On Injuries of the Head

Hippocrates

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Translated by Francis Adams

PART 1

Men'S heads are by no means all like to one another, nor are the sutures of the head of all men constructed in the same form. Thus, whoever has a prominence in the anterior part of the head (by prominence is meant the round protuberant part of the bone which projects beyond the rest of it), in him the sutures of the head take the form of the Greek letter tau, T; for the head has the shorter line running transverse before the prominence, while the other line runs through the middle of the head, all the way to the neck. But whoever has the prominence in the back part of the head, in him the sutures are constructed in quite the opposite form to the former; for in this case the shorter line runs in front of the prominence, while the longer runs through the middle all along to the forehead. But whoever has a prominence of the head both before and behind, in him the sutures resemble the Greek letter eta E; for the long lines of the letter run transverse before each prominence while the short one runs through the middle and terminates in the long lines. But whoever has no prominence on either part he has the sutures of the head resembling the Greek letter chi; for the one line comes transverse to the temple while the other passes along the middle of the head. The bone at the middle of the head is double, the hardest and most compact part being the upper portion, where it is connected with the skin, and the lowest, where it is connected with the meninx (dura

mater); and from the uppermost and lowermost parts the bone gradually becomes softer and less compact, till you come to the diploe. The diploe is the most porous, the softest, and most cavernous part. But the whole bone of the head, with the exception of a small portion of the uppermost and lowermost portions of it, is like a sponge; and the bone has in it many juicy substances, like caruncles; and if one will rub them with the fingers, some blood will issue from them. There are also in the bone certain very slender and hollow vessels full of blood. So it is with regard to hardness, softness, and porosity.

PART 2

In respect to thickness and thinness; the thinnest and weakest part of the whole head is the part about the bregma; and the bone there has the smallest and thinnest covering of flesh upon it, and the largest proportion of brain is situated in that region of the head. And hence it happens that from similar or even smaller wounds and instruments, when a person is wounded to the same or a less degree, the bone of the head there is more contused, fractured, and depressed; and that injuries there are more deadly and more difficult to cure; and it is more difficult to save one's life in injuries there than in any other part of the head; that from having sustained a similar or even a less wound a man will die, and that, too, in a shorter space of time than from a wound in any other part of the head. For the brain about the bregma feels more quickly and strongly any mischief that may occur to the flesh or the bone; for the brain about the bregma is in largest quantity, and is covered by the thinnest bone and the least flesh. Of the other portions, the weakest is that about the temples; for it is the conjunction of the lower jaw with the cranium, and there is motion there up and down as at a joint; and the organ of hearing is near it; and further, a hollow and important vein runs along the temple. But the whole bone of the head behind the vertex and the ear is stronger than the whole anterior part, and the bone itself has a larger and deeper covering of flesh upon it. And hence it follows, that when exposed to the same or even greater injuries from instruments of the same or greater size, the bone is less liable to be fractured and depressed than elsewhere; and that in a fatal accident the patient will live longer when the wound is in the posterior part of the head than when elsewhere; and that pus takes longer time to form and penetrate through the bone to the brain, owing to the thickness of the bone; and moreover, as there is less brain in that part of the head, more persons who are wounded in the back part of the head escape than of those who wounded in the anterior part. And in fatal cases, a man will survive longer in winter than in summer, whatever be the part of the head in which the wound is situated.

PART 3

As to the haedrae (dints or marks?) of sharp and light weapons, when they take place in the bone without fissure, contusion, or depression inwards (and these take place equally in the anterior and posterior part of the head), death, when it does occur, does not properly result from them. A suture appearing in a wound, when the bone is laid bare, on whatever part of the head the wound may have been inflicted, is the weakest point of the head to resist a blow or a weapon, when the weapon happens to be impinged into the suture itself; but more especially when this occurs in the bregma at the weakest part of the head, and the sutures happen to be situated near the wound, and the weapon has hit the sutures themselves.

PART 4

The bone in the head is liable to in the following modes, and there are many varieties in each of these modes of fracture: When a wounded bone breaks, in the bone comprehending the fissure, contusion necessarily takes place

where the bone is broken; for an instrument that breaks the bone occasions a contusion thereof more or less, both at the fracture and in the parts of the bone surrounding the fracture. This is the first mode. But there are all possible varieties of fissures; for some of them are fine, and so very fine that they cannot be discovered, either immediately after the injury, or during the period in which it would be of use to the patient if this could be ascertained. And some of these fissures are thicker and wider, certain of them being very wide. And some of them extend to a greater, and some to a smaller, distance. And some are more straight, nay, completely straight; and some are more curved, and that in a remarkable degree. And some are deep, so as to extend downwards and through the whole bone; and some are less so, and do not penetrate through the whole bone.

PART 5

But a bone may be contused, and yet remain in its natural condition without any fracture in it; this is the second mode. And there are many varieties of contusion; for they occur to a greater or less degree, and to a greater depth, so as sometimes to extend through the whole bone; or to a less depth, so as not to extend through the whole bone; and to a greater and smaller length and breadth. But it is not possible to recognize any of these varieties by the sight, so as to determine their form and extent; neither, indeed, is it visible to the eyes when any mischief of this kind takes place, and immediately after the injury, whether or not the bone has been actually bruised, as is likewise the case with certain fractures at a distance from the seat of injury.

PART 6

And the bone being fractured, is sometimes depressed inwards from its natural level along with the fractures, otherwise there would be no depression; for the depressed portion being fractured and broken off, is pushed inwards, while the rest of the bone remains in its natural position; and in this manner a fracture is combined with the depression. This is the third mode. There are many varieties of depression, for it may comprehend a greater and a small extent of bone, and may either be to a greater depth, or less so, and more superficial.

PART 7

When a hedra, or dint of a weapon, takes place in a bone, there may be a fracture combined with it; and provided there be a fracture, contusion must necessarily be joined, to a greater or less extent, in the seat of the dint and fracture, and in the bone which comprehends them. This is the fourth mode. And there may be a hedra, or indentation of the bone, along with contusion of the surrounding bone, but without any fracture either in the hedra or in the contusion inflicted by the weapon. But the indentation of a weapon takes place in a bone, and is called hedra, when the bone remaining in its natural state, the weapon which struck against the bone leaves its impression on the part which it struck. In each of these modes there are many varieties, with regard to the contusion and fracture, if both these be combined with the hedra, or if contusion alone, as it has been already stated that there are many varieties of contusion and fracture. And the hedra, or dint, of itself may be longer and shorter, crooked, straight, and circular; and there are many varieties of this mode, according to the shape of the weapon; and they may be more or less deep, and narrower or broader, and extremely broad. When a part is cleft, the cleft or notch which occurs in the bone, to whatever length or breadth, is a hedra, if the other bones comprehending the cleft remain in their natural position, and be not driven inwards; for in this case it would be a depression, and no longer a hedra.

PART 8

A bone may be injured in a different part of the head from that on which the person has received the wound, and the bone has been laid bare. This is the fifth mode. And for this misfortune, when it occurs, there is no remedy; for when this mischief takes place, there is no means of ascertaining by any examination whether or not it has occurred, or on what part of the head.

PART 9

Of these modes of fracture, the following require trepanning: the contusion, whether the bone be laid bare or not; and the fissure, whether apparent or not. And if, when an indentation (hedra) by a weapon takes place in a bone it be attended with fracture and contusion, and even if contusion alone, without fracture, be combined with the indentation, it requires trepanning. A bone depressed from position rarely requires trepanning; and those which are most pressed and broken require trepanning the least; neither does an indentation (hedra) without fracture and contusion require trepanning; nor does a notch, provided it is large and wide; for a notch and a hedra are the same.

PART 10

In the first place, one must examine the wounded person, in what part of the head the wound is situated, whether in the stronger or weaker parts; and ascertain respecting the hairs about the wound, whether they have been cut off by the instrument, and have gone into the wound; and if so, one should declare that the bone runs the risk of being denuded of flesh, and of having sustained some injury from the weapon. These things one should say from a distant inspection, and before laying a hand on the man; but on a close examination one should endeavor to ascertain clearly whether the bone be denuded of flesh or not; and if the denuded bone be visible to the eyes, this will be enough; but otherwise an otherwise an examination must be made with the sound. And if you find the bone denuded of the flesh, and not safe from the wound, you must first ascertain the state of the bone, and the extent of the mischief, and of what assistance it stands in need. One should also inquire of the wounded person how and in what way he sustained the injury; and if it be not apparent whether the bone has sustained an injury or not, it will be still more necessary, provided the bone be denuded, to make inquiry how the wound occurred, and in what manner; for when contusions and fractures exist in the bone, but are not apparent, we must ascertain, in the first place from the patient's answers, whether or not the bone has sustained any such injuries, and then find out the nature of the case by word and deed, with the exception of sounding. For sounding does not discover to us whether the bone has sustained any of these injuries or not; but sounding discovers to us an indentation inflicted by a weapon, and whether a bone be depressed from its natural position, and whether the bone be strongly fractured; all which may also be ascertained visibly with the eyes.

PART 11

And a bone sustains fractures, either so fine as to escape the sight, or such as are apparent, and contusions which are not apparent, and depression from its natural position, especially when one person is intentionally wounded by another, or when, whether intentionally or not, a blow or stroke is received from an elevated place, and if the instrument in the hand, whether used in throwing or striking, be of a powerful nature, and if a stronger person

wound a weaker. Of those who are wounded in the parts about the bone, or in the bone itself, by a fall, he who falls from a very high place upon a very hard and blunt object is in most danger of sustaining a fracture and contusion of the bone, and of having it depressed from its natural position; whereas he that falls upon more level ground, and upon a softer object, is likely to suffer less injury in the bone, or it may not be injured at all. Of those instruments which, falling upon the head, wound the parts about the bone, or the bone itself, that which falls from a very high place, and the least on a level with the person struck, and which is at the same time very hard, very blunt, and very heavy, and which is the least light, sharp, and soft, such an instrument would occasion a fracture and contusion of the bone. And there is most danger that the bone may sustain these injuries, under such circumstances, when the wound is direct and perpendicular to the bone, whether struck from the hand or from a throw, or when any object falls upon the person, or when he is wounded by falling, or in whatever way the bone sustains a direct wound from this instrument. Those weapons which graze the bone obliquely are less apt to fracture, contuse, or depress the bone, even when the bone is denuded of flesh; for in some of those wounds thus inflicted the bone is not laid bare of the flesh. Those instruments more especially produce fractures in the bone, whether apparent or not, and contusions, and inward depression of the bone, which are rounded, globular, smooth on all sides, blunt, heavy, and hard; and such weapons bruise, compress, and pound the flesh; and the wounds inflicted by such instruments, whether obliquely or circularly, are round, and are more disposed to suppurate, and to have a discharge, and take longer time to become clean; for the flesh which has been bruised and pounded must necessarily suppurate and slough away. But weapons of an oblong form, being, for the most part, slender, sharp, and light, penetrate the flesh rather than bruise it, and the bone in like manner; and such an instrument may occasion a hedra and a cut (for a hedra and a cut are same thing); but weapons of this description do not produce contusions, nor fractures, nor depressions inwardly. And in addition the appearances in the bone, which you call detect by the sight, you should make inquiry as to all these particulars (for they are symptoms of a greater or less injury), whether the wounded person was stunned, and whether darkness was diffused over his eyes, and whether he had vertigo, and fell to the ground.

PART 12

When the bone happens to be denuded of flesh by the weapon, and when the wound occurs upon the sutures, it is difficult to distinguish the indentation (hedra) of a weapon which is clearly recognized in other parts of the bone, whether it exist or not, and especially if the hedra be seated in the sutures themselves. For the suture being rougher than the rest of the bone occasions confusion, and it is not clear which is the suture, and which the mark inflicted by the instrument, unless the latter (hedra) be large. Fracture also for the most part is combined with the indentation when it occurs in the sutures; and this fracture is more difficult to discern when the bone is broken, on this account, that if there be a fracture, it is situated for the most part in the suture. For the bone is liable to be broken and slackened there, owing to the natural weakness of the bone there, and to its porosity, and from the suture being readily ruptured and slackened: but the other bones which surround the suture remain unbroken, because they are stronger than the suture. For the fracture which occurs at the suture is also a slackening of the suture, and it is not easy to detect whether the bone be broken and slackened by the indentation of a weapon occurring in the suture, or from a contusion of the bone at the sutures; but it is still more difficult to detect a fracture connected with contusion. For the sutures, having the appearance of fissures, elude the discernment and sight of the physician, as being rougher than the rest of the bone, unless the bone be strongly cut and slackened (for a cut and a hedra are the same thing). But it is necessary, if the wound has occurred at the sutures, and the weapon has impinged on the bone or the parts about it, to pay attention and find out what injury the bone has sustained. For a person wounded to the same, or a much smaller, extent, and by weapons of the same size and quality, and even much less, will sustain a much greater injury, provided he has received the blow at the sutures, than if it was elsewhere. And many of these require trepanning, but you must not apply the trepan to the sutures themselves, but on the adjoining bone.

PART 13

And with regard to the cure of wounds in the head, and the mode of detecting injuries in the bone which are not apparent, the following is my opinion: In a wound of the head, you must not apply anything liquid, not even wine, but as little as possible, nor a cataplasm, nor conduct the treatment with tents, nor apply a bandage to an ulcer on the head, unless it be situated on the forehead, in the part which is bare of hairs, or about the eyebrow and eye, for wounds occurring there require cataplasms and bandages more than upon any other part of the head. For the rest of the head surrounds the whole forehead, and the wounds wherever situated become inflamed and swelled, owing to an influx of blood from surrounding parts. And neither must you apply cataplasms and bandages to the forehead at all times; but when the inflammation is stopped and the swelling has subsided, you must give up the cataplasms and bandages. A wound in any other part of the head must not be treated with tents, bandages, or cataplasms, unless it also requires incision. You must perform incision on wounds situated on the head and forehead, whenever the bone is denuded of flesh, and appears to have sustained some injury from the blow, but the wound has not sufficient length and breadth for the inspection of the bone, so that it may be seen whether it has received any mischief from the blow, and of what nature the injury is, and to what extent the flesh has been contused, and whether the bone has sustained any injury, or whether it be uninjured by the blow, and has suffered no mischief; and with regard to the treatment, what the wound, and the flesh, and the injury of the bone stand in need of. Ulcers of this description stand in need of incision; and, if the bone be denuded of the flesh, and if it be hollow, and extend far obliquely, we cut up the cavity wherever the medicine cannot penetrate readily, whatever medicine it may be; and wounds which are more inclined to be circular and hollow, and for the most part others of the like shape, are cut up by making double incision in the circle lengthways,, according to the figure of the man, so as to make the wound of a long form. Incisions may be practiced with impunity on other parts of the head, with the exception of the temple and the parts above it, where there is a vein that runs across the temple, in which region an incision is not to be made. For convulsions seize on a person who has been thus treated; and if the incision be on the left temple, the convulsions seize on the right side; and if the incision be on the right side, the convulsions take place on the left side.

PART 14

When, then, you lay open a wound in the head on account of the bones having been denuded of the flesh, as wishing to ascertain whether or not the bone has received an injury from the blow, you must make an incision proportionate to the size of the wound, and as much as shall be judged necessary. And in making the incision you must separate the flesh from the bone where it is united to the membrane (pericranium?) and to the bone, and then fill the whole wound with a tent, which will expand the wound very wide next day with as little pain as possible; and along with the tents apply a cataplasm, consisting of a mass (maza) of fine flour pounded in vinegar, or boiled so as to render it as glutinous as possible. On the next day, when you remove the tent, having examined the bone to see what injury it has sustained, if the wound in the bone be not right seen by you, nor can you discover what mischief the bone itself has sustained, but the instrument seems to have penetrated to the bone so as to have injured it, you must scrape the bone with a raspatory to a depth and length proportionate to the suture of the patient, and again in a transverse direction, for the sake of the fractures which are not seen, and of the contusions which are not discovered, as not being accompanied with depression of the bone from its natural position. For the scraping discovers the mischief, if the injuries in the bone be not otherwise manifest. And if you perceive an indentation (hedra) left in the bone by the blow, you must scrape the dint itself and the surrounding bones, lest, as often happens, there should be a fracture and contusion, or a contusion alone, combined with the dint, and escape observation. And when you scrape the bone with the raspatory, and it appears that the wound in the bone requires the operation, you must not postpone it for three days, but do it during this period, more especially if the weather

be hot, and you have had the management of the treatment from commencement. If you suspect that the bone is broken or contused, or has sustained both these injuries, having formed your judgement from the severity of the wound, and from the information of the patient, as that the person who inflicted the wound, provided it was done by another person, was remarkably strong, and that the weapon by which he was wounded was of a dangerous description, and then that the man had been seized with vertigo, dimness of vision, and stupor, and fell to the ground, under these circumstances, if you cannot discover whether the bone be broken, contused, or both the one and the other, nor can see the truth of the matter, you must dissolve the jet−black ointment, and fill the wound with it when this dissolved, and apply a linen rag smeared with oil, and then a cataplasm of the maza with a bandage; and on the next day, having cleaned out the wound, scrape the bone with the raspatory. And if the bone is not sound, but fractured and contused, the rest of it which is scraped will be white; but the fracture and contusion, having imbibed the preparation, will appear black, while the rest of the bone is white. And you must again scrape more deeply the fracture where it appears black; and, if you thus remove the fissure, and cause it to disappear, you may conclude that there has been a contusion of the bone to a greater or less extent, which has occasioned the fracture that has disappeared under the raspatory; but it is less dangerous, and a matter of less consequence, when the fissure has been effaced. But if the fracture extend deep, and do not seem likely to disappear when scraped, such an accident requires trepanning. But having performed this operation, you must apply the other treatment to the wound.

PART 15

You must be upon your guard lest the bone sustain any injury from the fleshy parts if not properly treated. When the bone has been sawed and otherwise denuded, whether it be actually sound, or only appears to be so, but has sustained some injury from the blow, there may be danger of its suppurating (although it would not otherwise have done so), if the flesh which surrounds the bone be ill cured, and become inflamed and strangled; for it gets into a febrile state, and becomes much inflamed. For the bone acquires heat and inflammation from the surrounding flesh, along with irritation and throbbing, and the other mischiefs which are in the flesh itself, and from these it gets into a state of suppuration. It is a bad thing for the flesh (granulations?) in an ulcer to be moist and mouldy, and to require a long time to become clean. But the wound should be made to suppurate as quickly as possible; for, thus the parts surrounding the wound would be the least disposed to inflammation, and would become the soonest clean; for the flesh which has been chopped and bruised by the blow, must necessarily suppurate and slough away. But when cleaned the wound must be dried, for thus the wound will most speedily become whole, when flesh devoid of humors grows up, and thus there will be no fungous flesh in the sore. The same thing applies to the membrane which surrounds the brain: for when, by sawing the bone, and removing it from the meninx, you lay the latter bare, you must make it clean and dry as quickly as possible, lest being in a moist state for a considerable time, it become soaked therewith and swelled; for when these things occur, there is danger of its mortifying.

PART 16

A piece of bone that must separate from the rest of the bone, in consequence of a wound in the head, either from the indentation (hedra) of a blow in the bone, or from the bone being otherwise denuded for a long time, separates mostly by becoming exsanguous. For the bone becomes dried up and loses its blood by time and a multiplicity of medicines which are used; and the separation will take place most quickly, if one having cleaned the wound as quickly as possible will next dry it, and the piece of bone, whether larger or smaller. For a piece of bone which is quickly dried and converted, as it were, into a shell, is most readily separated from the rest of the bone which retains its blood and vitality; for, the part having become exsanguous and dry, more readily drops off from that

which retains its blood and is alive.

PART 17

Such pieces of bone as are depressed from their natural position, either being broken off or chopped off to a considerable extent, are attended with less danger, provided the membrane he safe; and bones which are broken by numerous and broader fractures are still less dangerous and more easily extracted. And you must not trepan any of them, nor run any risks in attempting to extract the pieces of bone, until they rise up of their own accord, upon the subsidence of the swelling. They rise up when the flesh (granulations) grows below, and it grows from the diploe of the bone, and from the sound portion, provided the upper table alone be in a state of necrosis. And the flesh will shoot up and grow below the more quickly, and the pieces of bone ascend, if one will get the wound to suppurate and make it clean as quickly as possible. And when both the tables of the bone are driven in upon the membrane, I mean the upper and lower, the wound, if treated in the same way, will very soon get well, and the depressed bones will quickly rise up.

PART 18

The bones of children are thinner and softer, for this reason, that they contain more blood [than those of adults]; and they are porous and spongy, and neither dense nor hard. And when wounded to a similar or inferior degree by weapons of the same or even of an inferior power, the bone of a young person more readily and quickly suppurates, and that in less time than the bone of an older person; and in accidents, which are to prove fatal, the younger person will die sooner than the elder. But if the bone is laid bare of flesh, one must attend and try to find out, what even is not obvious to the sight, and discover whether the bone be broken and contused, or only contused; and if, when there is an indentation in the bone, whether contusion, or fracture, or both be joined to it; and if the bone has sustained any of these injuries, we must give issue to the blood by perforating the bone with a small trepan, observing the greatest precautions, for the bone of young persons is thinner and more superficial than that of elder persons.

PART 19

When a person has sustained a mortal wound on the head, which cannot be cured, nor his life preserved, you may form an opinion of his approaching dissolution, and foretell what is to happen from the following symptoms which such a person experiences. When a bone is broken, or cleft, or contused, or otherwise injured, and when by mistake it has not been discovered, and neither the raspatory nor trepan has been applied as required, but the case has been neglected as if the bone were sound, fever will generally come on if in winter, and in summer the fever usually seizes after seven days. And when this happens, the wound loses its color, and the inflammation dies in it; and it becomes glutinous, and appears like a pickle, being of a tawny and somewhat livid color; and the bone then begins to sphacelate, and turns black where it was white before, and at last becomes pale and blanched. But when suppuration is fairly established in it, small blisters form on the tongue and he dies delirious. And, for the most part, convulsions seize the other side of the body; for, if the wound be situated on the left side, the convulsions will seize the right side of the body; or if the wound be on the right side of the head, the convulsion attacks the left side of the body. And some become apoplectic. And thus they die before the end of seven days, if in summer; and before fourteen, if in winter. And these symptoms indicate, in the same manner, whether the wound be older or more recent. But if you perceive that fever is coming on, and that any of these symptoms accompany it, you must

not put off, but having sawed the bone to the membrane (meninx), or scraped it with a raspatory (and it is then easily sawed or scraped), you must apply the other treatment as may seem proper, attention being paid to circumstances.

PART 20

When in any wound of the head, whether the man has been trepanned or not, but the bone has been laid bare, a red and erysipelatous swelling supervenes in the face, and in both eyes, or in either of them, and if the swelling be painful to the touch, and if fever and rigor come on, and if the wound look well, whether as regards the flesh or the bone, and if the parts surrounding the wound be well, except the swelling in the face, and if the swelling be not connected with any error in the regimen, you must purge the bowels in such a case with a medicine which will evacuate bile; and when thus purged the fever goes off, the swelling subsides, and the patient gets well. In giving the medicine you must pay attention to the strength of the patient.

PART 21

With regard to trepanning, when there is a necessity for it, the following particulars should be known. If you have had the management of the case from the first, you must not at once saw the bone down to the meninx; for it is not proper that the membrane should be laid bare and exposed to injuries for a length of time,as in the end it may become it may become fungous. And and there is another danger if you saw the bone down to the meninx and remove it at once, lest in the act of sawing you should wound the meninx. But in trepanning, when only a very little of the bone remains to be sawed through, and the bone can be moved, you must desist from sawing, and leave the bone to fall out of itself. For to a bone not sawed through, and where a portion is left of the sawing, no mischief can happen; for the portion now left is sufficiently thin. In other respects you must conduct the treatment as may appear suitable to the wound. And in trepanning you must frequently remove the trepan, on account of the heat in the bone, and plunge it in cold water. For the trepan being heated by running round, and heating and drying the bone, burns it and makes a larger piece of bone around the sawing to drop off, than would otherwise do. And if you wish to saw at once down to the membrane, and then remove the bone, you must also, in like manner, frequently take out the trepan and dip it in cold water. But if you have not charge of the treatment from the first, but undertake it from another after a time, you must saw the bone at once down to the meninx with a serrated trepan, and in doing so must frequently take out the trepan and examine with a sound (specillum), and otherwise along the tract of the instrument. For the bone is much sooner sawn through, provided there be matter below it and in it, and it often happens that the bone is more superficial, especially if the wound is situated in that part of the head where the bone is rather thinner than in other parts. But you must take care where you apply the trepan, and see that you do so only where it appears to be particularly thick, and having fixed the instrument there, that you frequently make examinations and endeavor by moving the bone to bring it up. Having removed it, you must apply the other suitable remedies to the wound. And if, when you have the management of the treatment from the first, you wish to saw through the bone at once, and remove it from the membrane, you must, in like manner, examine the tract of the instrument frequently with the sound, and see that it is fixed on the thickest part of the bone, and endeavor to remove the bone by moving it about. But if you use a perforator (trepan?), you must not penetrate to the membrane, if you operate on a case which you have had the charge of from the first, but must leave a thin scale of bone, as described in the process of sawing.

THE END