

THE AIR-TRACTOR¹

AS A SUBSTITUTE FOR THE FORCEPS IN TEDIOUS LABORS.

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CASES ever and anon occur of morbid protraction and delay in the second stage of labor, with the head of the child sunk down into the pelvic cavity, or resting upon the perineum; with the caput succedaneum enlarging more and more under the pressure and prolonged uterine contractions, and yet these contractions producing little or no effect upon the actual advancement of the infant; and with local and general symptoms threatening to supervene, and showing the propriety, if not the necessity, of the patient being relieved, and delivery being completed.

In such tedious and trying cases, if there were space for us to pass our hands between the soft parts and head, so as to seize with them, and drag upon the head, we could curtail the patient's sufferings. There is not room for this. Our hands are too thick for the purpose. As a substitute, accoucheurs under such circumstances introduce a thin metallic hand, so to speak, on each side of the

¹ Extracted from Proceedings of Edinburgh Obstetric Society, Dec. 20, 1848.

child's head—viz., the forceps—which exactly, like a couple of slender hands, take hold of the head, and enable us to apply, when necessary, extractive force to it. One objection which has been often urged against the use of the forceps (though it is an objection against their abuse rather than their use) is this, that the instrument, in being introduced between the maternal passages and head, is apt to injure these passages, and to contuse and even lacerate them during their working; that they are thus liable to inflict local damage on the mother at the very same time that they shorten the term of her sufferings and save her infant.

Is there any other mechanical power which it is possible for us to apply to the infant's head in order to seize and move it forward, which would not be liable to the same objection of danger to the mother?

In such tedious cases as seem to require the use of the short forceps, the idea has perhaps crossed the minds of most accoucheurs, that if they could get hold of the *exposed* portion of the scalp of the child, or of the skin forming the caput succedaneum, and could possibly pull by *this* hold, they might thus expedite the process of delivery, and abridge the sufferings of their patients. The spherical form of the infant's head, and the intimate mode in which the scalp is spread over the arch of the cranium, prevent the possibility of taking any such hold by the fingers alone. By means of a small suctorial disk, the shell of the patella or limpet, which is so common upon our shores, fixes itself with great force to the stones or rocks on which it is placed. Dibranchiate cephalopods—as the common cuttle-fish—fix their arms, by similar suctorial disks, so firmly to different surfaces, that their arms themselves will often tear before the suckers with which they are attached will give way. If we could fix upon the *exposed* portion of the fetal scalp the suctorial disk of a limpet or cuttle-fish with the usual force with which they adhere to the sea-rocks, &c., to which they are attached, we should have, in many cases, a power sufficient to enable us to apply by them the necessary amount of extractive force. The disks of the limpet and of the cuttle-fish attach themselves firmly to the surfaces to which they adhere, by being formed so as to act upon the principle of the common sucker used by the schoolboy to lift stones, &c.—viz., by removing, or rarifying as far as possible, the air placed between the attaching and attached bodies, and thus taking advantage of the great power exercised by pressure of the atmosphere upon the surfaces of solids. This pressure is, as is well known to all, equal to nearly fifteen pounds upon the square inch when the subjacent vacuum is perfect; or, in other words, it would require a force equal to fifteen pounds for every square inch attached, to effect

the separation of surfaces thus united. The limpet and cuttle-fish have the surface of the acetabula or disks with which they fix themselves so strongly upon the rocks, bedewed with a thick mucous secretion; after placing the surface of the disk upon the part to which they are to attach themselves, they, by a muscular movement, raise the centre of the disk so as to produce a more or less perfect vacuum; and the cuttle-fish has a central body in the middle of each disk, which it draws up and uses for this purpose, exactly on the principle of the piston of a syringe.

Such an arrangement and apparatus may be imitated by art; and when rendered more perfect and complete, may perhaps give us a simpler and safer obstetric power for some cases than even the forceps. In one protracted case which Dr. Simpson described, he had lately made use of this power to extract the child. When applied, the head was still high up in the pelvic cavity, and the instrument easily afforded such a hold of the head as to allow it to be slowly dragged forwards and extracted. During this extraction the instrument required to be reapplied once or twice. Dr. Duncan and Mr. Dickson were present at the delivery.

The instrument used in this case was very rude and imperfect. It consisted of a common metallic vaginal speculum, fitted with a piston, and with the edge of the trumpet-shaped concave disk at its outer or broader end covered with leather. This broader and leathered end was coated with lard, and applied to the head of the child; and then an exhausting effect produced by moving the piston forwards. The apparatus would admit of much improvement and simplification, as by its mouth being made expansible, and capable of altering in shape, instead of metallic and fixed; by its inner edge being coated, as in atmospheric railways, by a thin layer or cushion of air enclosed in caoutchouc; by the exhausting apparatus being valved and more perfect, &c., &c. But if the air-tractor could not be made both simple and satisfactory in its application, it would not replace the forceps; and more experience would be required to decide whether it had any title to do so.

If the instrument, when properly constructed, should be found to succeed, it would be still more advantageous in replacing the long, than in replacing the short forceps. In the case in which it was used, the head was at the height for which long forceps are usually required. If a suctorial tractor should answer in some long forceps cases, and enable us to drag with sufficient force upon the exposed portion of the scalp, it should save the danger dreaded by many, of wounding the uterus by introducing and working the blades of so long an instrument as the long forceps, high up in the neck and cavity of the uterus itself.

Presentations of the breech sometimes require instrumental assistance. The hook passed over the flexure of the thigh is dangerous, and very apt to injure. The forceps, as recommended in these presentations by some authorities, are often inapplicable and inefficient. Perhaps the air-tractor may afford us a new and sufficient instrumental force for the management of some of these cases. Its use would be simpler and safer than any of the other methods proposed.

Dr. Simpson further observed, that he was not aware that any one had applied practically this obstetric means before it was employed in the case detailed to the Society. But the idea of using such a power had been long ago proposed by a gentleman, for whose works and talents they all entertained the utmost respect, Dr. Arnott of London. In his admirable work on Physics, Dr. Arnott alludes to the subject in the following words: "The forceps," says he, "to be well and safely used, require address, which even the naturally dexterous man cannot possess without a certain degree of continued practical familiarity with it: and, except in large towns, a man must be unfortunate in his practice who often requires it; hence the really small number of persons who use it well. A tractor of three inches in diameter would act upon any body, to lift or draw it, with a force of about a hundred pounds—with more, therefore, than is ever required or allowable in obstetric practice. In lifting a stone, the tractor does not act as if it were glued or nailed to the stone, but merely bears or takes off the atmospheric pressure from one part, and allows the pressure on the opposite side, not then counterbalanced, to push the stone in the direction of the tractor; so when placed upon the child's head, it would not pull by the skin, in the manner of a very strong adhesive plaster applied there, as uninformed persons would be apt to suppose; but by taking off a certain atmospheric pressure from the part of the head on which it rested, it would allow the pressure on the other side or behind to urge the head forward on its way. Of course the pressure in such a case would not operate on the head directly, but through the intervening parietes and contents of the abdomen. It would be preferable to have a gentle and diffused action of the tractor over a large space, rather than an intense action on a small space, and therefore a tractor for the purpose now contemplated should not be very small, and should have a little air underneath it in a slight depression or cavity at its centre. The forceps must be more effective than the tractor for rectifying malpositions of the head, and diminishing its transverse diameter; but the tractor will answer both these purposes in a greater degree than might at first be expected."¹

¹ Elements of Physics, p. 636.

The inner cup might be round, oval, &c., and varying in form and size. The outer caoutchouc cup would admit of much further improvement. A double cup of caoutchouc seemed to render the instrument stronger. Of course, with all this, the vacuum, however great, was still always more or less imperfect.

The air-tractor seemed to possess various advantages over the forceps. It was far less dangerous to the mother, as it was attached to the exposed part only of the scalp of the infant; the forceps were required to be passed high up between the head and maternal passages, and in incautious and inexperienced hands were apt to injure one or both. The materials of the air-tractor, caoutchouc and sponge, were safer to the mother and child than the material of the forceps (steel). The forceps always took up a certain amount of space between the head and passages; the air-tractor did not. The air-tractor was greatly less in size, and consequently far more portable. It could be applied with sufficient firmness and power to enable us to rotate the head, or change its *position*; as from, for example, an occipito-posterior to an occipito-anterior position, the form of rotation most frequently required in practice. It probably could be applied also to change the *presentation*—which the forceps could not effect—as, for instance, to bring down the occiput, when fixed there, in frontal presentations. Perhaps it may be found as useful, or more so, when the head is at the brim as when it is at the outlet. It may be made so as to fix upon the breech—in cases in which the forceps cannot be very readily or safely used. If found perfectly easy of application, it may enable the accoucheur, by adding a few pounds to the strength of each pain, to bring to a safer and speedier termination cases that would otherwise go on tediously, hour after hour, and in which we should still not choose to use so formidable an instrument as the forceps; for it is to be recollected that the danger of parturition to both mother and child increases in a ratio progressive with its duration. In cases of inertia of the uterus—the most common cases for the short forceps—it will probably be found specially applicable. And in such instances it is surely better to extract the child by a safe force, thus applied *ab anteriori*, than to effect its expulsion by the ergot of rye—which produces its result by forcing the uterus to push and press its parietes with renewed power and violence against the opposing body of the fetus.

In conclusion, Dr. Simpson stated that he had now used the air-tractor which he had constructed, in several cases of labor, and with results answering his best expectations. But it doubtless admitted of much further improvement in construction, in mode of application, in working, and other details.

The two preceding abstracts of communications on the air-tractor, read before the Medico-Chirurgical and Obstetric Societies, express the same views, but somewhat differently illustrated in the detail. We have chosen to reprint them complete, rather than omit any portions which might be regarded as repetitions. We observe that Scanzoni, in his *Lehrbuch der Geburtshilfe*, alludes to some experiments before the Medico-Physical Society of Würzburg, in which M. Schierlinger demonstrated that the air-tractor would not lift more than 15 or 20 lbs. without separating from the surface to which it had been applied, and that this force must be totally ineffectual for the purpose of extracting a foetal head detained at the outlet of the pelvis.

We can only understand how this should be the case with an imperfect instrument, as we have on many occasions seen a tractor of the size described by Dr. Simpson, bear 70 or 80 lbs. without pulling off.

The chief objection in the practical use of the tractor is doubtless in its application, and not in its power of traction; the large size of the caoutchouc cup rendering difficult its introduction within the maternal passages. To this may be added the difficulty of keeping the valves in working order.

Dr. Simpson however holds, and we believe correctly, that if ingenuity could suggest any form of tractor which, umbrella-like, could be folded into little space for introduction, and afterwards expanded over the scalp, and then exhausted by the attached piston, it might supersede the forceps in many cases.

Mr. Young, the instrument-maker, has shown to us a recent letter from an English practitioner, who speaks in the highest terms of the value of the tractor in his obstetric practice. Indeed, although in its present form the air-tractor may not be so generally applicable in obstetric practice, as to lead to its common adoption amongst practitioners; yet when we revert to the history of some of our most useful obstetric instruments (contrast, for example, the rude form of the early forceps with their present improved construction), we have reason to hope, that the tractor may, at some future time, be so far improved, as to be easily applied and used.—(Ed.)