

NOTE ON AXIS TRACTION.

BY CHARLES JEWETT, M.D.

Professor of Obstetrics, Long Island College Hospital.

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The object of this paper is a brief discussion of the principles of axis traction with special reference to the construction of the instrument which I present.

I may say by way of apology that it will be necessary first to pass in review certain elementary matters, in order to make plain the main points I wish to consider.

A common but faulty method of using the ordinary forceps consists in pulling straight upon the handles. The traction is thus applied directly in the line of the handles, as illustrated in Figure 1.

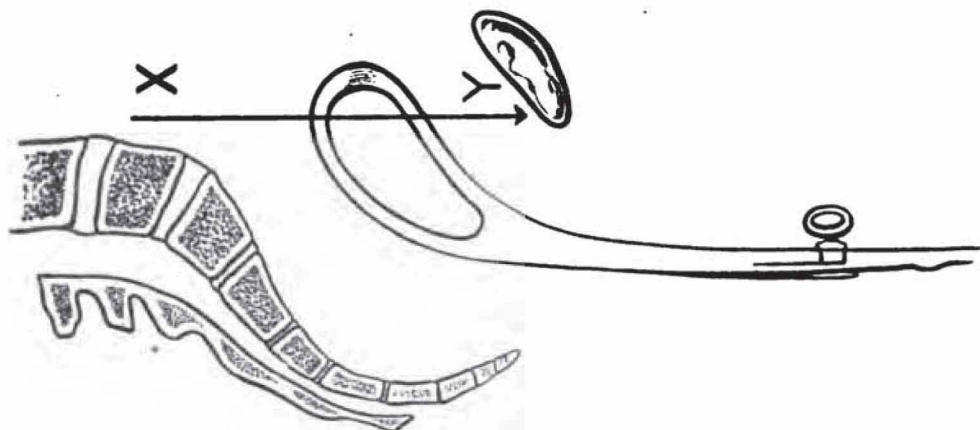


Fig. 1.

Pulling in this manner in a high operation a considerable portion of the force is expended against the pubic bones. Obviously all the power exerted in this direction is not only lost, but the misspent force is expended in doing harm. It acts to injure the soft parts between the head and the pubic bones. This defect in the ordinary forceps can be overcome in a great measure by the use of Pajot's manœuvre or a similar one, as illustrated in Figures 2 and 3.



Fig. 2.

If the patient lies upon a low bed the operator proceeds as shown in Fig. 2. With the patient on a table the manipulation is managed as depicted in Fig. 3.



Fig. 3.

In either case one force is applied in the line of the forceps handles with the hand that grasps them, and another force downward, at a right angle to the first, with the other hand. If these two forces are properly adjusted their resultant will act in the line of descent. Thus axis traction is theoretically possible without the aid of special appliances. As a fact, however, the exact adjustment of the two forces is impracticable. Even if it were possible we have no such accurate knowledge of the direction of the pelvic axis in the given case, especially in the abnormal pelvis, as will enable us to make the line of traction conform fully to the line of descent. Practically then this manipulation of Pajot's, valuable as it is, is only a rude approximation to axis traction.

It is true if you place the finger along the posterior surface of the symphysis you have a rough guide to the direction of the axis of the pelvic inlet. The plane of the anterior wall of the pelvic cavity is practically parallel with the axis of the brim. But even in the normal pelvis your estimate of the direction is only an approximate one, and the difficulty of pulling in the right line is still greater in the deformed pelvis, and therefore to make traction by this method in a line strictly coincident with the axis of the inlet is clearly impossible. The same difficulty obtains throughout the entire course of the parturient canal.

It may occur to you that with the aid of Pajot's method the waste force and the injury done are small and generally unimportant. Yet in difficult deliveries we often need to utilize all the power that can be properly employed. In all cases it is in the interest of both patients that the delivery be accomplished with

the least possible expenditure of force. This is the aim of the properly constructed axis traction forceps. Its object is to make traction absolutely in the line of descent not only in the pelvic excavation but from beginning to end of the delivery. To do this it must be an instrument of precision.

The chief requisite is a reliable index of the right line of traction. We must be able to know at each and every point of descent in any and all pelves in precisely what line to pull, and must be able to pull in that line. A true axis traction forceps perfectly fulfills these requirements. I will endeavor to show how : Remembering the parabolic shape of the birth canal, the direction in which the head moves obviously changes at every point in the descent. Between the brim and the pelvic floor the course conforms to the curvature of the sacrum ; it differs little from a straight line. When the head has reached the floor of the pelvis its course changes sharply forward and thence maintains a gradual upward sweep till it is expelled. If forceps be applied (in a proper position) to the head at the brim, and, as the head descends, the axis of the blades conforms at every point to the axis of the canal, the direction of the handles will change at every step in the descent. The handles would thus serve as a constant index of the changing direction in which the head is moving. Here is the secret of a true axis traction forceps. They should be so constructed that once properly applied to the head, traction will not at any point in the descent disturb the parallelism between the axis of the blades and that part of the birth canal in which they lie. Then the direction of the handles will serve as a constant guide to the line of traction. In order to do this it is plain that the traction rods should be attached to the blades by a movable joint and the traction bar to the rods by a universal joint, so that the pull can exercise no directive influence upon the head except for descent. If the traction rods are so attached that they are parallel to the shanks of the forceps when the pull is in the axis of the blades, then the pull will be maintained in the axis of the birth canal throughout the delivery by keeping the traction rods constantly in line with the shanks or handles. This is a great gain, for unless you are more successful than myself in the use of the ordinary forceps, it is hard to know whether the forceps handles are at a given moment a little too far forward or backward. With a true axis traction forceps you are relieved of that difficulty so long as you keep the traction rods and the handles of the forceps parallel ; then your pull is in the right direc-

tion either for the hard parts or the soft parts. That is the chief vantage of a properly constructed axis traction instrument.

But to accomplish this result one thing further is necessary; attention must be paid to the location of the stud from which the traction rods pull. If the attachment of the rods is too far forward or backward, the pull will disturb the normal relation of blades to passages. In the former case the heel of the blade will be carried backward and the tip correspondingly forward; in the latter the blades will be tilted in the opposite direction.

If the attachment be too near the tip of the blades, the blades will be unstable and will topple over forward or backward out of line with the parturient axis; if the attachment be too near the heel of the blade the index will be less sensitive. Theoretically then the location of the stud to which the traction rod is attached must be the center of the blades. Since, however, that point would fall within the fenestra of the blade, to locate the stud in this position it would be necessary to have a transverse bar across the opening. But the child's head would then be exposed to injurious pressure. As a compromise, therefore, the stud is placed just below the fenestra. If the fenestra be made short the only disadvantage involved is a trifling loss in the sensitiveness of the index.

It will readily be seen by examining any of the numerous instruments that have been devised for axis traction that almost without exception they fall short of their purpose. Even in the Tarnier instrument, which more nearly meets the requirements I have stated than most of its modifications, the location of the traction stud is not at the vantage point.

Forceps provided with rigid arms projecting backward from the shanks at a right angle, and from which traction is to be made, are open to the objections that they can only approximate the right line of traction, that they have no index and exert more or less directive influence upon the head. The various devices for attaching removable tractors to the ordinary forceps are almost equally faulty.

To Dr. Milne Murray of Edinburgh we are indebted for elucidating the principles upon which precision in axis traction depends. He has worked out the mechanical projection upon which a true axis traction apparatus should be constructed and by which the accuracy of construction in existing devices for the purpose may be tested. (*Ed. Med. Jour.*, August and September, 1891.)

The method proposed by Murray for testing the construction of axis traction instruments is as follows: First. Find the point on the forceps blade where the pelvic curve begins; then locate the center of the tip of the blade; connect the two points by a straight line; bisect that line by a perpendicular; then from a point on the perpendicular describe an arc of a circle that shall cut the extremities of the line first drawn. Now draw a tangent to the arc at the point where the perpendicular intersects it; the tangent is the right line of traction. The stud therefore, to which the traction rod is applied should fall in this line just below the center of the blade and as near to it as practicable.

The model of axis traction forceps which I present is based upon Murray's projection. It is so made that if the traction rods be kept constantly parallel with the shanks of the forceps during delivery the pull will be maintained precisely in the line of descent throughout the entire course of the parturient tract. At the same time the head is left wholly at liberty to follow the mechanism imposed upon it by the birth canal.

The pelvic and cranial curves of the Tarnier instrument have been preserved, but the half Smellie has been substituted for the

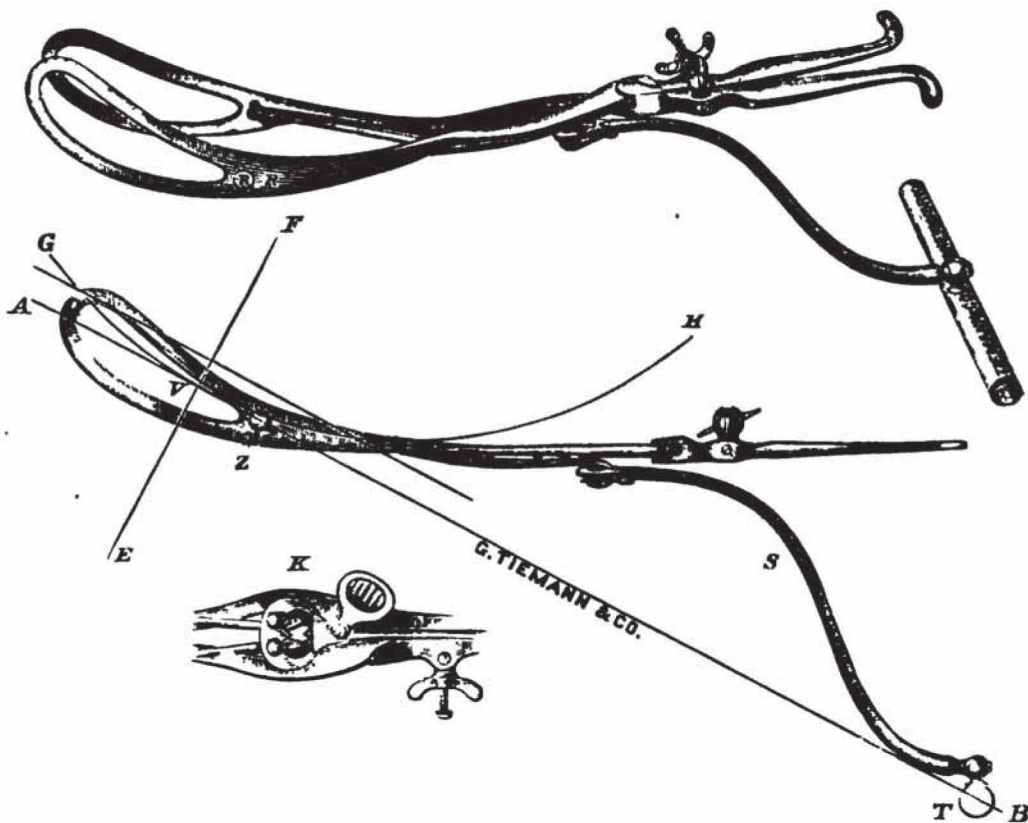


Fig. 4. The writer's axis traction forceps.

button lock as simpler and more convenient in use. The traction bar is attached to the rods by a new device which permits less mobility at this point than obtains in most other instruments, securing greater precision in the line of traction. The fixation screw is the same as in the Tarnier pattern, but its use is not in all cases required, the walls of the pelvis frequently seeming to hold the blades in proper relation to the head.

One important object has been to make the instrument lighter than the French pattern. The model of Tarnier is unnecessarily cumbersome.

My practice has usually been to bring the head to the pelvic floor with the axis traction apparatus, then to substitute the ordinary forceps. Murray and also Nagel contend that the axis traction forceps should be used throughout the delivery. They claim as great advantage for the instrument in the lower as in the upper part of the passages, for precision in the line of pull.

Murray thinks the frequency of perineal injuries in ordinary forceps deliveries is due to the difficulty of properly directing the force. This is entirely obviated with a true axis traction instrument. He goes so far as to say that in an experience of ten years with his improved forceps he has never had a laceration of the perineum, and that experience has included rigid perineums, narrow pelves, face cases and difficult occipito-posterior positions.

I have not been so fortunate. I have in three cases completed the extraction with the axis traction forceps, once with Simpson's and twice with Murray's own instrument, and in every instance had an extensive rupture of the pelvic floor. Yet I believe, as Murray contends, that the axis traction instrument offers the same advantage for the soft parts as for the hard parts of the birth canal. The extracting force can be applied with greater accuracy in the right line than with the simple forceps. But misdirection is not the only cause of rupture. A certain proportion of pelvic floor injuries are unavoidable by any method of delivery. In my experience, without episiotomy, lacerations at the vaginal orifice occur in 15 to 20 per cent. of first labors in spite of all other precautions with or without forceps.

I may say that Milne Murray advocates the use of the forceps in preference to version in narrow pelves. If I am not in error this opinion he held before the days of axis traction forceps. With the aid of the new instrument his position is more defensible than before. One of his arguments is that in extraction by the breech the traction force in the cavity is applied almost at right

angle to the axis of the parturient canal, and therefore delivery by the head with an instrument that pulls in the axis of the parturient canal is better than version. Version in my hands in suitable cases has proved a very satisfactory procedure, but it is open to the same objection as the forceps, that serious fatal injuries are liable to occur in difficult extractions. I think therefore that opening the pubic joint, which is more likely to result in a living child than either forceps or version, is to be preferred where delivery by either of the latter means would be extremely difficult.