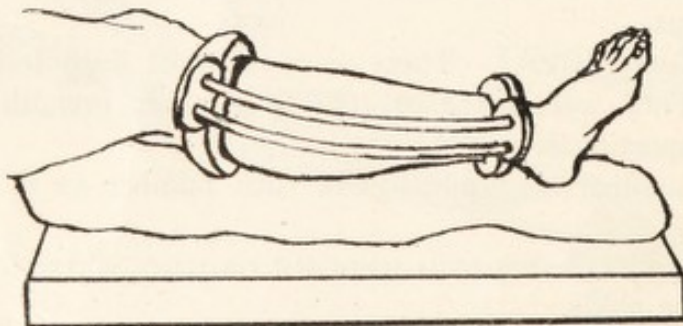


FIG. 6. Splint for leg-fracture described by Hippocrates. Made of elastic rods fitting into loops on shackle-like pads above the ankle and below the knee. After Littré.

Palladius says that they should be made of the wood of the lime tree, or, where this could not be procured, reeds were to be used. They were to be round, and secured with three loose fillets or ribands, one at their upper, and one at their lower end, and one at the middle.

Paulus Ægineta says that they should be arranged not more than one finger's breadth from each other.

Special Splints. A special form of splints for fractures where the deformity could not be kept reduced by ordinary methods is described by Hippocrates.

"One should sew two round pads of Egyptian leather, such as are worn by persons confined for long in shackles, and the pads should be deeper on their aspect facing the wound, and shallower on that facing the joint, and they should be well stuffed and soft and easy fitting, the one to the part above the ankle, and the other to the part below the knee.

"Each pad should have two loops on its inner aspect and two on its outer. (Fig. 6.)

"Then taking four equal rods of the wood of the cornel tree, each of the thickness of a finger, and of such a length that they can be fitted into the loops by bending, adjust them, two on the inside of the leg and two on the outside.

"They should be of such a length that suitable extension may be kept up.

"The two which are uppermost (as the patient lies on his back) may be tied together. (Fig. 7.)

"If the apparatus does not fit properly it will do more harm than good, as indeed any other contrivance will."

Galen, commenting on this passage, says that the pads which Hippocrates describes as round are really like snakes or like the sausages which butchers make, by filling intestines with chopped meat or other such food.

Minor Splints. In fracture of the lower jaw Hippocrates bound the teeth together with gold wire, and applied a light splint of moulded leather on the outside of the jaw.

In fracture of the nose, Paulus Ægineta says that tents of cloth were applied to each nostril. Some sewed into these the quills of goose feathers, so that the patient could breathe through these.

Box Splints. Hippocrates says that he is rather at a loss whether to recommend box splints or not. They are of some use, but not of so much as many suppose, and a board, unless padded, is rather an uncomfortable thing for a limb to lie on. (Fig. 8.) However, the common people have more confidence in the treatment where they are used; and they are useful in such times as the bed requires rearranging or the patient has the bowels moved.

If used at all they should be of sufficient length. Those for fracture of the thigh should reach from the hip to the heel, for, if flexion of the knee be allowed, distortion of the part is caused.

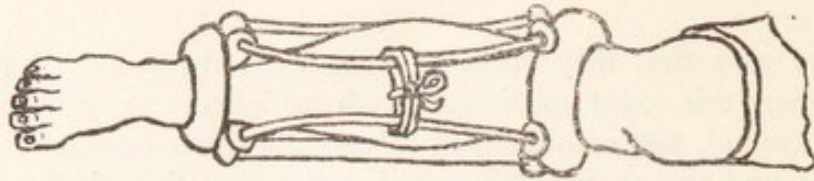


FIG. 7. Top view of the same to show the tying together of the two top rods.

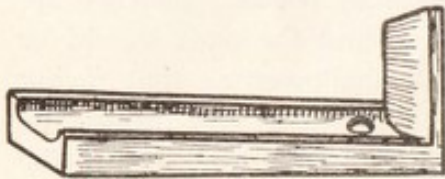


FIG. 8. Box splint or "canal" after Scultetus.

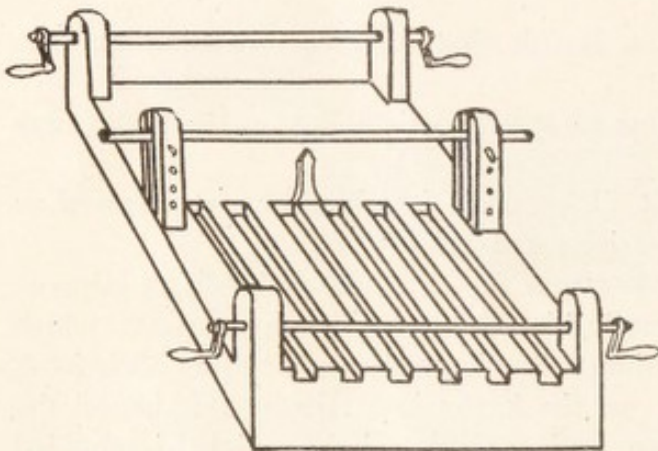


FIG. 10. Seamnum of Hippocrates after Littré.

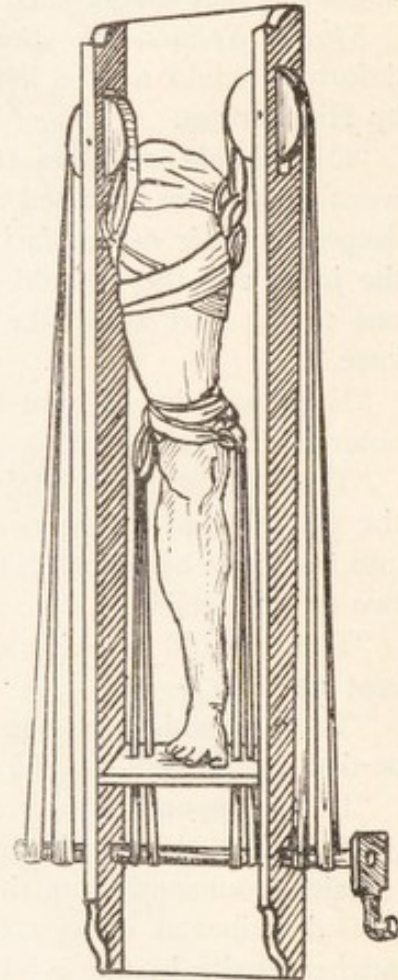


FIG. 9. The Glossocomium of Galen, applied for fracture of the thigh. After Vidius.

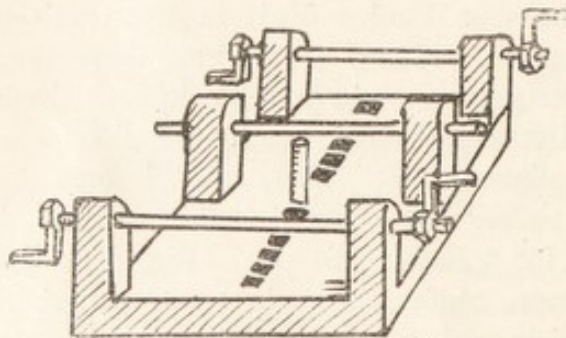


FIG. 11. Seamnum of Hippocrates after Vidius. It differs from the description of Hippocrates in having slots instead of grooves, but it is the oldest figure of the instrument.

Nothing, however, is more convenient than a cushion or something similar, either of wool or linen and not hard. It is to be made hollowed along its middle, and laid below the limb. In any case a shawl should encircle both splint and limb, as children are swathed in bed.

Paulus Ægineta describes the box splints as of wood or earthenware. Some applied them only in cases of compound fracture. A better means of steadying the limb, he thinks, is to make a long pillow of a garment, and to fold it up at the sides, round the limb, and to steady the whole with pillows. The garment should be lined with a skin, to catch the embrocations.

Galen says that they should be rounded externally and hollowed inside. They were made of different kinds of wood.

Celsus says that they should have in their lower part a hole for the escape of discharge, and they should have a foot plate.

Glossocomium of Galen. This ingenious and useful splint, says Galen, had been invented by the practitioners of his time.

It took its name, he says, from the Attic name for a box used for storing papers of value or which one wished to conceal or to carry on a journey, and was variously spelled glossocomum or glossocomium or with two t's instead of two s's. (Fig. 9.)

It might be applied to the femur or the tibia, and was to be used continually till callus had formed.

Galen gives a full description of it, but its principle is best understood from a drawing such as that given by Vidius or Scultetus.

On rotating the handle the upper and lower fragments are simultaneously pulled apart.

Dislocations. The different varieties of dislocations of the joints were known to Hippocrates nearly as completely as we know them to-day, and the various manipulations necessary for their reduction are fully described.

Cases which resisted reduction by means of ordinary measures, such as extension over the back of a chair or the lower half of a door in the case of the shoulder, were treated by more powerful apparatus, improvised or kept for the purpose.

Bands for extension and counter-extension were applied. These consisted preferably of supple leather, but in the absence of these Hippocrates says that iron chains, cords, or the ropes for ships may be used, being wrapped round with woolen cloth at the parts where they are to come in contact with the skin.

In reducing dislocations of the fingers, Hippocrates says that nooses formed from the twisted bast of palm shoots are suitable. Aristotle refers to these in his book on the *Parts of Animals*.

The power to be applied was obtained by means of winches or drums on axles, levers, wedges, screws and pulleys.

Hippocrates only mentions three of these: "Of all the mechanical instruments used by men the most powerful are these three, the winch,



FIG. 12. The scamnum in use for Dislocation at the astragalus.

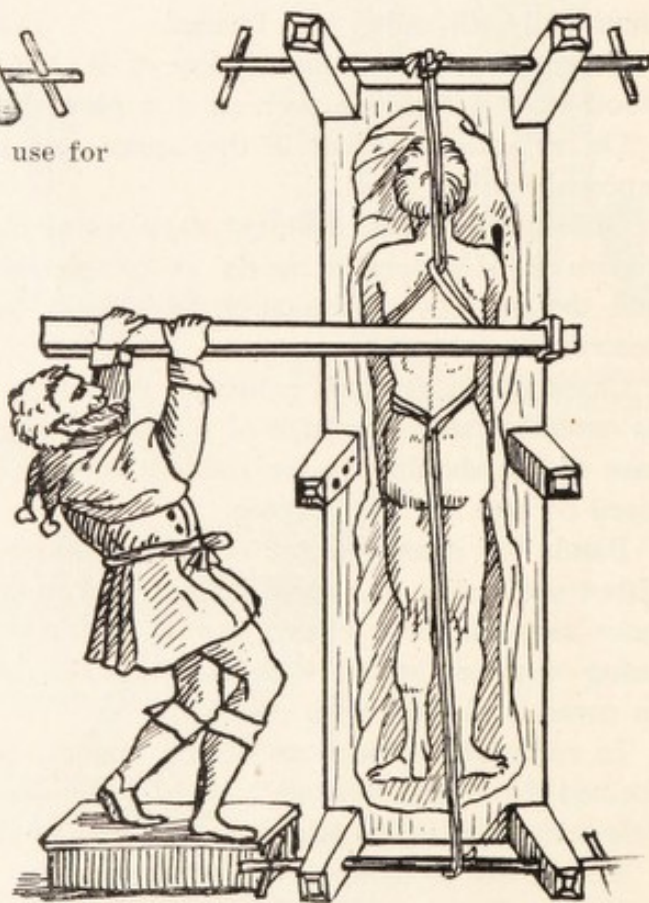


FIG. 13. Reduction of a Gibbosity of the spine by the scamnum.

the lever and the wedge." He does not mention the screw, though it is most likely that the Greeks of his time knew of it, but we shall see that later the Greeks applied it, as in the machine of Nymphodorus, to generate power for reducing dislocations.

Hippocrates does not in this passage refer to the use of the pulley, though in another place he mentions it in connection with the treatment of fracture of the spine, and we shall see several instances of its use for converting the direction of motion in machines for the reduction of dislocations.

In one of these, the machine of Fabrus, a system of pulleys is arranged to give a considerable increase of power, so that it is not unlikely that block and tackle arranged to multiply power would be used as well, although we have no direct description of such.

We may note that Scultetus (Tab. xxi) illustrates a block and tackle which he says that he has taken from Vitruvius, Lib. 10, ch x, and which he says was in use in his day for the reduction of dislocations.

As many of the surgeons were "*periodeutae*," traveling about from place to place, it was not possible for them to carry about the heavy contrivances that the practitioner settled in a large town could have at his command, but Hippocrates shows how to improvise imitations of these, and small winches which could be attached to such household implements as ladders were carried as part of the portable outfit.

The Scamnum, or Bench, of Hippocrates. This contrivance, of which the first account (Fig. 10) is given by the father of medicine, was used by all succeeding ancient surgeons, and Scultetus shows many figures of it in actual use in his time. Galen had a very high opinion of it. He says that all varieties of dislocation could be reduced by it.

Hippocrates says that "the best thing for any physician who practices in a populous city is to have prepared a proper wooden machine with all the mechanical powers applicable in cases of fractures and dislocations, both for making extension and for levering.

"For this purpose, it will be sufficient to possess a board resembling in length, breadth, and thickness, the quadrangular threshing boards made of oak.

"It should be six cubits, or a little more, in length, and about two cubits in breadth. A foot will be sufficient thickness for it.

"Along it from one end to the other an excavation (in the ground) must be made so that the working of the levers may not be higher than necessary.

"Then at both sides we are to raise short, strong, and firmly fixed posts carrying axles; and in the middle of the bench five or six long grooves are to be scooped out, about four inches distant from each other, three inches will be sufficient breadth and also depth for them, and although the number of grooves I have mentioned will be sufficient there is nothing to prevent their being made all over the bench.

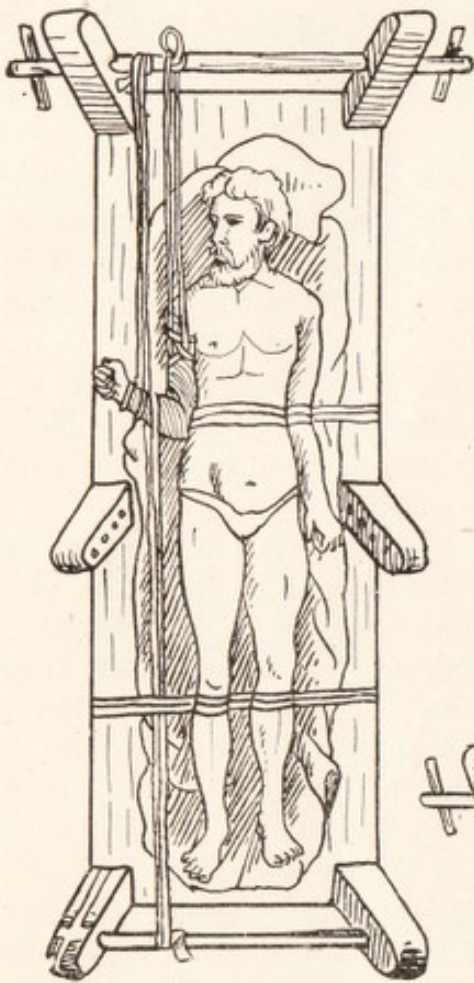


FIG. 14. The scamnum in dislocation of the elbow, after Vidius.

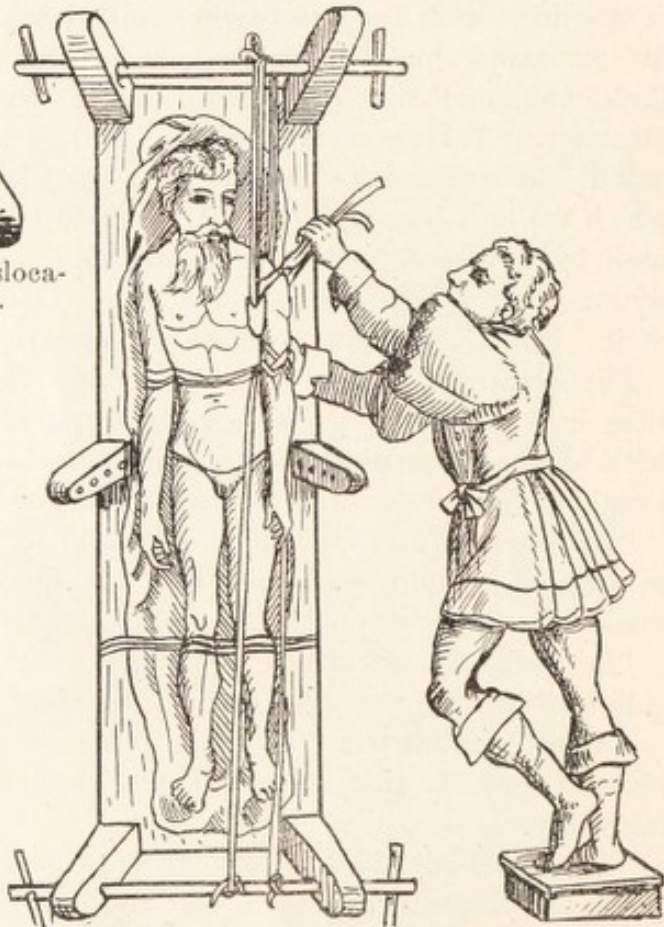


FIG. 15. Reduction of dislocation of the Humerus by the scamnum. After Vidius.

“And the bench should have in its centre a fairly deep hole of a square shape, and of about three inches in size, and into this hole, when judged necessary, is to be adjusted a corresponding piece of wood, rounded in its upper part, which at the proper time is to be adjusted between the perineum and the head of the thigh bone. This upright prevents the body from yielding to the force dragging downwards by the feet. For sometimes this piece of wood serves the same purpose as counterextension (i. e., by thongs) in an upward direction, and sometimes, too, when both extension and counterextension are made, this piece of wood, if susceptible of some motion to this side or that, will serve the purpose of a lever for pushing the head of the thigh bone outwards.”

It is on this account that several grooves are scooped out in the bench.

The lever may be round or flat to suit different cases. Another mode of using the scamnum was to raise two posts at the middle of the sides, and to insert into them a transverse bar like the step of a ladder, to act as a horizontal perineal bar.

Figure 10 shows the machine constructed from this description by Littré.

A figure of the machine, by Vidius, is somewhat different, (Fig. 11) square holes taking the place of the longitudinal grooves described by Hippocrates.

I shall now proceed to give a few descriptions of actual applications of the machine to reduction of different dislocations, which, it is hoped, will be readily understood by the aid of the accompanying figures, which are mainly taken from drawings by Vidius in illustration of a chapter by Heliodorus. One cannot help thinking that this machine must originally have given the idea for the instrument of torture known as the rack. This was well known in the time of Cicero.

Celsus says that the scamnum was quite powerful enough to produce rupture of the muscles.

Fig. 12 shows the machine in use for dislocation forwards of the astragalus. Extension and counterextension are being made by thongs fastened below the knee and above the ankle.

Fig. 13 shows an attempt at reduction of the spine. Extension is being made below the seat of the lesion by a thong passed round the abdomen above the crest of the pelvis, while counterextension is maintained by a thong passed under the armpits.

The operator's assistant is levering down the gibbosity with a flat board used as a lever.

Fig. 14 shows the reduction of a dislocated elbow. The forearm is pulled down by a thong passed over its middle, while counterextension is maintained by thongs attached to the humerus and the forearm near the wrist.

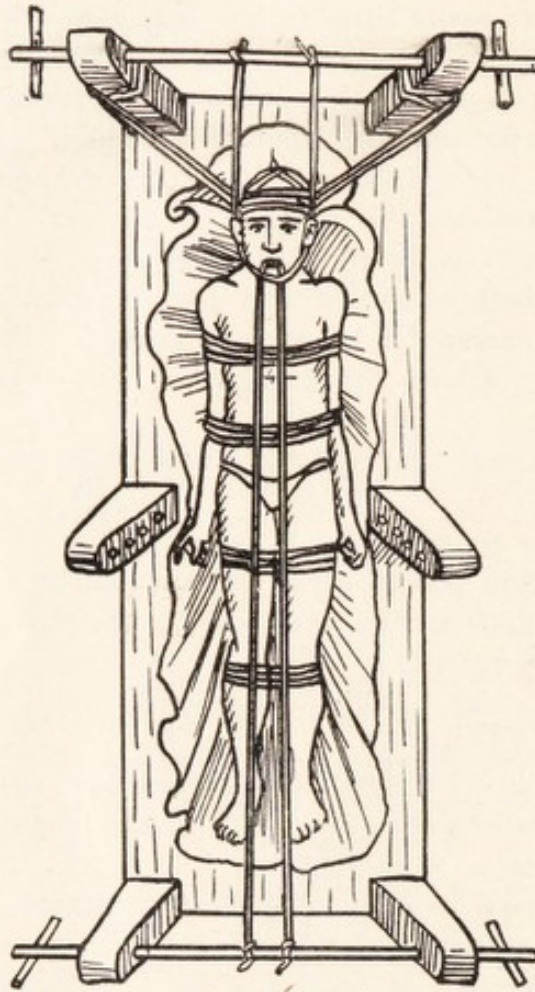


FIG. 16. The Scamnum in dislocation of the jaw. After Vidius.



FIG. 17. Counterextension by an axillary loop on the injured side and a perineal band on the other. Extension by a clove hitch above the knee. The surgeon's hands are seen levering the head of the bone inwards while the assistant props the left side of the body.

Fig. 15 shows reduction of the humerus. While the extension and counterextension are made, the assistant pulls outwards the head of the humerus by a thong passed under the arm in the axilla.

Fig. 16 shows reduction of a dislocated jaw. Heliodorus is the only author who describes the use of a machine for this purpose, and it seems rather a superfluous display of force but it may occasionally have been necessary, as from what Hippocrates says it would seem that owing to the dearth of practitioners in some parts it was not uncommon to meet with cases which had remained unreduced for some time.

Of dislocation outwards at the hip (Fig. 17) Paulus Ægineta says:

"If the dislocation is outwards, the extension is to be made as above, but the thong at the perineum is to be passed by the opposite parts, the groin at the one side, the clavicle at the other. The surgeon is to propel the limb from without inwards, the lever being fixed in one of the furrows formerly prepared, and an assistant fixing the sound nates, that the body may not yield."

Hippocrates says that instead of the perineal extension band the upright perineal prop may be used.

Of dislocation inwards, Paulus Ægineta says that if it be not reduced after trying with the patient on his back and using the upright perineal prop:

"The erect piece of wood (Fig. 18) is to be removed, and two other pieces, ~~i. e., the perineal prop~~ of wood fixed on either side, like posts, not more than a foot in length, and let another piece of wood be adapted to them like the step of a ladder, so that the figure of the three pieces of wood may resemble the Greek letter H, the middle piece of wood being fixed a little below the tops.

Then, the man being laid on the sound side, we bring the sound leg between the posts, underneath the piece of wood corresponding to the step of a ladder, while the injured one is brought above it, so that the head of the thigh is upon it; but a folded garment is to be first wrapped about it to prevent the thigh from being bruised. Then another board of moderate breadth and of such a length as to extend from the head of the thigh to the ankle, is to be bound along the inner side of the thigh to the ankle.

Then extension being made, either by the pestles mentioned in treating of the dislocation of the vertebra or some such instrument, the leg is to be pulled downwards along the board which is fastened to it, so that by the force exerted on it the head of the thigh-bone may return to its proper place."

The Ambè. We have seen that in using the scamnum (Fig. 19) for the reduction of dislocation inwards of the thigh, Paulus Ægineta, (also Hippocrates, from whom Paul is copying), recommends us to fix a piece of board along the inside of the thigh and leg, to assist in levering the head of the bone into position. A board applied in this way was also used in reducing the dislocations of the shoulder, either by lever-

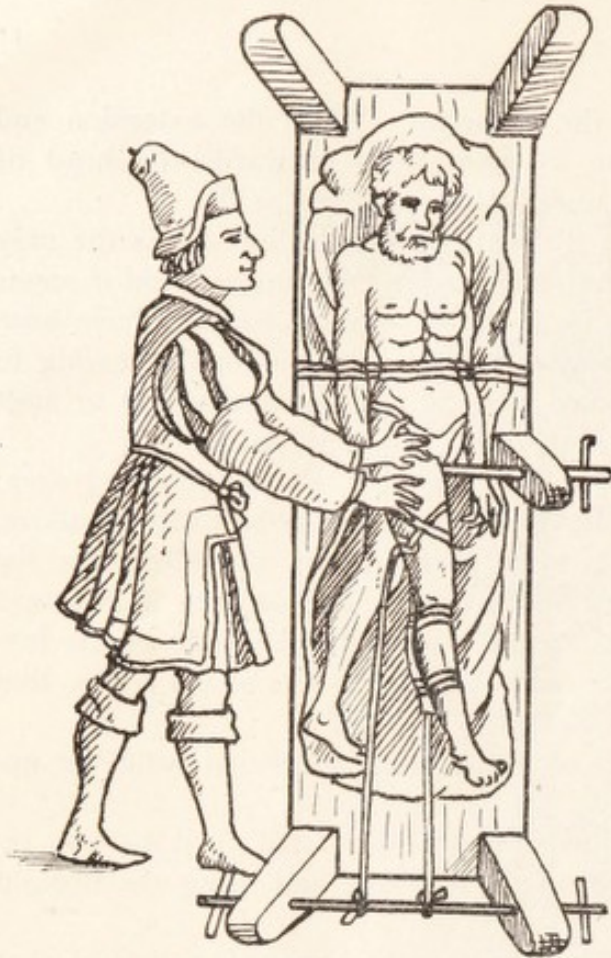


FIG. 18. The scamnum in dislocation inwards of the thigh. Counterextension maintained by the horizontal bar.

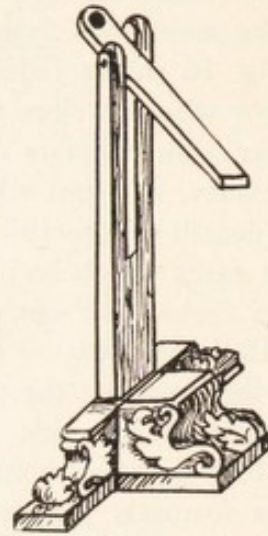


FIG. 19. Shows the ambé, fitted into a specially prepared upright supported on an ornamented base. After Scultetus.

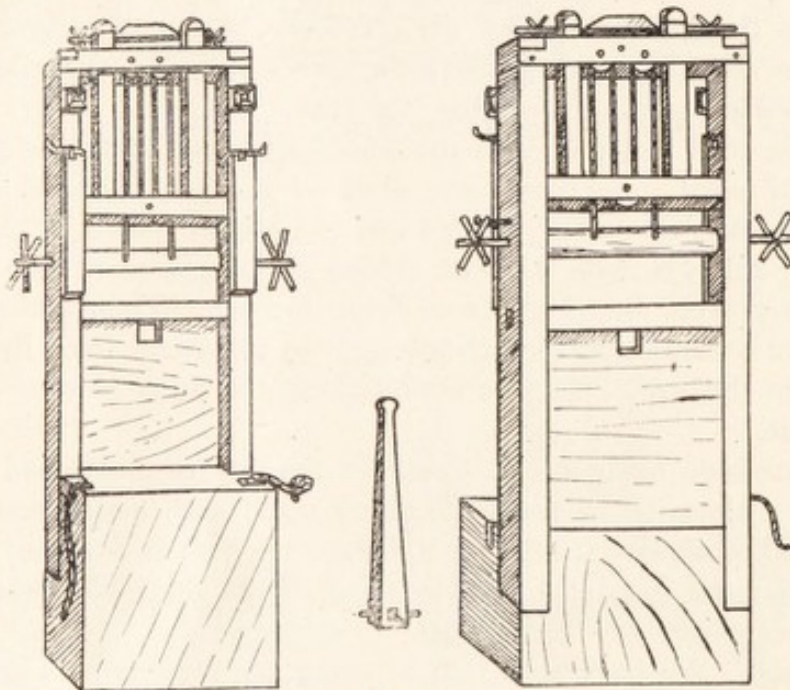


FIG. 19A. Anterior and posterior views of the machine of Fabrus. (After Vidius.) Between them is an ambé which has at its axillary end a bolt to fit into the top cross-bar of the machine.

The power varies only with the ratio of the diameter of the axle to length of crank. The pulleys do not multiply power.

ing the board over the back of a chair or the lower half of a door, or by using it in conjunction with some specially constructed machine, such as that of Fabrus, with which we shall meet presently.

A board especially prepared for this purpose had a rounded enlargement on its extremity, to assist in pushing the head of the humerus outwards.

The name of this enlargement (*'άμβη*) gradually became transferred to the whole instrument. The "ambè" was well known in England till well into the last century.

The time of its disappearance in England may be fixed by a passage in Adams' edition of Hippocrates (vol. ii, p. 575) where he says: "Of late years the ambè has fallen completely into disuse, and none of the various modifications of it are to be seen except in the cabinets of the curious." (This was in 1849.)

Scultetus shows us an ambè mounted in a specially prepared upright for use in the surgery (Fig. 19).

The ambè is thus described by Hippocrates:

"We must get a piece of wood five, or at least four, inches broad, two inches in thickness, or thinner, and two cubits in length, or a little less, and its extremity should be rounded, and made very narrow and very slender there, and it should have a slightly projecting edge (*'άμβη*) on its round extremity—not on the part that is to meet the chest, but the head of the humerus.

"A piece of soft shawl should be glued to the end of the piece of wood so as to give the least pain on pressure.

"Having pushed the end of this piece of wood as far in as possible, between the ribs and the head of the humerus, the whole arm is to be stretched along this piece of wood, and is to be bound round at the arm, the forearm, and the wrist, so that it may be particularly well secured, but great pains should be taken that this piece of wood should be introduced as far into the armpit as possible, and that it is carried past the head of the humerus.

"Then a crossbeam is to be securely fixed between two pillars, and afterwards the arm, with the piece of wood attached to it, is to be brought over this crossbeam so that the arm may be on one side of it and the body on the other and then the arm with the piece of wood is to be forced down. The crossbeam is to be fixed so high that the rest of the body is raised on tiptoe.

"This is by far the most powerful method of effecting the reduction of the shoulder for thus one operates with the lever on the most approved principles."

Celsus (Bk. VII, ch. xv) describes the ambè thus:

"A wooden spatula is necessary if the body is rather big and the tendons are rather strong, and it should be of the thickness of two fingers and in length reach from the axilla to the fingers. And at the top of it there is a head rounded and gently hollowed out, so as to re-

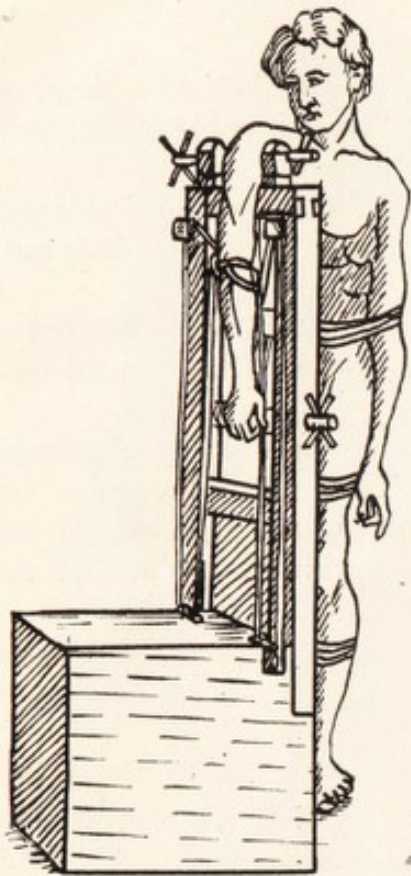
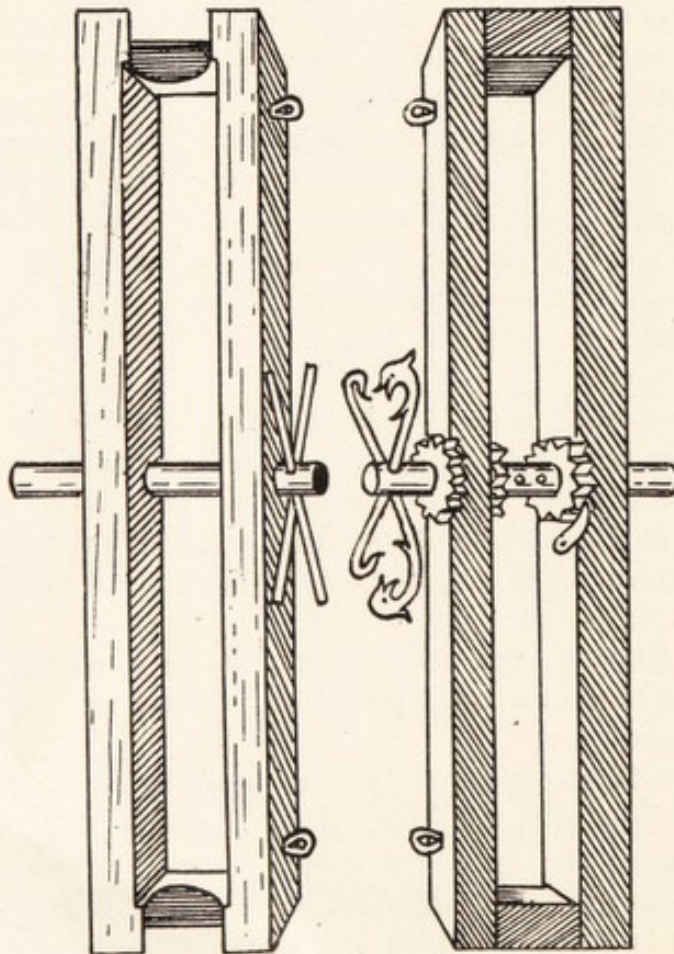


FIG. 20. Patient with arm arranged in the machine of Fabrus for reduction of dislocation of shoulder. The thongs from a clove hitch applied above the elbow are taken over two pulleys above and two pulleys below so that the clove hitch cannot move up nor down, and the elbow is thus maintained at the same level. (N. B. These thongs are not connected to the axle in any way.) Patient strapped so that he cannot resist the treatment.



FIG. 20A. Setting a fractured humerus in the manner described by Hippocrates. After Vidius.



FIGS. 21 AND 22. Portable winch, known as the plinthium of Nileus, for affixing to a ladder.

ceive a part of the head of the humerus. In it there are two holes at three places separated from each other by an interval, and in these soft thongs are inserted.

"This spattle, wound round with a bandage in order that it may not injure by contact, is so applied to the arm at the axilla that its upper end is put under the top of the axilla; then by its thongs it is bound to the arm, at one place a little below the head of the humerus, at another a little above the elbow, at a third above the hand—indeed the spaces and holes have been arranged for this purpose.

"The arm, tied in this manner, is passed over the step of a poultry ladder at such a height that the man cannot stand and while the body is let down on one side, the arm is made tense on the other, and thus it is brought about that the head of the humerus—impelled into position by the end of the board—is reduced, sometimes audibly, sometimes not so.

"Many other methods can be learnt by reading Hippocrates alone but not one has stood the test of experience better."

The Machine of Fabrus. Heliodorus describes the construction of this machine, and its application for the reduction of dislocations of the humerus. Probably it is a machine used by artisans for some such purpose as the elevation of large blocks of stone, as it seems unlikely that such a large and cumbrous machine should have been especially invented for the single purpose of reducing the dislocation of one joint. Two views of the machine are given, (Fig. 19A).

It consists, as will be seen, of two upright posts supported on a heavy base, while inside the posts a frame carrying two upright bars is raised and depressed by the rotation of an axle acting on a system of pulleys. Through the heads of the upright bars there passes another axle carrying a padded projection which is placed in the armpit.

The arm is strapped to an ambè in the manner described already and is passed over the axle, the patient standing on tiptoe outside the machine. (Fig. 20.)

The arm is maintained at one level by thongs affixed by a clove hitch above the elbow and passing over pulleys above and below. On rotating the lower axle the frame is pushed upwards, forcing the head of the bone into position, while at the same time an assistant forces the head of the bone outwards by a half turn of the upper axle, causing the padded projection to push outwards.

Extemporized Apparatus and Substitutes. Having now described the apparatus which was used by practitioners settled permanently in populous places, we may consider the substitutes for these which were used by surgeons on their travels, or under other circumstances where the major apparatus was unavailable.

Hippocrates says we must always be ready to make use of whatever happens to be at hand.

He says that dislocation inwards at the hip may be reduced in the following manner.

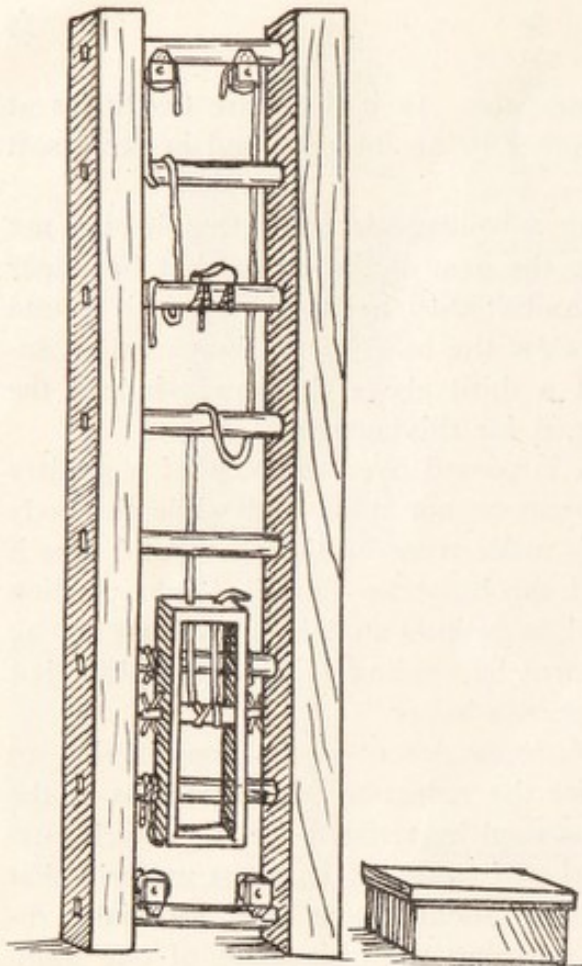


FIG. 24. Ladder arranged as a machine for the reduction of dislocations. A Plinthium of Nileus has been tied on the lower part of it and below this are two pulleys for the converting of the direction of extension. A similar pair of pulleys have been tied on the top step of the ladder.

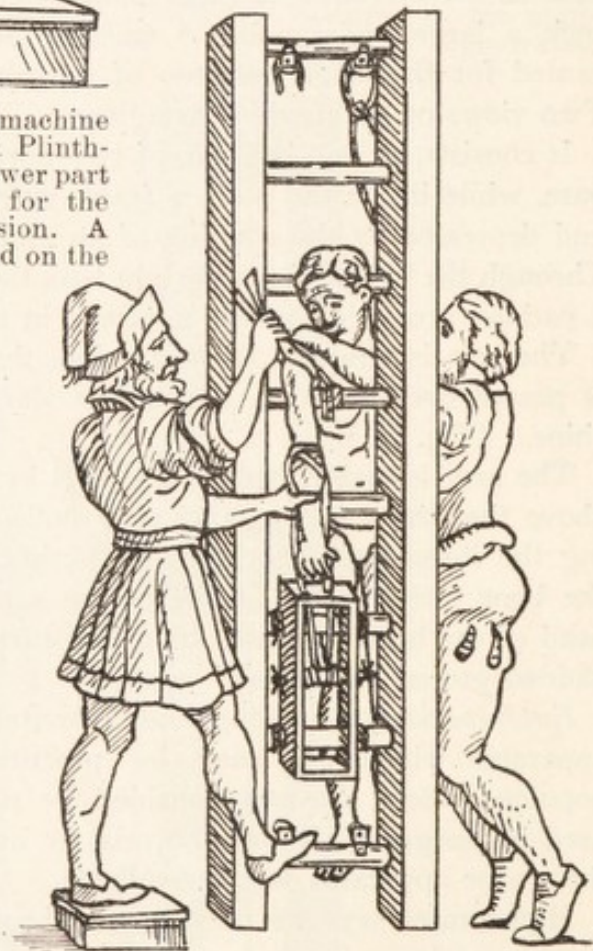


FIG. 25. Reduction of shoulder by ladder with Plinthium of Nileus. Extension having been made, the operator is pulling out the head of the humerus by a thong. The assistant is bearing down on the patient's neck.

It is a good, proper and natural mode of procedure, and has something of display in it, if anyone take delight in such ostentatious methods.

The patient is to be suspended from a crossbeam by the feet tied together by a strong, soft and broad cord.

The feet are to be about four inches or less from each other and a broad and soft leather collar also connected with the crossbeam, is to be put on above the knees, and the affected leg should be so extended as to be two inches higher than the other.

The head should be about two cubits from the ground and the arm should be stretched along the sides, and bound with something soft.

All these preparations should be made while he is lying on his back so that he may be suspended for as short a time as possible.

When the patient is suspended a person properly instructed and not weak, having introduced his arm between his thighs is to place his forearm between the perineum and the dislocated head of the femur, and then, having joined the other hand to the one thus passed through the thighs, he is to stand by the side of the suspended patient and suddenly suspend and swing himself in the air as perpendicularly as possible.

In fracture of the humerus, if the bone be set while the elbow is extended, the muscles of the arm will assume a different position when the elbow is flexed.

To set it in the flexed position, therefore, suspend a piece of wood like the handle of a spade from the roof by two chains one at each end.

Place the patient's arm over this, so that the bar lies in the axilla.

Over the flexed forearm pass a shawl to which attach a great weight, so as to produce extension on the lower fragment of the humerus and thus reduce the deformity.

Apply the waxed bandages and compresses in this position.

The Pestle. Of reduction of the shoulder by means of the pestle,—an article for the preparation of food to be found in every Greek home,—Hippocrates says:

"Those who accomplish the reduction by forcibly bending it over a pestle operate in a manner which is nearly natural. The pestle should be wrapped in a soft shawl for thus it will be less slippery.

"It should be forced between the ribs and the head of the humerus. And if the pestle be short the patient should be seated on something, so that his arm can with difficulty pass over the pestle.

"But, for the most part, the pestle should be longer, so that the patient, when standing, may be almost suspended by it. And then the arm and forearm should be stretched along the pestle while some person secures the opposite side of the body by throwing the arms round the neck near the clavicle."

Hesiod (*Works and Days*, 1, 421) says that the length of the culinary pestle was three cubits.



FIG. 26. Reduction of the ulna.

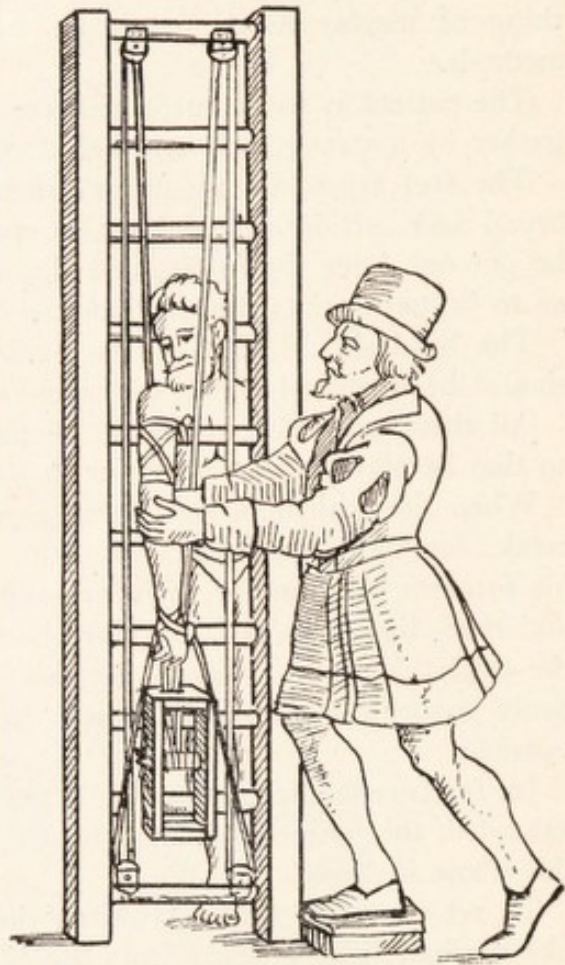


FIG. 27. Reduction of both bones at the elbow

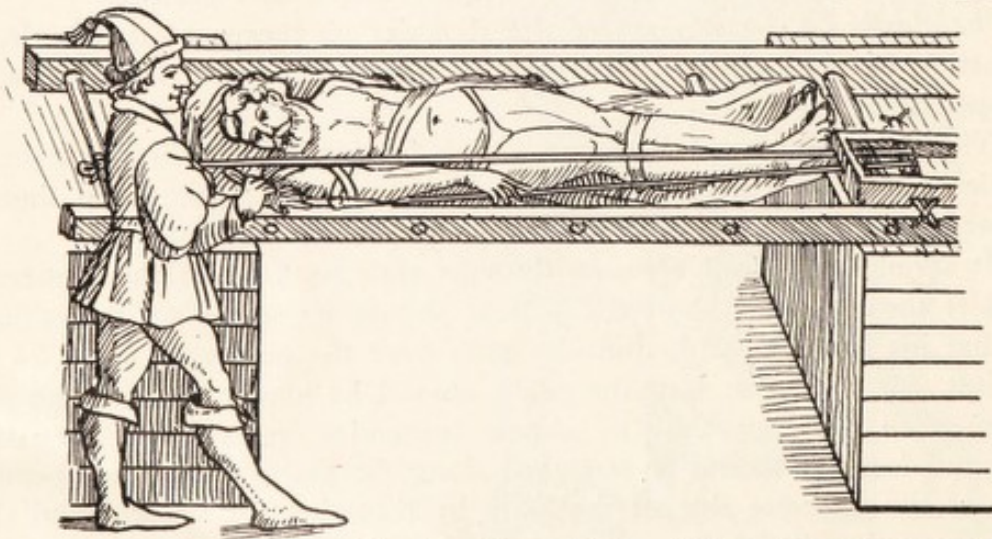


FIG. 28. Reduction of the shoulder with the ladder in the horizontal position. Operator pulling head of humerus outwards with a thong.

From other passages in Hippocrates it would seem that any pestle-like rod may be indicated. The word Celsus uses means a staff.

Hippocrates describes several methods of improvising a scamnum.

Any strong couch may be used as the bench, and extension and counter-extension may be produced by poles levered against boards fixed to the feet of the couch, thongs being attached to the middle of the poles.

Or instead of boards attached to the feet of the couch a ladder may be placed below the couch and the poles levered against the steps of the ladder.

If along with either of these methods it were desired to extemporize a lever to press down a hump back, this could be done by driving a post into the ground alongside the couch and making a hole in the post for the end of the lever to play in.

Or the couch could be drawn alongside a wall and a hole made in the wall for the end of the lever.

In fracture-dislocation of the foot the extension might be made as follows:

Having fixed in the ground the nave of a wheel or some such object, something soft is to be bound round the foot.

Next, some soft thongs are to be attached to the foot and the ends of the thongs are to be fixed to a pestle or similar pole. The end of the pole is to be fixed in the nave.

On pulling back the pole, the foot is extended, while counter extension is made by pulling on the shoulders and the ham of the patient.

Or, counterextension can be made by driving a pole into the ground to act as a perineal support.

Ladder. A ladder was an object which was always at hand and of service in the reduction of dislocations.

In treating of the ambè we showed one use of the ladder, namely to reduce the shoulder by levering the arm over a step. For other dislocations portable fittings could be applied to generate power for extension and to convert the direction of motion.

Thus, two pulleys might be affixed to the top steps and two to the lower, and a portable winch fitted to the lower part of the ladder.

One simple form of winch for this purpose was called the *plinthium of Nileus*.

It consisted merely of a small frame carrying an axle, with or without a ratchet. (Figs. 21, 22.)

Fig. 24 shows a ladder fitted up with pulleys at its top and bottom and a *plinthium of Nileus* below.

Fig. 25 shows the reduction of the humerus by a ladder so fitted. The ladder having been fixed in the ground, the arm has been passed over a step of the ladder and the *plinthium of Nileus* has tightened the thongs attached to the arm till the patient is almost suspended.

The operator is pulling the head of the humerus outwards by means of a fillet, while an assistant is pressing down the shoulders of the patient.

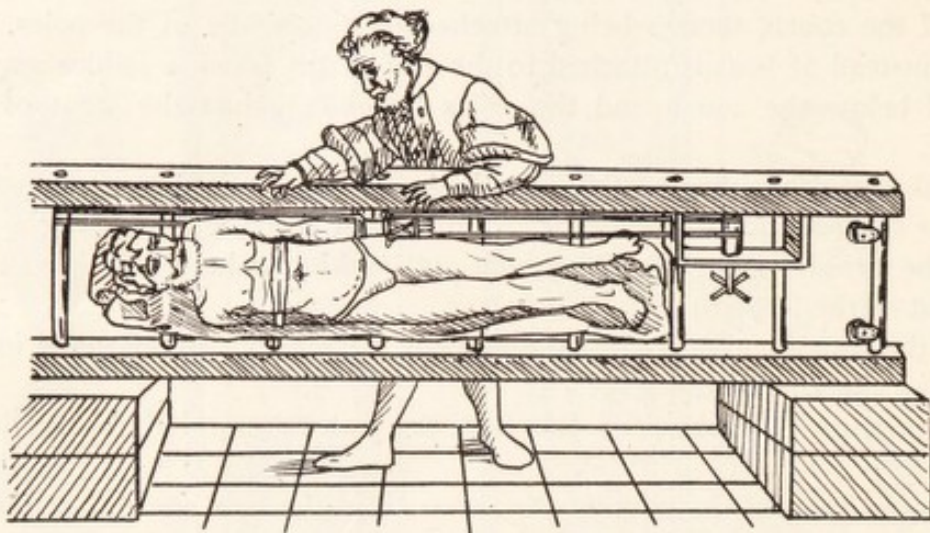


FIG. 29. Reduction of the wrist. The ladder is probably meant to be lying flat, but in the figure it is shown tilted up on its side in order to bring the parts into view.

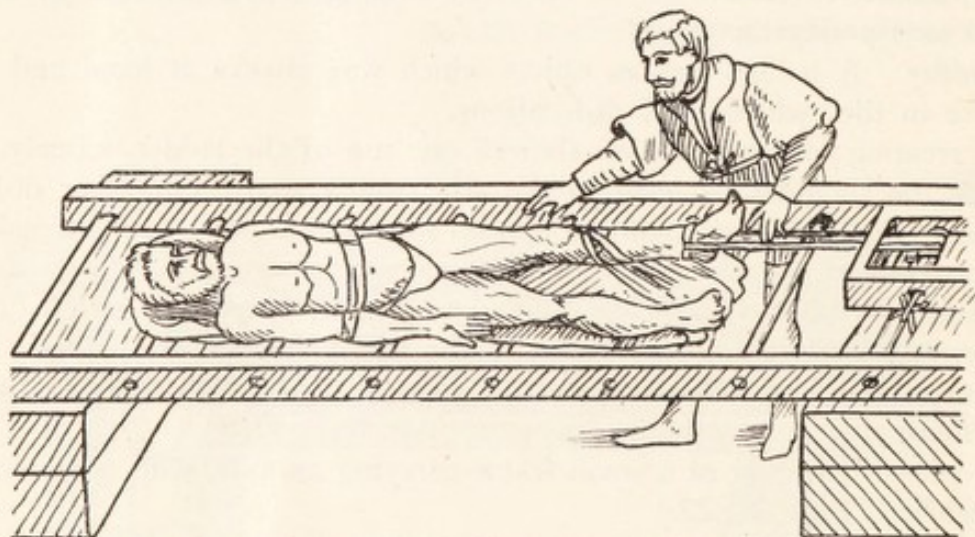


FIG. 30. Reduction of the dislocated astragalus with the ladder in the horizontal position.

Fig. 26 shows the reduction of the ulna at the elbow, and Fig. 27 the reduction of both bones dislocated together. Fig. 28 shows the reduction of the shoulder. The ladder is placed horizontally in this case, the ends being supported on a pile of wood or stone blocks.

The patient is bound on the ladder, and while extension is made on the arm, the head of the humerus is pulled outwards by a thong passed inside it.

Fig. 29 shows the reduction of the wrist, extension and counterextension are made by thongs affixed below and above the wrist by clove-hitches; while Fig. 30 shows the reduction of the ankle on similar principles.

(In the case of the wrist the ladder is shown tilted up on its side, in order to bring the parts into view.)

A portable winch of more powerful principle was the *Glossocomum* of Nymphodorus. It is shown in Fig. 31; first, as it appeared when closed and ready for use, and next, with one of the shutters removed to show its internal construction.

It will be seen to consist of a crank, the rotation of which causes a worm on it to turn a cogged wheel.

Round the axle of the cog wheel are ropes passing to another axle, the circumference of which is increased by drums so as to multiply the power, after the manner shown in the figure. One whole turn of axle moves cogged wheel forward one cog. Some of the inner details of the winch are shown below. Another portable winch was the *Trispastum* of Appelles or of Archimedes. Its construction is shown in Fig. 32, which shows the sides removed to display the working. In actual use, however, it was closed in like the last winch.

Reduction by Means of Inflating a Bladder. In describing the reduction of the dislocation of the spine Hippocrates says that he has tried to reduce the deformity by inflating a bladder affixed to a bronze tube and placed under the spine. The experiment, however, did not succeed for when the man was fairly extended the bladder yielded, and the air could not be forced into it, and besides, the hump of the patient was apt to slip off the bladder.

Hippocrates says he has written this expressly, for it is a valuable piece of knowledge to learn what things have been tried and have proved ineffectual, and wherefore they did not succeed.

Again he says that reduction by the bladder was celebrated in the case of the hip joint.

It is not a powerful method. It should be placed between the thighs uninflated so that it may be carried as far up in the perineum as possible, and the thighs, beginning at the patella, are to be bound round with a swathe, as far up as the middle of the thigh, and then a bronze pipe is to be introduced into one of the loose feet of the bladder and air forced into it. The patient is to lie on his side with the injured limb uppermost.

From this description it would seem that the bladder had consisted of some small skin such as that of a kid.

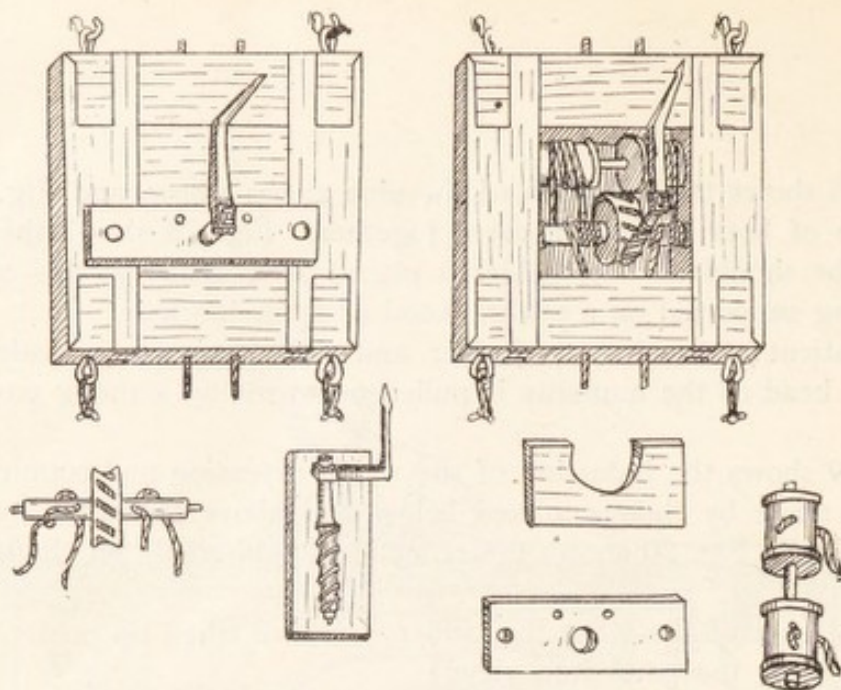


FIG. 31. Glossocomum of Nymphodorus. Two views, one showing it closed and ready for use, the other with the lid removed, to show the principle. A crank drives a shaft with a worm thread on it. The threads of the worm engage in notches in a drum. Ropes pass from the axle on which the cogged wheel drum is carried, to drums carried on a second axle. Below are parts of the machine showing its structure and also the method of fixing the rope ends. After Vidius. Power, ONE TURN OF AXLE only moves the cogged wheel one notch—great power therefore varying with length of crank. Power still further increased by lower axle being smaller than drums of upper.

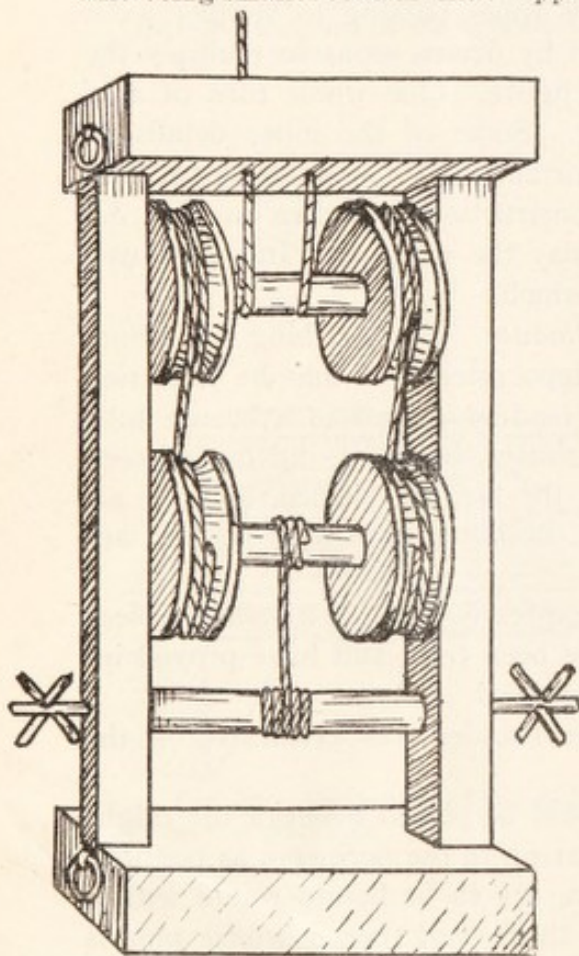


FIG. 32. Trispastum of Apelles or Archimedes with the sides removed to show the works. The power depends on ratio of diameter of axle to length of crank in this figure. But if the lower drums were made smaller than upper as in Fig. 31, power would be further augmented accordingly.

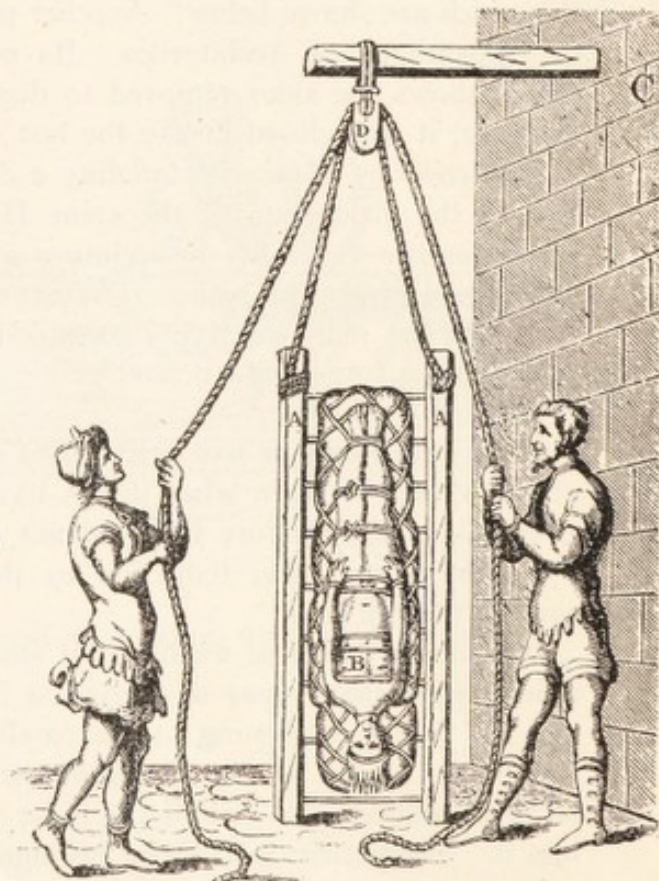


FIG. 33. Sucussion on a ladder for dislocation of the spine. The patient is bound to the ladder by the lower part of the body, the upper hanging free. The ladder is raised by the pulleys and suddenly allowed to drop.

Succussion, or Suspension on a Ladder. This was done for dislocation of the spine, and usually to astonish the mob, Hippocrates says, although so far as he was aware, the method had never straightened anybody yet. To the mob, however, things of this sort are wonderful, and they never give a thought as to their utility.

A ladder was padded with leather, and on this the patient was laid on his back. The ankles were tied to the ladder by soft strong bands.

The arms were bound to the sides of the patient but not to the ladder.

By means of a rope or ropes affixed to the lower end of the ladder (Fig. 33) it was raised along the gable of a high house or a high tower, or the mast of a ship fixed in the ground. The ropes should run over a pulley or a winch.

For the sake of completeness we may conclude with a short account of the materials used for the treatment of congenital clubfoot by Hippocrates.

Most cases are remediable. After pulling and pushing the parts into position they are to be retained with cerate made with a full proportion of resin, with compresses or pads similar to those described in the treatment of fractures, and soft bandages applied in sufficient quantity but not too tight. The foot should appear to incline a little outwards.

A sole of leather not very hard, or of lead, is to be bound on as you are about to finish the bandaging, not in contact with the skin. The bandaging is to be carried up to the top of the calf, and the bandages are to be finished by stitching. A small shoe of lead is to be bound on externally to the bandaging, having the same shape as the Chian slippers had. This, however, should not be necessary. Thus this method requires neither cutting (tenotomy) nor burning nor any other complex means, for such cases yield sooner to treatment than one would believe. However they are to be fairly mastered only by time and not until the body has grown up in the natural shape, and then recourse is to be had to a shoe.

The most suitable are the buskins, which derive their name from traveling through mud, for this sort of shoe does not yield to the foot but the foot yields to it. A shoe shaped like the Cretan is also suitable.

(As Galen, the great admirer and annotator of Hippocrates, confesses that he is unable to give an exact account of either the Chian slippers, the buskins, or the Cretan shoes, we may leave it to individual imagination to conjecture their appearance.)

