Hodge, (H. L.)

ON COMPRESSION OF THE FŒTAL HEAD BY THE FORCEPS AND CEPHALOTRIBE.

BY

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ON COMPRESSION OF THE FŒTAL HEAD BY THE FORCEPS AND CEPHALOTRIBE.

By HUGH L. HODGE, M.D., Philadelphia.

PHILADELPHIA, *November* 5, 1874.

GENTLEMEN OF THE PHILADELPHIA OBSTETRICAL SOCIETY:

IN a letter addressed to this Society, dated November 6, 1872, my father promised to prepare a paper upon the compressibility of the fœtal head by the forceps, and upon the great value of cephalotripsy and that form of cephalotribe which would render it most useful as a compressor, and also as a tractor.

He at once began the preparation of this paper, and continued to work upon it until within two days of his death, in February, 1873. Among his final directions, in the last hour of his life, he told me to take charge of it and complete it. This I have endeavored to do in his own words, by extracts from what he had already written and published on the subject. The article, prepared in this manner, is, I think, of more value than it could have been made in any other way, because it contains nothing that is not his own thought expressed in his own words. But it is only a fragment of what it would have been if he had lived.

Respectfully yours,

H. LENOX HODGE.

"One the most dangerous errors relative to the forceps that a student could take up, would be the opinion that the forceps is, in its very design, a compressive instrument. It is not so; the forceps is not a pincers, it is an extractor—it is a real tire-tête; and I think it ought to be established as a principle in obstetrics, that where there is not space enough for the descent of the head without the forceps there cannot be produced a due proportion by merely squeezing the head down to the required dimensions by such an instrument." (Meigs' Treatise on Obstetrics, 4th edition, p. 528.)

This was the earnest teaching, both written and oral, of my excellent friend, the late Chas. D. Meigs, M.D., Professor of Obstetrics in Jefferson College. It is not his alone, but seems to be the universal opinion of British practitioners since the time of Smellie, if we can form an opinion from the size and dimensions of the various forceps which have been, and still are, in use in the British domains. Very slight compression can be made upon the head even when the handles are brought in contact. Obstetricians are afraid to trust the novitiate, or even themselves, in the use of an instrument capable of diminishing any of the diameters of the head. Many of the practitioners of our own country practically adopted the same opinion by employing the English forceps with some slight modifications.

The fear of undue compression influenced the mind of Dr. Foster, who, in 1781, recommended "a stop, or kind of nail, to pass from one handle to the other at their extremities," for the "excellent purpose of preventing too much pressure upon the head of the child," etc. ("Principles and Practice of Midwifery," by Edward Foster, M.D. Lond., 1781). It is singular with what pertinacity this idea has been maintained among the English-speaking people, for we find that the late Prof. Elliott, of New York, recommends "a sliding pivot" on his modified forceps, not being willing to trust his own prudence and judgment in the use of his own instrument.

This opinion as to the impropriety of compression, sanctioned by some of the best obstetric authorities, is, I believe, fundamentally erroneous, and has greatly restricted the practical use of the most invaluable of all obstetric instruments, the forceps. It is not surprising, therefore, that Prof. Barnes, as late as 1870, affirms that the English forceps "has declined" since the time of Denman and Smellie, and that the highest compressing power

of this instrument has not been developed. "Indeed the present forceps are not much better than Chamberlen's."

My observations upon this important subject will be best arranged under distinct propositions.

First.—*The vault of the fœtal cranium is so constructed as to render it capable of compression.*

This is well known and acknowledged. It depends not merely on the interosseous spaces termed fontanelles, but also, upon the arrangement of the commissures of the cranium, improperly called sutures. The edges of the several bones are not serrated, but are simply in contact, and are connected by a fibro-cartilaginous tissue possessed of some elasticity, and at the same time very strong. The bi-parietal commissure is extended forwards between the two portions of the os frontis to the nose, and is usually termed bi-frontal. There is often, also, to be observed, a transverse fissure across the base of the occiput, behind the foramen magnum, and may be termed the bi-occipital commissure. It is evident, therefore, that a very large proportion of the head—indeed, all that part above a line drawn from the base of the occiput over the external meatus auditorius to the orbital ridges—is capable of great diminution in size, simply from its anatomical arrangements.

Second.—*Compression does actually occur in Labor.*

This also is acknowledged by the most sceptical. It is observed in every case of labor to a greater or less degree where the head meets with any resistance in its transit, whether from the rigidity of the muscular and other tissues or the disproportion between the head and pelvic canal. The alteration of the form of the head varies according to the presentation and other circumstances. In the usual vertex presentation the cranium is diminished in its lateral direction, and increased in its length. The first is evidently owing, as observation proves, to the riding of one parietal bone over the other, and also of one portion of the os frontis over its fellow. The elongation of the occipito-mental diameter, which, Dr. Barnes affirms, may be to the extent of one inch or more, is not so easily explained. Some slight motion may possibly exist at the connections of the os frontis, and the malar and nasal bones may allow of some recession of

the os frontis. Still more may be gained by the backward projection of the occipital bone, permitted by the bi-occipital commissure. These, however, do not appear to be sufficient to explain the elongation of the occipito-mental diameter from five to six and six and a-half inches, as has been alleged. I suspect, however, that the elongation of the head is more apparent than real, owing to the tumefaction of the scalp from pressure, effusions, etc. As to the lateral diminution of the head, it is usually stated from three to six lines. Baudelocque's well-known experiments upon heads of stillborn children would limit it to three or four lines; but, as well-developed fœtuses have been born alive, where the conjugate diameter of the brim has not measured more than three inches, we have a right to infer that the bi-parietal diameter would be lessened to six or eight lines. Much depends upon the degree of ossification of the head, and the peculiar circumstances of the labor.

THIRD.—*Compression of a fœtal head at term can be effected to a great extent with safety to the child.*

It is impossible to determine *à priori* what are the safe limits. Much depends on the compressibility of the cranium. Much upon the degree of pressure applied, much upon the intermittent character of the pressure, and much on the time which is expended. Hence, children are often born alive under apparently the most unfavorable circumstances, and sometimes they are stillborn, when great hope is entertained of their safety. The experience of the profession has indicated that children at term may be born with safety by the natural efforts of the mother, when the antero-posterior diameter of the superior strait measures three inches, under which circumstances, efforts should always be made for its preservation. If the diameter be less than three inches, no reasonable hope can be entertained, unless the head be imperfectly ossified, as in premature children.

FOURTH.—*The death of the fœtus during labor from pressure, results from two causes—1st, the diminution or suspension of the functions of placenta and funis, and 2d, from the cessation of the circulation generally.*

This last is often a sequel of the first, but as it is accompanied with different phenomena, should be considered separately.

It is usually asserted that the death of the infant is owing to pressure upon the brain, *per se*, as the primary and essential cause. This cannot be admitted, for it is well known that the life of the fœtus in utero is almost entirely organic or vegetable. The brain, so all-important as the centre of the nervous system after birth, is really of no value to the fœtus. Its organic actions, its growth and nutrition can be carried on as well without as with the brain. This is fully demonstrated in the case of an anencephalus or an acephalus fœtus. There is in the Obstetric Museum of the University of Pennsylvania, a fœtus almost twice the size of its twin, which was perfect, and yet there were no head and no upper extremities developed. In addition, experience proves that, no matter how much pressure is made upon the cerebral mass during labor, even for a long time, the child may survive, provided there be no solution of continuity of the tissue and no internal extravasation.

The essential cause of the death of the fœtus is a suspension of its respiratory function. This, physiologists have established, resides not in the lungs, but in the placenta, while the funis or cord is the conduit by which impure and pure blood is carried to and from the placenta. Experience also clearly demonstrates that the interruption of this important function is as dangerous to the fœtus as a cessation of breathing to the adult. The child perishes in a few minutes if its connection with the parent be interrupted. Many restrict the time to two or three minutes. Dr. Barnes and other good authorities affirm that five minutes is the extreme limit.

It is the general declaration that pressure upon the cord for any length of time is fatal. This is the truth, but only part of the truth. Pressure upon the placenta, or the separation of this organ from the uterus, is equally the cause of death. In pelvic deliveries, and also in cases of prolapse of the funis, accoucheurs direct various measures to protect or relieve the cord from pressure, which directions are often valuable. But in cranial deliveries we have no reason to suppose that the cord is often subjected to pressure, and yet in tedious and severe labors the child often perishes. The explanation of this circumstance is, that after the membranes have been ruptured, the whole placenta is compressed between the body of the child and uterus. A flat body of some eight or nine inches in

diameter is thus exposed to pressure from the powerful contraction of the uterus, augmented by spasmodic contractions of the abdominal muscles. All are familiar with the great force of these powers, sufficient almost to paralyze the hand of the accoucheur when within the cavity of this organ, or even, in some instances, to cause a rupture of its walls. We have a right, therefore, to presume that in most cases during the second stage of labor, there is at least a partial interruption to the circulation of blood, and therefore to the respiratory functions of the placenta. That death does not ordinarily ensue is owing to the admirable provision of nature that the expulsive efforts of the parturient woman are intermittent, not continuous. If, however, the pains should be severe and persistent, and the labor tedious, death does result from the interruption of the functions of the after-birth. This affords us an explanation why the secale cornutum, which excites such permanent and violent contractions of the uterus, has proved so detrimental to the fœtus.

There is still another circumstance why, in some cases, the infant perishes, which has been strangely overlooked by even the best authorities in the profession. It is the separation of the placenta from the uterus before the head is delivered. This may be occasionally noticed in cases of vertex presentation, where from a blow or fall the placenta has been detached with or without hemorrhage; also in cases of placenta prævia. But it is chiefly in cases of pelvic deliveries where the danger to the fœtus from this cause is most imminent. Practitioners, even the most distinguished, such as Professors Simpson and Barnes, appear to be satisfied that the child will be comparatively safe if the cord can be removed to the side of the infant's face, or tucked away in the notch on each side of the sacral promontory, forgetting that when the head is fairly engaged in the superior strait, the uterus is as completely emptied as it is when the child is born. It is contracted to a small size above the head of the child, and the placenta very universally separated from its walls. This seems to me by far the most frequent reason why children so often perish in pelvic deliveries, and why so little confidence should be placed in attempting to remove the cord from pressure.

The changes which take place in the child from the suspen-

sion of this respiratory process are very analogous, perhaps perfectly identical with those of asphyxia in the adult. In all cases of tedious labor, the surface of the child, and especially its face, is of an unusual blue color. In proportion to the interruption of the placental functions, the blue tinge deepens, and in confirmed cases, the whole surface is purple, the eyes are injected, the external tissues tumefied, which tumefaction often extends to the neck and the chest, while the hands and feet are often pallid and cold. The tongue and lips are also cold and blue, the pulsations of the heart are feeble, and that of the cord partially or completely suspended. This has been termed the apoplectic condition of the new-born infant, but is in reality a case of asphyxia or venous engorgement from suspended placental functions. All the phenomena will rapidly disappear if the pulmonic respiration be re-established. In bad cases, more permanent and serious evils may result from effusions of serum or pure blood, not only into the subcutaneous tissues, but also into the cavities of the cranium and thorax; hence the functions of the brain, heart and lungs cannot be established, or else are so imperfectly excited that the child remains blue, with an imperfect circulation and oppressed respiration, with great dullness, and with feebleness of its muscular powers, usually perishing after a few hours or days. It is in this way that children so often die during labor or immediately afterwards.

A second cause of death to the fœtus is the suspension of the circulation. The child is born showing few, if any, marks of vitality, with no pulsation in the cord, and seldom more than a feeble thrill of the heart. The limbs are motionless, the face and whole surface of the body pallid, the features sunk, and little or no impression can be made upon its sensibility. It has been termed the anæmic condition of new-born children, but I have always regarded it as the sequela of prolonged asphyxia. It arises from the same causes, and it is possible that it may be, in a great degree, dependent upon such continued pressure from the uterine powers, that the circulation in the placenta and child is completely arrested.

A practical deduction from these facts is all-important. The practitioner, in all his operations, should never forget that all pressure on the child's head or body should be intermittent;

that the placental and circulatory functions should not be suspended; and, secondly, that no hope but that arising from speedy delivery can be entertained for the safety of the child when the placenta is detached from the uterine surface.

FIFTH.—*Compression upon the head of the fœtus can often be made by the forceps, not only with safety, but with great advantage during labor.*

The safety of delivery by the forceps is a point settled beyond controversy. It is established by universal experience. It seems almost equally incontrovertible, that in every forceps delivery more or less pressure is made by the instruments very generally employed in Europe and America. For in them the fenestræ are so small, or of a shape so peculiar, that the parietal protuberances cannot project through them, hence the thickness of each blade must be superadded to the measurement of the transverse diameter of the head, and necessitates, therefore, sufficient pressure on the head for their accommodation.

Again, after the instrument is applied, the handles must be approximated, in order to have a secure hold, as otherwise the blades would vacillate, or even slip upon the scalp of the child. When Dr. Meigs directs that only one blade should be acted upon at a time, carrying it from one side to another, so as to pry out the head, it is manifest that the head is compressed between that blade and its fellow, or pelvis upon the opposite side. And when Prof. Barnes affirms that no pressure should be made by the forceps, that they should be used simply as tractors, it is still evident, that as the head is drawn from a larger to a smaller space, the compression upon the sides of the pelvis, which necessarily results, is enhanced, not only by the thickness of the blades, but in proportion to the tractive power exercised.

Compression being thus always more or less effected by the forceps, the important question arises to what extent it can be carried with safety to the infant. It has been already said that this cannot be possibly determined, as the limit must vary in different cases.[1] Experience, however, shows clearly that

[1] Dr. Barnes would limit the use of forceps to a conjugate diameter of three and a half inches or more.

Baudelocque restricts the degree of compression of the head to one-fourth

children may often be saved by means of the forceps, when the passages are contracted and the head arrested. By this valuable instrument I have often delivered children with safety in women who in previous labors had lost their infants, and in some cases when there were but three inches in the conjugate diameter of the brim. The experience of many other practitioners coincides with my own.

In modern works, therefore, it is a settled principle that a perforator should not be employed until a previous attempt at delivery has been made by the forceps or by version. Of course, when the contraction is so great, the prognosis must always be doubtful. Many children perish and many are preserved. No statistics have established the proportion of safe deliveries under these untoward circumstances, as the condition of the patient and child, the time of operating, the skill of the operator, the instrument employed, and other conditions vary exceedingly.

Perhaps no one circumstance is of more importance than the construction of the forceps. Even the best in general use are lamentably deficient in some one or more points. Most of the English forceps are too short. Their long forceps, so called, have fenestræ so small that they occupy space—that is, the thickness of the blades must be superadded to the diameter of the cranium, while they are incapable, even when the handles are closed, of making any effective compression. They are, therefore, totally inadequate to accomplish delivery when the short diameter of the strait measures but three inches, as the measurement from one blade to the other is, very generally, nearly three inches. I do not wonder, therefore, that the experienced and judicious Dr. Burns ("Burns' Obstetrics," by Dr. James, Phila., pp. 429, 30) observes, that it might not be possible, in a greatly contracted pelvis, to withdraw the forceps if applied. It may be added that all such attempts must be exceedingly dangerous to the mother's tissues during the passage of the head. No wonder, then, we read of such horrible laceration of the uterus and vagina, accidents which

inch; Velpeau, Osiander, and Siebold to one-half inch. Joulin and Chassagny made many experiments, proving that the head can be moulded more by the forceps than is commonly believed. Delore thinks compression of the head by the forceps may be harmless, if exerted over a large surface.

ought *never* to occur with a well-constructed instrument. The forceps of Dr. Haighton and those of Prof. Davis differ from the generality of British forceps in having large fenestræ, so that when properly applied they do not occupy space. The former instrument was, on this account, strongly recommended by Prof. James, of the University of Pennsylvania, and the latter by Prof. Meigs, of Jefferson College, but both instruments are confessedly inadequate for deliverance at the brim of the pelvis. Dr. Davis and Dr. Meigs would both restrict their use to cases where the head is *within* the pelvis, and the former invented a second instrument of a peculiar structure for the head retained at the brim.

The forceps generally used on the Continent of Europe are capable of making compression, and hence, if we may judge from the reports given, are far more efficient than the British. When the head is at the superior strait, Baudelocque's instrument, especially as modified in this country by Dr. Dewees, is certainly one of the most powerful and valuable devised,[1] and by it many children have, doubtless, been saved who otherwise would have perished. It is suitable to all obstet-

[1] The forceps used in Great Britain and often in this country, have short handles compared with the long handles of those used in France. It is evident that the longer the handle, the greater power as a lever, hence, its efficiency is greatly augmented and in cases of great difficulty much force can be exerted by very little muscular effort. The short handle, on the contrary, under similar circumstances demands much muscular effort, which not only induces fatigue, but renders it impossible to be very accurate or delicate in the application of the necessary force, and so we read of, not only the exhaustion produced in the operator, but of the slipping of the forceps, endangering the tissues of the mother and child and imperilling the equilibrium of the accoucheur. The power of this valuable instrument as a lever has been dreaded as much as its compressing power, forgetting the fundamental maxim *arte non vi*, and that the practioner should be governed by his science and judgment, and not by the artificial restraints imposed by the instrument.

The latest account we have seen showing the inefficiency of the English forceps, as to their powers as levers and compressors, is reported in the Edinburgh Med. Jour., Feb., 1873, as detailed in the Obstet. Soc., Dec. 11th, 1872. The forceps had been applied three times in a case of contracted pelvis; there were two gentlemen in attendance. The one being exhausted by his efforts yielded the instrument to his companion, who, after great exertion, advanced the head very little. Perforation, hooks, etc., were resorted to, and the fifth effort was made with the forceps, by which, with much difficulty, the head was extracted. The operation was regarded by the members of the Society as being very well executed, especially as the woman recovered.

ric emergencies. By the advice of Prof. Dewees, I used it advantageously for many years, but found that it had its defects, three being very important ones. The first was, that when the blades were passed high up in the pelvis, the orifice of the vagina was unduly stretched by the divergency of the blades near the lock, and hence there was danger of injuring the perineum, especially in primiparous patients. The second and more important defect was the small size of the fenestræ, so that the parietal protuberances could not project through them; hence, owing to the thickness of the blades, undue encroachment was made upon the cavity of the pelvis and undue compression upon the head. A third defect that it had, was the flatness of the internal surface of the blade, so that it did not conform to the convexity of the cranium, and the internal edge of the fenestra was very thick compared with the external margin. Hence, when much pressure was made by the forceps, the edges of the fenestræ left their mark, often bruising and sometimes actually cutting the fœtal scalp, giving rise to inflammation and even abscesses. I determined, therefore, to modify this otherwise excellent instrument, by accepting some of the peculiarities of Haighton's and Davis' forceps. The chief of these modifications consisted in rendering the internal surfaces of the blades concave, so that they would correspond exactly to

the surfaces of the head; also in enlarging the fenestræ that the parietal protuberances could project through these openings, and thus no encroachment would be made upon the diameters of either the pelvis or the head. They may be said to occupy no space. Again, I adopted the plan of Dr. Davis in having shanks intervening between the lock and the blades, and running parallel to each other, one anterior and the other posterior, and not laterally, as in Davis' instrument, by which arrangement there is no stretching the vagina, no danger of injuring the perineum, however high in the pelvis they may be introduced.

One great improvement in these forceps is the form of the space between the blades: it is ovoid, the small extremity of which is towards the points of the blades, and the large extremity towards the shanks. Hence the greatest transverse diameter is about two-thirds the distance from the ends, and the whole space is in exact conformity to the ovoid shape of the fœtal cranium. When traction, therefore, is made, the force is applied, not upon one portion of the head, but upon the whole anterior surface, extending from the parietal protuberance to the face. This arrangement, if the instrument be made of well-tempered steel, is an effectual preventive of its slipping; the greater the force applied, the greater will be the compression of the head, and a retraction of the whole more within its grasp. If the head should be small the points of the blades may reach beyond the chin, and of course be firmly secured.

This modified forceps I presented to the class at the University during the session of 1837–38, but an account of it was not published until 1843, when my friend, Prof. Huston, of the Jefferson College, politely requested a drawing and a description of it for his edition of Churchill's Obstetrics (p. 335). I have used it very frequently in almost every variety of forceps cases where the head was in the superior or inferior strait, and even when there were great pelvic contractions to the extent of even three inches in the conjugate diameter of the brim. In all instances it proved most efficient and safe. I do not know that any injury has ever resulted from it either to the mother or child, not even an abrasion of the scalp. It has been much used, not only in this city, but, perhaps more extensively than any other, throughout the United States. I have heard of no criticism as to its safety and efficiency.

For the successful use of forceps as compressors, many circumstances must be taken into consideration. No unnecessary delay should be permitted. As soon as it is ascertained that the natural powers are inadequate, artificial means should be employed. It is unwise to wait until the patient's strength is exhausted and the fœtal life jeopardized by the severe and repeated uterine efforts. Sir Jas. Y. Simpson has abundantly demonstrated, by an array of facts, that the more prolonged the labor the greater, *ceteris paribus*, is the danger to the mother and child. In contracted pelves the difficulty can be ascertained at

the beginning as well as at the end of labor, hence, the forceps should be applied as soon as the os uteri is dilated or at least easy of dilatation. There is no objection, and, to the experienced practitioner, no difficulty, in passing a suitable instrument even into the cavity of the uterus when the first stage of labor is completely over, and before the head is driven down or wedged in the contracted aperture. The blades being properly adjusted there is no necessity for immediate action. The forceps for a time may lie passively in the hands of the physician until the head is considerably depressed. Assistance should then be gradually rendered, when the compression, traction, and moderate leverage may be used with great efficiency in causing transit of the fœtal head. The natural *vis a tergo*, conjoined with the artificial *vis a fronte*, as Dr. Barnes expresses it, will thus insure as little delay as possible at that particular juncture when alone danger is to be apprehended; the rest of the delivery in ordinary cases is easy.

All action with the forceps should be intermittent, and in unison with the uterine efforts. Constant traction would keep up constant uterine action, which, interfering with the respiratory process of the placenta, would be dangerous.

Another important rule is that the blades should be as nearly coincident as possible with the *occipito-mental* diameter of the head, as compression will then be made in the most favorable direction. If the head should be arrested with the occiput towards the pubis, this rule can be readily fulfilled, but this is a rare circumstance. The head, far more frequently, is found directly transverse; these direct applications over the parietal protuberances will be, in contracted pelvis, so dangerous to the tissues of the mother, that it should not be attempted; in such cases, the forceps should be applied obliquely over the side of the occiput and the side of the os frontis, one blade being directed towards the sacro-iliac junction and its fellow towards the opposite ramus of the pubis. Compression in the lateral direction can thus be very satisfactorily made. The blades acting in this way over the opposite extremities of the head would have a tendency to facilitate rotation, which would be a desirable circumstance. Hence the importance of learning precisely the exact position, by means of the commissures and fontanelles, of the head in the strait. This is in contravention of the German

practice, followed by many English practitioners, even by Dr. Barnes in his recent excellent work, of applying the blades of the forceps to the sides of the pelvis irrespective of the position of the head, a practice which I must regard as unscientific and often very detrimental. By following this rule the occiput and face would often be embraced, and all compression in this direction would tend to increase the transverse diameters of the head already locked between the pubis and sacrum, augmenting the difficulty of transmission and enhancing the dangers to the mother's tissues, especially the bladder and urethra. Such an application of the instrument can only be justified in rare and extreme cases.

Another rule for the successful application of the forceps, whenever they are employed, especially where the pelvis is contracted, is that flexion of the head must be previously induced[1] either by the natural bearing down efforts, or by the accoucheur. If the head be not flexed, the blades cannot be passed in the direction of the long diameter of the head, but will glide in the direction of the vertical diameter, for the top of the head, as represented by the anterior fontanelle, would be the lowest in the pelvis, and the base would be the highest. Traction thus made would be comparatively inefficient, and in the contracted pelvis perhaps wholly ineffectual, as the long diameter of the head would correspond to the lateral diameters of the pelvis; the occipito-frontal or mental instead of the vertical or cervico-bregmatic. This mode of operating is far too frequent, especially since M. Nægelè has so greatly ignored the deviated positions of the vertex, and introduced a practice at variance with the true mechanism of labor. Another serious objection to this direction of the blades, is that their points will necessarily project beyond the base of the cranium, endangering the tissues of the neck, or, if the cord should happen to be there, even the life of the child, by the pressure or laceration of the funis.

The almost universal direction given by our brethren across the water, of passing the blades over the ears of the child irrespective of the position of the fontanelles, has a tendency to

[1] Dr. Burns, who wrote his valuable work before the opinions of Naegelè had indoctrinated the profession, gave the same advice of pushing up the face and bringing down the occiput, by the vectis, before applying the forceps.

confirm this serious error. I have no doubt that under the guidance of these and similar rules, the application of the forceps, in moderately contracted pelvis, will be far more successful than it has usually been represented, particularly by British obstetricians, and that the powers of this invaluable instrument will be still further developed.

Sixth.—*Delivery in moderately contracted pelves can be effected with greater safety by the forceps than by podalic version.*

Of late years this question has been warmly debated by the profession, and is still *sub-judice*. Prior to the introduction of the forceps, version was the only resource in cases of difficulty. It was, however, generally abandoned, notwithstanding the high authority of Madame La Chapelle, preference being given to the long forceps. A revulsion in favor of version has taken place since the year 1845, owing to the great talents and the laborious efforts of Sir Jas. Y. Simpson, whose authority, supported by that of Dr. Radford, has induced many of the best accoucheurs, not excepting M. Cazeaux, of Paris, and Prof. Barnes, of London, to adopt his ideas and practice. The question is, of course, a very difficult one, and at present it is impossible to come to any positive determination, simply from clinical experience, so far as facts can be collected.

I do not now propose an examination of this point, having in my work on the Principles of Obstetrics, on p. 404 et seq., presented my objections both to the theory and practice of Dr. Simpson. I shall, therefore, now merely give the conclusions therein reached. The idea of Dr. Simpson that the top of the head of the child is flattened when driven down in a moderately contracted pelvis, and therefore that the transverse diameter is elongated, is hypothetical. No evidence is adduced, and it is difficult to conceive how it can be substantiated. Authors do not allude to it, and the ease with which the parietal bones overlap each other, as so constantly observed, is opposed to this assertion.

In speaking of the form of the head as being conical, it is a great error to say the base of the cone is at the top of the head, and the truncated apex at the lower part, and represented by the bi-mastoid diameter, measuring two and a half inches. That

in some unusual cases the base of the cranium presents, especially when traction has been improperly directed, there can be no doubt, but this is *contra naturam*. It is very universally true when the process of labor is not interfered with, that either the chin or vertex presents. Hence, the proper representation of the form of the obstetric head is that of a double cone, the apex of one being at the occiput and the other at the chin, their common base being represented by the cervico-bregmatic circumference, and of course by the bi-parietal and cervico-bregmatic diameters. The head is, therefore, ovoid, and by a wise provision of nature the large extremity of the ovoid usually, 96 per cent., descends first. Any presentation of the top of the head as represented by the anterior fontanelle, or of the base of the cranium, is irregular and comparatively very rare. Moreover, it would be complicated by having the occipito-frontal, or long diameter of the cranium, substituted for the short or vertical, diameter. Dr. Simpson dwells upon the importance of having the bi-mastoid diameter present first in preference to the vertical, owing to the wedge-like form of the side of the head facilitating the descent, and that this portion is more compressible than the broad expanse at the summit; but as already remarked it is not the top of the head, but the occiput, that presents. It is with this portion, therefore, that the comparison should be made. The compressibility of the side of the head is very trifling, the mastoid portion of the temporal bone cannot be contracted, and this occupies one-half of the distance to the parietal protuberance, while a large proportion of the space between the occipital protuberances and the parietal protuberances is compressible, as is abundantly demonstrated in protracted labors, where the head becomes elongated and diminished in its lateral direction. The presentation of the vertex, therefore, is more favorable for delivery than the presentation of the base of the cranium. The length and compressibility of the occipital extremity being greater than that of the sides, no argument, therefore, for version by the feet can be drawn from the supposed advantage of the wedge form of the side of the head.

Numerous objections exist against podalic version. True, it is an easy and a safe operation when the uterus is distended with the liquor amnii, when it is in a relaxed state, and the

child in a mobile condition, and when there is no special impediment to delivery, and where the chin is approximated to the breast. But even in such cases, statistics demonstrate that the average death of children is thirty-three per cent.; but in difficult cases, M. Capuron, who is endorsed by M. Cazeaux, affirms that the fatality amounts to seventy or seventy-five per cent. We have no statistics at present as to any advantages which can be positively claimed for the forceps in contracted pelvis. Neither can we expect any favorable report from those who employ the British forceps, for reasons already mentioned. The Continental physicians have generally trusted to this instrument rather than to version; and even the high authority of Dr. Simpson, supported by many of his English compeers, by Madame Lachapelle and M. Cazeaux in France, does not appear to have made many converts. Dr. Lusk, in a résumé of German practice, published in Elliot's "Obstetric Clinic," covering many thousand cases, states that after making every allowance for doubtful cases, the mortality of children in deformed pelvis was thirty per cent. in vertex cases, and thirty-six per cent. in version cases. Dr. Lusk concludes from his extensive review, that the experience in Germany is decidedly in opposition to Simpson's views. Even M. Cazeaux, who gives a preference to version, has known children to be delivered naturally when the short diameter of the pelvis has measured three inches, or even less, and advises, that if turning should be impracticable, an attempt should be made with the forceps before perforation, as with their assistance children have often been born alive. Dr. McClintock, of Dublin, and Dr. Martin, of Berlin, are both in favor of occipital rather than pelvic deliveries in contracted pelvis. In the former case, time can be allowed for the gradual moulding of the head, while in the latter, the delivery must be speedily effected with strong traction.

Theoretically, the strongest argument in favor of version is the assertion by Drs. Simpson and Barnes, that it is not the bi-parietal diameter which is immediately involved, but that the head is nipped in the bi-frontal diameter, between the pubis and sacrum. They support this opinion with the fact that an indent or depression is often found on the side of the os frontis where it had been pressed by the promontory of the sacrum,

and not at the projection of the parietal bone. Hence, it is the bi-frontal, measuring three inches, which is involved, and that, as a necessary consequence, the whole head posterior to the bi-frontal commissures, descends upon the right or left side of the pelvis, thus rendering, they say, deliveries by the base more easy than deliveries by the vertex. The truth of this assertion is not by any means clear, for if the side of the os frontis presses against the sacrum posteriorly, it would imply that the head was in an oblique position, and hence it would not be the os frontis that would be opposed to the symphysis pubis, but the parietal bone behind the ear, which would give, not the bi-frontal, but the fronto-parietal diameter as corresponding to the conjugate diameter of the strait, which would measure fully as much as the bi-parietal diameter. Moreover, it presupposes that the transverse or oblique diameters of the strait are not contracted, which they usually are in a deformed pelvis. Even if it were true that the head could thus be brought through, presenting its bi-frontal diameter, this constitutes no argument in favor of pelvic deliveries, inasmuch as there must be the same accommodation on one side of the pelvis for a larger part of the head where the vertex presents, and hence the bi-frontal diameter would be concerned in the one case as much as it is in the other. The simple truth is, that there is a body of a peculiar size and shape which is to pass through the kidney-shaped opening, and this body being an ovoid, it is, mechanically speaking, of no importance whether the smaller or greater extremity of the ovoid projects first through the opening.

I cannot, therefore, avoid the conclusion, in view of all the facts and opinions, that, in cases of contracted pelvis where there are at least three inches in the conjugate diameter, the delivery by suitable forceps is far more safe for the mother, and that the mortality for the child would be less. All practitioners acknowledge the great difficulties and dangers incident to podalic version when the passages are contracted, enhanced immeasurably when the liquor amnii has been evacuated and the uterus firmly contracted on the child. Often in these cases it is not merely dangerous, but actually impracticable. Details are unnecessary. If the forceps be employed, comparatively no additional danger to the mother is incurred; the child de-

scends with that presentation which is always regarded as the most favorable. The blades of the forceps occupy no space. All the compression that is requisite, is made by the forceps rather than by the walls of the pelvis, and the greater the compression of the head, the less pressure there is upon the pelvic tissues. The extracting powers of the instrument can be regulated with the greatest facility, and be employed or intermitted at pleasure; time being given for the gradual moulding of the head, as well as for the extractive efforts, inasmuch as the circulation of the funis and placenta are comparatively little disturbed. In my own experience the tissues of the mother have not been injured, or her life endangered. The advantage then for the mother greatly preponderates.

In version, even in natural labors, the child frequently perishes, often in the proportion of one to three, but in deformed pelves the deaths are more than double. The reasons have been already stated. The placental functions are necessarily interrupted, so that the whole process of delivery must be accomplished in four or five minutes. No time is allowed for the gradual compression and moulding of the cranium. Powerful traction must be made by the muscles superadded, according to some, by the weight of the accoucheur, all of which power is directed through the medium of the child's neck, injuriously to its tissues, and not unfrequently there is a complete laceration of it, so that the practitioner sometimes finds himself prostrated, holding the decapitated trunk in his hands. Certainly this is not in accordance with science based on natural laws. The danger to the child from the above causes is aggravated by the neglect of the leading advocates of this practice to secure flexion of the head in unison with nature's mode of delivery, securing the synclitism of the cervico-bregmatic circumference of the head, instead of the occipito-frontal, as must be the case when the bi-mastoid descends first.

I may add that version or the forceps, in cases of contracted pelvis, should be regarded, in the present condition of our knowledge, as an elective operation. The practitioner, recognizing the deformity, should determine as soon as possible which mode of delivery to adopt. His decision should then be irrevocable. This must be the case if version be employed, the forceps must be abandoned; it ought also to be the case when the forceps

operation is determined on. The blades being once applied should not be removed till delivery be accomplished, for, if the instrument be well constructed, the child can be delivered, if there be three inches in the conjugate diameter, sometimes, though not always, with safety. Nevertheless, we continually read in the journals of the forceps being applied once or twice and then abandoned with the declaration that after much effort the head would not descend. This certainly indicates the bad character of the instrument. What is still more surprising is, that after such failure version must be resorted to, and even with safety to the child. It has been said that success justifies the means, but how a practitioner can be justified, in a protracted case of delivery, where the waters have been long evacuated and the body of the uterus firmly contracted upon the body of the child and placenta, and when a portion, if not the whole, of the presenting part has passed the circle of the os uteri, in attempting version, is inexplicable. *A priori* it would seem to be impossible. The uterus is firmly contracted to a comparatively small size, there is no room for the return of the presenting part, and every attempt to push up the head and to introduce the hand, must be of the most imminent danger to the integrity of the vagina and uterus, and we know that the operation is often impracticable and fatal. No latent hope that the child might possibly be saved under these circumstances can compensate for the immense risk to the mother.

If the considerations now presented be hereafter confirmed, the utility of this invaluable obstetric instrument, the forceps, will be greatly enhanced. Its value, however, is not to be restricted even to the cases mentioned, for it may be affirmed—

Seventh, *The obstetric forceps, when well constructed, is the best extractor in cases of dead children, and also in cases of craniotomy.*

Of course, if the child be dead, there can be no objection, even when there is no disproportion between the head and the pelvis, to make powerful compression not only by the hands, but by a fillet wound tightly around the extremities of the handles. Some little time may be allowed for the yielding of the bones of the head before traction be made, then delivery can be effected with comparative ease, as all the diminution

made in the cranium not only facilitates its descent, but diminishes the pressure on the sensitive tissues of the pelvis.

If, however, there be any mechanical impediment, the head should be perforated, either before or after applying the forceps, and the brain and meninges should be well torn up, and then compression be made in the manner just mentioned. By the Hodge forceps the transverse diameter can be thus diminished to two inches, and for reasons already mentioned, the head will glide more and more into its grasp as the parietal bones yield, so that slipping will be an impossibility, and all requisite power is at command for delivery. So far from injuring the mother's tissues, they are comparatively safe in proportion to the diminution of the size of the head. Compare this with all the extractive instruments hitherto employed in craniotomy, as the crotchet, single or double, the craniotomy forceps of every variety, the cranioclast, tire-tête, etc. The direct influence of all these instruments is that of mere tractors. The head, it is true, is indirectly diminished, but as Dr. Meigs well expresses it, it is upon the principle of wire-drawing; the body is drawn from a larger to a smaller opening by mere force. The diminution of the size is effected by the resistance of the walls of the aperture. In labor, therefore, in a deformed pelvis, the opening is formed of bone covered by vital tissues; all the compressing force, thus, which is often immense, must be at the risk of the integrity of these tissues. The horrible results not unfrequently met with in the form of contusions and lacerations of the neck of the uterus, of the vagina, bladder, rectum, etc., are too well known to need repeating. Another terrible source of mischief is the slipping or tearing away of the hooks and crotchets, by which even the hand of the practitioner, as well as the parts above mentioned, are lacerated; or by the dragging away of portions of the cranium with their sharp serrated edges, with consequences almost equally severe, when extraction is to be repeated over and over again. No wonder craniotomy is reported by a late writer as the most terrible of obstetric operations, or that M. Baudelocque, Jr., should declare that fifty per cent. of women in these bad cases perish! How tedious and painful also is the convalescence of those that escape! How often are they left with fistulæ of the vagina, bladder and rectum! How fre-

quently do they suffer from dangerous thrombi, pelvic abscesses, vaginitis, metritis, adhesions and contractions of the vagina and neck of the uterus, and complete atresia!

I feel confident that nearly all these sufferings can be avoided by abandoning this wretched "wire-drawing" process and adopting an entirely new principle; that diminution of the head may be accomplished, not through the intervention of the mother's tissues, but by forceps, strong as they need be to insure sufficient compression for an easy delivery. This principle I have adopted and inculcated for more than thirty years, and have no reason to doubt its comparative safety, having observed no ill consequences even in very protracted deliveries, or when the transverse diameter was reduced to three inches. My first experience was in the case of a young primipara who had been five days in labor, under the care of a midwife, and afterwards of several physicians, who, *inter alia*, had given large doses of ergot. The patient was still in good condition, but the uterine efforts had subsided. Tumefaction of the head was so great that the presentation could not be determined with accuracy. I applied a strong pair of Bandelocque's forceps, but soon found the head was immovable. Perforation was therefore necessary, but as the head was firmly held, I determined that the forceps ought not to be removed. I gradually approximated the handles with a strong fillet, and was gratified to find that the head soon became movable and was delivered without any real difficulty. It was found that the arrest was owing to a presentation of the side of the head at the superior strait, and that the blades had been passed over the occiput and os frontis, and thus the long diameter of the cranium was lessened sufficiently for the transit of the head through the pelvis, and also through the inferior strait and vulva, and this without laceration of any of the tissues, not even the perineum. The patient readily recovered.

My next experience was equally remarkable. My excellent friend, Dr. Warrington, called me in consultation where there was an arrest of the head at the brim, the conjugate diameter being about three inches. Dr. W. had used the forceps, and repeated the operation after my arrival, but the head not descending he requested me to operate. I had no hesitation to make strong compression as well as traction, and for some time there

was no apparent effect, but during my efforts we were startled by a loud noise evidently within the abdomen. After which all difficulty vanished and delivery was accomplished. An examination showed that the noise was caused by a sudden collapse of the left parietal bone, which became, as it were, inverted, concave externally. The patient recovered without any bad symptoms.

Such facts—and many might be adduced—prove that the forceps may be so constructed as to be capable of making compression, and on suitable occasions they should be used as compressors, and as a substitute for the various tire-têtes heretofore employed.

EIGHTH.—*On the principles above inculcated, the introduction of cephalotripsy into obstetric practice by M. Baudelocque, Jr., should be regarded as the greatest improvement in operative midwifery since the seventeenth century.*

The cephalotribe, or brise-tête, indicating a crushing instrument, I have always thought an unfortunate name. True, the head is broken or crushed, but this is only one effect. It fulfils all the duties of a pair of forceps. Baudelocque's instrument is, indeed, nothing more than an enormous pair of strong forceps furnished with a screw by which the handles can be approximated, and thus the head in the grasp of the blades would be lessened and delivered through a contracted passage. Like the forceps, therefore, they act as *compressors*, *tractors* and *levers*. This idea should be borne in mind, as in many modifications since made, it seems to have been forgotten, some regarding it simply as a brise-tête, and others more as a double crotchet.

We have already indicated the great value of the principles involved; first, that the head is to be diminished, not upon the principle of wire-drawing, by the tissues of the mother, often to their irreparable injury, but by means of the blades. All the compression thus made lessens the pressure upon the mother's organs, perhaps in a direct ratio. This result is generally so effectual that, unless the deformity be very great, no injury is sustained by the parent. This, at any rate, is my experience. The mother's tissues were unhurt, and her convalescence unretarded. This affords a great contrast with all the reported

crochet deliveries, as they are usually termed, so tedious, so painful, so dangerous, not only to the pelvic organs, but also to the life of the mother. Well might Chailly exclaim, "Grâce au Ciel! that all the hooks and pincers have been driven from practice by the introduction of the cephalotribe." Thus he wrote in France thirty years ago; and I cannot but regret that the advance of improvement has been so slow that hooks and craniotomy forceps are still the common resort of the profession in all parts of the civilized world.

The original cephalotribe of M. Baudelocque, Neveu, was first described by him in a paper before the French Institute, in 1829. A more elaborate account was published in 1832; and in 1833, a gold medal, valued at two thousand francs, was accorded him as a testimonial of the high estimation of the value of his instrument.

This cephalotribe was very heavy as well as long. It resembled, in its general conformation, the French forceps, the blades being without fenestræ and very concave on their internal surface, while at the extremities of the handles a strong screw was fixed, attached to a crank mandible, by which the handles could be forcibly approximated and the head crushed. Its weight was seven pounds. Soon after, in 1841, Busch reduced the weight to four pounds, and it became generally employed in France. A short history of the cephalotribe is given by Dr. Lusk, of New York, in a paper before the Academy of Medicine, and published in the *Medical and Surgical Reporter* for June 8, 1857, from which it would appear that, in Germany, the cephalotribe was first modified by Prof. Brann, of Vienna, afterwards by Scanzoni, of Wurzburg, by Busch, of Berlin, and Seifert, of Prague. Dr. Paul Grenser, of Dresden, states that there are four varieties in general use in Germany. The character of these German instruments differs from the French, in being much shorter and lighter, with the ends of the blades turned inwards, and their internal surfaces furnished with ridges, so that they act much upon the principle of the double crotchet.

Many years elapsed before the accoucheurs of Britain adopted the cephalotribe. They did not approve even of the long French forceps, and dreaded the stronger compressors of Baudelocque, Jr.

"The theoretical objections to the brise-tête of Baudelocque [1] seem to be very great, *à priori*. First, its weight, amounting, according to the specimen in the author's possession, to nearly five pounds; second, its unnecessary length; third, the great power of the screw, and the large size of the handle or crank—all of which circumstances demand great care and attention in its employment, and sometimes may render its use difficult. The main theoretical objection, however, is the effect which such a powerful compression must have upon the bones of the head, and the dangers which may result to the mother. It might readily be supposed that the bones of the head being fractured, their sharp edges would be driven through the scalp of the child into the tissues of the mother; all attempts to extract, under such circumstances, would be exceedingly dangerous, if not impracticable.

"Experiment and observation have, however, not confirmed these theoretical objections. The author made a number of experiments upon the heads of children that died at term, and found that when the brise-tête was applied upon the sides of the head, the transverse diameter would be readily diminished to two inches, while the occipito-mental diameter, and also the cervico-bregmatic, were lengthened. The bones were turned inward upon the cavity of the cranium, and although fractured, in no case did they penetrate the scalp. . . . . The top of the head projected during the process of compression to a considerable degree beyond the edges of the blades, but this of course would afford no impediment to delivery. Being satisfied of these important points, the author, not willing to employ the heavy instrument of Baudelocque, induced Mr. Rohrer, who had assisted him so materially in the construction of his forceps, to make, in 1843, some modifications in the French instrument. These modifications chiefly embrace the size and weight of the instrument, the change in the cephalic curve, and some alteration in the mechanical arrangement of the screw in the handle. . . . . The instrument thus modified is far more manageable than the cephalotribe, and even than the common forceps, as the blades are narrower. The name 'compressor cranii' has been adopted as indicative

[1] Principles and Practice of Obstetrics, by Hugh H. Hodge, M.D. Philadelphia, Blanchard and Lea, 1864, p. 273, et seq.

of its mode of operation. The whole weight of the instrument is three and three-quarter pounds. The proper *blades*, or cephalic portions, are without fenestræ, as in the brise-tête, and are six inches and five lines long, and one inch and five lines broad; the extremities are rounded, and the exterior convex, and well polished. The pelvic curve is lessened, and a perpendicular line, drawn from the upper edges of the points of the blades to a horizontal surface, upon which the instrument is placed, measures three inches; the cephalic curve is similar to that of the author's forceps, so that when the handles are closed, the points are in contact, and the greatest breadth, measured from their outer convex surfaces, is one inch and nine lines, and is nearer to the shanks than to the points, the former distance being two inches and three lines, and the latter four inches and three lines. Hence, the blades, when closed, can be passed through an orifice measuring two inches by one inch and five lines, and include an oval space. The inner surface of the blade is smooth, but quite concave from one edge to the other, contributing, by the projection of the margin of the blades, to prevent any slipping of the instrument. The danger of slipping, however, is chiefly counteracted by the peculiar form of the cephalic curve, as above described, causing the whole head, where compression is made, to glide more and more within the grasp of the forceps, till even the points project, in some instances, beyond the chin.

"The *shanks* are thick and strong, and diverging from the joint, terminate at the distance of three inches and five lines, in the cephalic portions. The lock is formed of a pivot, half an inch in length, strongly riveted into the left branch, and surmounted with a very broad flat button, an inch and a quarter in diameter. The right branch is furnished with a mortise for the reception of the pivot, as in the English forceps. The flat surfaces of each blade, at the joint, measure about two and a half inches, by one inch in width. These surfaces, in conjunction with the broad button of the pivot, prevent any disposition of the blades to twist when compression is made, and thus maintain the parallelism of the blades.

"The handles are nine inches and six lines in length, each one being flat and slightly tapering from the joint toward its extremity, where they measure seven to eight lines in width,

but toward the joint, about eight or nine lines, and three lines in their thickness. These flat surfaces are roughened.

"At the lower extremity of the left handle is attached a screw, four and a half inches long, fixed by a pivot, and is made to pass through a large opening or foramen at the extremity of the right handle. It may be convenient to have a slit in this foramen, so that the screw may be turned in or out at pleasure. A movable nut with female screw, and furnished with three projecting handles, an inch and three quarters in length, is adapted to the male screw, so that when the screw has been passed through the opening of the right branch the nut will act as a powerful screw and lever to close the blades, and make any requisite degree of compression.

"The *Compressor Cranii* being made of strong steel, well tempered, is unyielding, and capable, under the influence of the screw, to compress any fœtal head at term, so that its transverse diameter should measure but two inches. It is as effectual, therefore, as the heavy brise-tête of Baudelocque, while being lighter and of smaller size, it can be handled with much more ease and precision. It can, indeed, owing to the narrowness of the blade, be applied with more facility than even the forceps. In operating with the compressor cranii, in a case, for example, of deformed pelvis, the blades are to be introduced separately wherever there is most room, and as near as practicable to the sides of the child's head, but, of course, never directly toward the pelvis or sacrum. The male blade must be introduced first, and then the female blade on the opposite side; this can generally be done with facility. The practitioner should take care, if possible, to insert them so deeply that the points of the instrument should reach the face of the infant, in order that the whole head should be subjected to pressure, otherwise, after compressing the cranium, it may possibly be requisite, if the deformity be great, to loosen the instrument and reapply it so as to embrace the facial extremity

of the head. Being carefully applied, pressure on the handles will be sufficient to determine whether the instrument is properly located, and whether the tissues of the mother are not within its grasp. The screw, then, may be employed, and very slowly tightened as the vault of the cranium yields, and as the top of the head becomes more and more projected below the blades into the pelvis. When the compression is completed it will be advisable, especially in those cases where the blades have been applied to the sides of the pelvis before making any traction effort, gradually to twist the forceps, so as to approximate the blades to the sacrum and the pubis. The effect of this manœuvre will be to bring that diameter of the head which has been diminished to two inches in the direction of the shortest diameter of the superior strait; for it is manifest, that if the blades of the compressor be applied to the sides of the pelvis they will have a tendency rather to increase the size of that portion of the head intervening between the pubis and the sacrum, while by turning the instrument, and with it the head, the smallest diameter of the cranium will correspond to that of the superior strait. This being accomplished, the instrument may now be used as a tractor and lever, slowly and carefully, in causing the descent of the head, precisely as delivery is effected by the forceps.

"Great care should be taken as the head passes over the perineum that this tissue is not injured by undue pressure from the head, or from the extremities of the blades, which may, when the compression is great, be found projecting beyond the chin.

"When the deformity is great, especially at the lower part of the pelvis, after the compression of the head has been completed, and after it has descended to the floor of the pelvis, it may be advantageous, by means of the craniotomy scissors, to remove the upper portion of the head which projects below the margin of the blades, taking the convex edge as a guide for the course of the scissors; thus, much less space will be occupied by the head, and less pressure made upon the vagina, the rectum and perineum. This may be the more necessary, as the cervico-bregmatic diameter, which corresponds to the coccy-pubal, is augmented during the compression.

. . . . . .

"But whatever modifications the instrument may require, the great fundamental principle now urged upon the profession, that the diminution of the size of the child's head should be accomplished by instruments acting as compressors, and not by the bones and soft tissues of the pelvis—as must be the case where tractors of any kind are employed—is not to be forgotten in any case where cephalotomy has to be performed. This principle being acknowledged, the operation of craniotomy will be divested of half its terrors; perforation and compression, each of which can be very easily and safely performed, embrace all the important peculiarities of the operation, traction being securely effected, as in the common operation of the forceps. The patient thus escapes all those varied dangers arising from slipping of the crotchet, the breaking up of the bones of the cranium, and the removal of sharp broken fragments of the bones by means of hooks, osteotomist, cranioclast, etc.; and especially the terrible contusion and laceration of the tissues and viscera of the pelvis, which must result, to a greater or less degree, by dragging the child's head through the contracted passages. . . . . .

"If there be three inches in the antero-posterior diameter of the superior strait, craniotomy should not be resorted to, if the child be living, until at least every other measure, especially by means of the forceps, has entirely failed. And it is in such cases, where the deformity varies from that of a standard pelvis to that where the short diameter is three inches, that the forceps, in modern times, has been so effectual in preserving the lives of many infants, which would otherwise have perished from neglect on the one hand, or from craniotomy on the other.

"If, however, the deformity be below three inches in the conjugate diameter, and the patient arrived at the full period of gestation, craniotomy becomes justifiable for the sake of the mother; for a living child at term cannot pass through a pelvis so contracted. . . . . .

"If, however, the contraction of the short diameter of the pelvis be two inches, or under, then, ... the Cæsarean operation is to be preferred, as affording a better prospect for the mother, while it has the strong recommendation of affording a good prospect of safety for the child."

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