With Compliments of the Author.

AXIS-TRACTION FORCEPS

THE

PRINCIPLES AND APPLICATION

OF

AXIS-TRACTION FORCEPS

WITH SPECIAL REFERENCE TO THE INSTRUMENT DEVISED BY TARNIER

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REPRINTED FROM TRANSACTIONS OF THE MAINE MEDICAL ASSOCIATION

PORTLAND, ME.
BROWN THURSTON COMPANY
PRINTERS

THE PRINCIPLES AND APPLICATION OF AXIS-TRACTION FORCEPS,

WITH SPECIAL REFERENCE TO THE INSTRUMENT INVENTED BY TARNIER.

BY STANLEY P. WARREN, M.D., OF PORTLAND.

THE argument attempted in this paper is to show, not which is the best of two operations, forceps or version, in delivering from the brim, but, when forceps are decided upon, what is the best forceps to be used. Your discussion, then, will naturally be restricted to the merits or demerits of the particular forceps in question.

The extraction of a child from the pelvis at the brim does not depend simply upon the brute strength of the operator. If the decision has been made that forceps are to be used, the intelligent operator will ask himself: First, "Does one kind of instrument have any special advantage over some other for the purpose in view?" Experience and common sense both tell him "yes." Second, "In which direction shall I pull?" There is a choice here, too. Third, "Is time an important element in success?" Deferring for further consideration the answering of the first two of these questions, in regard to the last it may be said here, that though either extremes of time are to be rejected, it appears to be established that it is the operation, as a whole, that is dangerous, rather than the mere pressure of the instrument. Statistics show that it is not the forceps alone, but the prolonged and difficult labor, which is the chief cause of idiocy in such cases as are attributed to the

forceps by WINCKLER and BOLLAAN. In 810 cases of idiocy, 35 (4.3 per cent) were placed to the forceps, while 316 (26.6 per cent) were charged to the prolonged or difficult labor. *Annual of the Universal Med. Sciences, 1890, Vol. 2, loc. sic*

For instance, the head is found engaged at the brim and fixed there by some one of the many causes which check descent. The accoucheur decides to apply the forceps, using his well-tried and trusty pair which have delivered hundreds of women and have never failed him. He pulls and sweats, for hours perhaps; something must come, and something will, if he sticks to it long enough. Finally the child is dragged out decidedly the worse for wear, and the woman has present or future mutilations, from which date a life of pain or invalidism. Such cases are common our broad land over. Now, in the light of all the advances in medicine which the close of this century claims with pride and honor, has he done the best for his patient he could? While other specialists have profited by the progress in anatomy, diagnosis, instruments, in the tactile sense, in the dynamics of the special organ, can the obstetrician, in conscience, be content to stand where RAMSBOTHAM and DENMAN left him? The highest skill, acquired from special study, from the mechanical instinct, from that inexplainable natural fitness, and from constant practice, that skill alone should attempt these desperate cases. Why should one be so quick to appreciate his deficiences, when the eye or the ear is involved, and yet think himself fit for the emergencies of the most important of all specialities, obstetrics, when his stock in trade is a bichloride tablet and a SIMPSON'S forceps? One of the brightest teachers and operators of New York City said, in the Obstetrical Journal for May 1892, "the teaching is beginning to prevail that obstetrics, as a science, carries with it something more than the ultimate expulsion of the fœtus by nature, or its extraction by art. The thoroughly trained obstetrician of to-day realizes that his chief responsibility lies in

so conducting labor, in so watching its progress, that interference be not forced upon him, but deliberately elected."

In using forceps at the brim, there appears to be a general misconception of the true mechanical principle involved. The instrument selected by a large majority of operators is the common long forceps. All varieties of this, HODGE, SIMPSON, ELLIOT, or the PORTLAND (which are the varieties most used in this vicinity) are based upon the Smellie forceps.

Slide No. 1,* Smellie's forceps, from Lusk's obstetrics. For a hundred and fifty years the English-speaking world has fixed upon this as the best form for use in the excavation. It was never intended by Smellie himself for the brim, but only when the head was well in the cavity. Its general shape is a curve, whose cord is from the tip of the blade to the end of the handle.

Slide No. 2, Simpson's forceps, with a line drawn from tip to tip, representing the cord described.

Power is exerted with it in the line of the cord, viz.: it draws mainly upon a line in front of the instrument. Now suppose that the bony rim of the pelvis was incomplete at its anterior third, and that here the gap was filled in with elastic tissue. In such a condition the Simpson forceps would do well enough when used at the brim. For since, with all modifications of it, power is expended in a line of draught anterior to the blades, the head must be pulled out of the pelvic rim, and directly forward of the normal line of descent through the supposed gap. But with the natural pelvis, any form of Simpson's forceps draws the part grasped forward against the firm symphysis and pubic rami, which stand directly in the way of such exit. And here is just the difficulty with the common long forceps: it draws the head out of its natural path of descent, the axis of the pelvic basin, and into an unnatural one, against which the pubic arch is an impassible barrier.

* The paper was illustrated by the sterioptican, and the slides were shown, as numbered.

Two things have delayed the answering of this problem — how to draw the head through the birth-canal in the line of its least resistance. First, the limited knowledge of the female pelvis; and second, the conservatism of the general practitioner. While it is not necessary to more than allude to the latter, of the former this may be said: The anatomy of the student and of the practitioner are two altogether different things. The student learns in the dissecting-room the major details of the female pelvis, and retains them to about the same degree which he does that of the other parts of the body. The obstetrician finds that his memory must be of parts as related to the whole rather than of the details of independent tissues. And it is specially to be remembered that very recently our knowledge of the obstetrical pelvis has been materially changed, by the facts that are established from frozen sections of the pelves of women dying in actual labor. The writings of HART and BARBOUR and BRAUN tell us that much was left untaught, or taught wrong, in the older text-books. One point — a very important item in the obstetrical pelvis — these frozen sections correctly settle, the true place of the sacro-vertebral angle. The promontory of the sacrum is upon one side of the birth-canal, like a jetty upon the bank of a stream. It diverts the head out of a direct downward course, to drive it forward upon the opposite wall, the pubes. The planes of the pubes cause a refluent current, and the moving body is driven at a second angle, over again to the sacral side. The sacrum and coccyx continue in turn the descent, at still a third angle, and the child glides down, and now forwards, along their curves, to finally go through the outlet at a last and fourth angle. Thus the promontory is the initiatory obstacle to delivery, and is a most important factor in fixing the route, which ends in birth. When a woman is lying on the back, we are apt to think of the promontory as situated too

low down for its proper position in the pelvis, and do not tilt the pelvis forward enough.

Slide No. 3 shows a tracing from a plate by BARBOUR of a frozen section of a pelvis taken from a woman dying in labor, giving the normal position of the promontory, in its relation to the pelvis as a whole. The slide also illustrates the statement of PARVIN, "the angle made by the antero-posterior diameter of the inlet, and a line representing the axis of the body, is from 130 to 140 degrees. The sacro-vertebral angle is nearly four inches higher than the superior angle of the pelvic joint." — *Parvin's Obstetrics, loc. cit.* The axis of the inlet, then, is not, as commonly thought, vertical, or from behind forwards, but at right angles with the plane of the inlet, and therefore the first part of the descent of the head is downwards and backwards. Hence it follows that traction, with forceps at the brim, must — at first — be downwards and backwards, if the child is to follow the true path of descent. The slides now shown illustrate both the true and falsely represented positions of the promontory, and indicate certain other parts of the pelvis relative to this paper.

Slide No. 4. From LUSK's Obstetrics, 1884, edition, page 349. The picture from which this slide is made is incorrect in several particulars; the promontory is too low as regards the symphysis. The uterus at its junction with the vagina, and the vagina itself, is not normal, nor the rectum. Probably the picture was intended to be schematic rather than anatomically exact, but as it is it is misleading.

Slide No. 5. From an Atlas of Gynecology and Obstetrics, published by Wilde & Co., in 1884. The child is represented at term, with the uterus, the pelvis, and its contents in antero-posterior section. The vagina and rectum are drawn widely dilated, though labor has not begun, and the cervix is grossly inaccurate.

Slides Nos. 6, 7, 8, I am able to show through the kindness of DR. GORDON.

They are photographs of plates illustrating an article read by DR. BARBOUR of Edinburgh, before the British Obstetrical Society, and are the property of DR. GORDON, who kindly loaned them to me for this paper. They are line drawings of frozen sections of the pelves of women dying in actual labor, and are therefore anatomically correct. Points to be specially noted are the following:

Slide No. 6. First stage. The promontory, center of the inner face of the symphysis, and the end of the coccyx, are nearly at the angles of an equilateral triangle. The axis of the plane of the inlet is from before backwards. The cervix is still closed. The vagina and rectum are also closed, the bladder is contracted, and the perineal body is rectangular rather than pyramidal, as commonly drawn. Notice particularly that the head at the inlet points backwards rather than forward.

Slide No. 7. Second stage. The head points directly downwards, and now rests upon the floor of the pelvis, the bag of waters is well formed, the uterus and vagina are now one canal, the rectum is slightly compressed against the sacrum and coccyx, while the anus is widely dilated, the perineum is thinned and stretched forwards, and the bladder is pushed above the symphysis and contracted. The slide shows beautifully the molding of the head to conform to the curve of the cavity.

Slide No. 8. Third stage. The uterus is empty, its cavity closed except for a small space near the fundus, the uterus as a whole has settled down in the cavity, and in so doing has closed the upper part of the vagina and rectum, while their lower portions are more or less open. The open space in the upper zone of the uterus will explain how hemorrhage after delivery will sometimes persist, though the uterus is apparently firmly contracted.

Slide No. 9. Showing the position of the child in the uterus, from a frozen section after labor has begun; from BRAUN. *American System of Obstetrics, Vol. 1, page 559.* The child presents in the first cephalic position, the head points backwards and downward and has descended nearly to the floor of the pelvis, the amnionic sac reaches to the vulva and is just ready to rupture, and the perineum is rectangular. The pelvis is tilted forwards so much that the promontory is nearly vertically above the symphsis.

Slide No. 10. The uterus and the parturient canal, the child removed. From BRAUN. *Lusk's Obstetrics, 1884 edition, page 132.* It is intended to show by this plate that the axis of the plane of the inlet is downwards and backwards, and that therefore the draught of the forceps must be downwards and backwards, when extraction is to begin at the inlet.

From what has thus far been said, and shown, of the topoggraphy of the obstetrical pelvis, it would seem evident that there is no such thing as a universal forceps, equally good for all stages of delivery. A carpenter does not try to do all kinds of planing with only one kind of plane, but provides himself with various ones, each for a special purpose. Just so the obstetrician should have different tools for different emergencies, for there is no greater mistake than the old maxim, that a good workman can do good work with poor tools.

One of the pressing needs of the accoucheur has been a tractor which would pull in the true obstetrical axis. It should be remembered that the axis of the bony pelvis is somewhat different from the axis of the dynamic pelvis or the birth-canal.

Slide No. 11. The dynamic pelvis. "If the presenting pole of the fœtus enters the inlet in a line perpendicular to its plane, the emergence of that pole from the vagina will be in a line perpendicular to the prolonged previous line. Hence, according to later writers, a curved line does not represent the line

of the direction taken by the presenting part in passing through the birth-canal. A cast of the bony pelvis, and the canal formed at the expense of the soft parts, shows that the completed cavity is not a curved, but chiefly a cylindrical canal. This cavity has its fundus at the coccyx, and the presenting part of the fœtus descends in a straight line to the fundus. The cavity is there closed, but presents an opening upon its anterior wall, and the line of direction now becomes one nearly perpendicular to that of descent." *Parvin's Obstetrics, page 47.* In the American System of Obstetrics, Vol. 1, page 449, the term is thus defined: "The axis of the cavity of the pelvis is a curved line passing through the center of the pelvic canal, and parallel to the face of the sacrum and coccyx. In other words, the axis of the pelvic canal is a curved line, identical in its curvature with the curve of the hollow of the sacrum and coccyx. When we examine a number of sacral bones, we shall find that no two are alike in their curvatures; some are nearly straight, some curved almost to deformity; between these two extremes there will be found every shade of different curve. Hence it follows, that the axis of the pelvic canal is not a fixed mathematical curve, but is really a line differing in each female, and depending absolutely on the curvature of each individual's sacrum and coccyx."

Slide No. 12. Impressions of pelves, from specimens in the Medical Museum of the University of Pennsylvania, showing the difference in the sacral curves.—*American System of Obstetrics, page 550, Vol. I.*

It seems, therefore, to be accepted by authorities, that the natural path of the child through the pelvis is not a fixed curve, whose radii are of equal length from a given center, but that it has every grade of angle, as varied as each pelvis differs from every other. For the present purpose, the passage outward of the child, beginning with its start from the inlet and ending with its birth at the outlet, may be divided

into three stages. In the first third the direction is backward and downward, or even perpendicular to the plane of the inlet, and ends when the head rests upon the pelvic floor. In the second third the direction changes, by a relatively acute angle, to a more forward movement, and in the third and final stage ends with the head directed upward. With this statement of the path of the child understood, it will be clear, perhaps, why the common long forceps is not the instrument to be chosen for delivery at the brim. It is impossible, and I am speaking, of course, only generally, to depress its handles enough to pull in the axis of the superior straight. I am aware that ALBERT SMITH advocated the plan of the operator's grasping the handles at the lock as the fulcrum, while using the other hand at the extremity of the handles as a lever. "Though force is wasted by pressure upon the symphysis, still children are not unfrequently so delivered without great damage to the mother."—*American System of Obstetrics, Vol. II, page 148.* But in a long delivery few have the necessary endurance for this double action, a pulling and pushing, and I think that there have been devised better methods of gaining the desired result.

An instrument capable of working in the natural canal, then, is theoretically required, and such a want has been practically met. Traction in the axis of the pelvis has been proposed a number of times since CHAMBERLAIN'S day. HERMAN, in 1840, applied traction rods to the common forceps arms, but the idea seemed to have attracted little or no attention, and various other makeshifts, with cords and metal rods, have been tried. In 1877 TARNIER introduced his instrument, and while there are other ways of attaching the traction arms to the blades, his forceps, as a whole, has received the most favor. "The instrument has been considered as marking a new era in obstetrics, and as being the only important change since LEVRET

gave the forceps the pelvic curve."—*Parvin's Obstetrics, page 651.*

Slide No. 13, TARNIER'S forceps, from CAZEAUX'S Obstetrics, 1889 edition, page 963.

Slide No. 14. Wells' axis-traction attachment, applied to ELLIOT'S Forceps, from CAZEAUX'S Obstetrics, page 963.

Slide No. 15. BRUES' axis-traction forceps, from PARVIN'S Obstetrics, page 652. The particular thing to be noticed, in all these varieties of axis-traction forceps, is the ingenious way in which has been carried out the main design, which is, to be able to draw not only downwards but backwards at the same time.

Slide No. 16. Drawing showing SIMPSON'S and TARNIER'S forceps, with their principle of working contrasted. In the former the "line of draught" is shown to be a line drawn from the tip of the spoon to the tip of the handle. In the latter the "line of draught" is shown to be a line drawn through the spoon, and continued along the secondary handle. This change in the direction of the traction is obtained by attaching a second pair of handles to the heel of the blades. By using these the line of draught is, as WINCKEL says, "in the prolongation of the blades," straight down the birth-canal, rather than toward one side of it, as it is when the common long forceps are acting.

Slide No. 17. Drawing of section of frozen pelvis, from BARBOUR, showing head at the brim, with TARNIER'S forceps applied, to demonstrate that these instruments act in the center of the canal, when the secondary handles are used. The great advantage offered in this plan of forceps, is that with it the operator supplies an effective power in a natural and desired direction. With all respect to the opinions of those present, it seems to me to be an error of judgement to attempt to extract from the brim with the ordinary long forceps, reasoning from the arguments already advanced and from personal ex-

perience. It inevitably draws the head too far forward against the anterior rim of the pelvis, which can be passed only at the expense of what, I claim, is needless time and strength. The German, WINCKEL, one of the accoucheurs of the world, though not recommending the Frenchman, TARNIER'S, particular form of instrument, does accept the general idea, and gives it his earnest approval in these words. "Extensive experience, among these nations who employ forceps in cases where the head is still very high and freely movable, or where only a small segment of it has entered the pelvis, and in contracted pelves with the head high up in the transverse diameter, has shown that the ordinary forceps are not suitable, because with them traction in the direction of the axis of the pelvic inlet is very difficult, and the head has not sufficient freedom of movement." *Winckel's "Text-Book of Midwifery," page 703.*

The indications for axis-traction forceps are briefly as follows. It is hardly necessary to say that it is an instrument for special needs, and that it can do immense damage as well as good, so that special care should be taken in using TARNIER'S or any other variety of this form of forceps. It is intended when the head is arrested at the inlet and forceps are requisite. Occiput-posterior positions are particularly suitable for it, since the head is more readily drawn down to the floor of the canal by the traction bars, when the usual forceps will complete the delivery. As might be expected, in cases of pendulous abdomen the axis-traction instrument is specially useful. When forceps are needed for the after-coming head it will be a valuable assistant. Other cases, which will occur to you, I will not take time to specify.

The mere application of the blades offers no special difficulty. To obtain the full benefit of the principle, it is important that the woman should be placed upon the bed with her hips well forward, so that the operator can pull sufficiently far

back enough. The blades are applied with reference to the pelvis, rather than to their position on the child's head. Care should be taken, also, that the blades are inserted high enough to firmly grasp the head, and when fitted, the binding screw is tightened until the head will not slip out when a hard pull is made. Traction is made by the cross-bar handle alone, and with the rods lying on the perineum.

Slide No. 18. Showing traction with TARNIER'S forceps, from PARVIN'S Obstetrics, page 648.

I have noticed that at first the pull is rather a push than a pull, for the reason that to draw backward, as related to the woman, is to push away from the operator. The binding screw ought to be frequently loosened, so that the child's brain shall not have its circulation too much interfered with. When the head is visible between the blades, the handles should be brought to a horizontal position. As soon as the perineum begins to stretch and the anus opens, then carry the handles upward.

Slide No. 19. Protecting the perineum and illustrating the position of the handles at the outlet when delivering with TARNIER'S forceps, from PARVIN'S Obstetrics page 662.

"The extraction of the head, according to its position in the pelvic inlet, is begun in the first position of the forceps with the handles directed downward. As soon as the head is visible between the blades, we bring the handles to a horizontal—second position—and, when the perineum begins to stretch and the anus opens, we carry them upward in the third position, in order that we may roll the head out under the symphysis about its transverse diameter."—*Winckel's Obstetrics, page 702.*

Though the TARNIER instrument looks somewhat formidable and complicated, yet a little experience with it shows that its real advantages far outweigh these apparent evils. LUSK puts it very happily when he says, "to one accustomed only to the familiar forceps, the facility with which delivery can

be accomplished with TARNIER's forceps would seem hardly credible." It has been my usual custom to remove the TARNIER instrument (the special variety of axis-traction forceps with which I am practically familiar), when the perineum is reached, and to substitute a lighter pair, thereby incurring less risk of doing damage to the parts about the outlet.

Every general practitioner has to see something of that oldest branch of medicine, obstetrics. Most respond to its calls because they have to, rather than because they want to. A few find it a most fascinating study, despite its toils and dangers. When the public's eyes and noses are out of order, it insists upon the services of the specialist, one who has demonstrated his ability to treat such delicate organs by testimonials of special training. But it allows any one, man or woman, learned doctor or ignorant peasant, to assume the responsibility of conducting delivery without let or hindrance.

The time is ripe for the recognition by the profession of the speciality of operative midwifery, for which there is as much need as there is for that of the oculist or the gynecologist. Not every one can be a successful obstetrician. There is no organ in the body that will make such tremendous demands upon one's skill, coolness, and ready invention, as a pregnant uterus. And the same dear public is slowly coming to the opinion that the skilled workman is as necessary to its pregnant woman as it is for its other diseases. In fact, this paper is a plea for the skilled workman with skilled tools.

The following analysis of 19 cases is given, all in private practice. It includes first trials, and also those when more accustomed to the instrument:

In counsel, 8 cases; personal cases, 11. Primiparæ, 10; multiparæ, 9.

Positions — head, first, 10; second, 2; third, 5; shoulder, 1; neck, 1; both these last two were changed by external version to cephalic presentations and delivered by the Tarnier.

Reasons for use — disproportion, 9; fibroid in cervix, 1; straight pelvis, 4; pendulous abdomen, 3; hydrocephalic head, 1.

Average weight of children — 8.75 pounds; living, 12; still-born, 6; unrecorded, 1.

Causes of death, excluding the forceps — tight cord, 3; deformed pelvis, 1; long attempts at extraction previously exerted, 2; hydrocephalic head, with contracted pelvis, 1.

This summary of the paper is offered that the special points may be grouped together for particular attention.

1st. Obstetrical emergencies need not only special skill, but also special instruments.

2d. The axis of the brim being from before backward, the line of draught of the obstetrical forceps applied at the brim should be from before backward.

3d. Since the line of draught of the common long forceps is forward of the center of the birth-canal, therefore this forceps is not suitable for delivery at the brim.

4th. The symphysis-pubis is the chief obstacle which weakens the full working power of the Smellie type of forceps at the inlet.

5th. The axis-traction principle of delivery is the only one thus far published, which acts in natural directions at the brim.

6th. Therefore this is the correct forceps to be applied at the brim.