Thesis submitted for the Degree of Doctor of Medicine of the University of Edinburgh, 1881.

By William Turner MB CM
(MA Abdn)

"On Version versus Forceps as a Method of Delivery in Cases of Deformity of the Pelvic Brim."
Cases have been from time to time recorded where a foetus at full term has survived its transit through a pelvis narrowed in its conjugate diameter beyond the limits that are ordinarily recognized for the safe delivery of a mature child, but such instances are for the most part too ill authenticated to be readily accepted as true, and too rare to lead to any alteration in current rules of practice.

In searching the records for information regarding such cases, the following were the most worthy examples that I met with:

Lachapelle (Pratique des accouchements, Paris 1825, Livre V, Memoire p.229) relates a case where she delivered a child through a conjugate 2.75 French inches. Forceps had slipped, version had been performed, and the head extracted suddenly. A large girl was born alive but did not live long.

Dangau (Journal de Chirurgie, par Malfaigne, Janvier 1843) gives an account of a woman whose pelvis was found after death to measure 2.75 French inches. Of nine children which she bore, one was said to have been delivered alive, and it presented the breech. All the others were born dead.

In a case described by Simpson (Select Obst Works, p.579) and which appears more than any other to have given origin to his ideas on this subject, he delivered by version a child whose head was deeply indurated. The bitemporal diameter of the head, at the seat of indentation, was carefully measured, and was found, when held compressed by the fingers,
Blurring in mind the conclusions arrived at by Sir James Simpson, to strongly advocated by him in his teaching and so fully discussed in his well known series of papers on turning as an alternative for Cephalotomy and the long forces in deformity of the Brim of the Pelvis, forces would appear to be in the minds of the younger practitioners at least, the exclusively the favourite operation in tedious head-first labours, whatever the cause of obstruction might be.

The following case, which I had the opportunity of carefully observing, is of interest as bearing out Simpson’s views and as demonstrating, more satisfactorily perhaps than has often hitherto been done, the extreme degree of pelvic contraction which is compatible with the safe passage of a well-developed child.

Mary Cassidy, a primipara, about 30 years of age, and unmarried, was admitted to the Glasgow Maternity Hospital on February 20th at 10 PM.

The patient stated that she was at the full term of her pregnancy. It was ascertained that she was a native of Ennistowill, and that she had crossed from Ireland to Glasgow two days previously, accompanied by her assumed future husband, who had come to Scotland in search of...
employment. On landing she had been described by him, 
and had remained in a destitute condition until she 
found refuge in our hospital (These facts I have included 
as bearing upon the subsequent history of the case.)

On admission the patient appeared to be well nourished 
and of healthy constitution. She was 5 ft 4 inches in height, 
and had well formed limbs and chest. Nothing in 
her features or gait indicated the presence of the 
rachitic diathesis. The expression of her face was 
vacant; and the rattle did not understand, or did 
not care to answer, the simplest questions until they 
had been several times repeated; and her answers 
were such as to give little information. In short she 
presented symptoms very much akin to those of 
Dementia in a mild form.

The patient, having been placed on a delivery bed, 
(she had already been in labour for about five hours,) 
I proceeded to make examination of her abdomen.

On inspection the uterine tumors was noted to be somewhat 
unnaturally prominent; its contractions were of average 
duration, and of more than ordinary strength. By 
external palpation limbs were felt in the left groin, 
but no head lay in the inlet to the pelvis. The fetal 
heart beat at 142 per minute, and was best heard on
the right side, a little below the level of the umbilicus.

On examination for vaginismus the margin of the order was found as large as a florin, soft and dilatable. The sharply defined heel of the left foot was easily recognized, dipping into a shallow bag of membranes. Very pronounced bulging of the bodee of the upper sacral vertebra was noted and I had forceps then brought to hand in anticipation of difficulty with the approaching head. No actual measurement of the pelvis however was made.

In half an hour the os was felt to be fully half dilated. The membranes were ruptured during that examination and great care was taken to avoid such accidents, and the left foot descended into the vagina. By it side also a protruding loop of cord was felt. It pulsated at the rate of 75 per minute, but the number increased as the uterus relaxed. (The pulsation of the foetal heart ascertained at different parts of the labour varied from 68 to 142 per minute.) An attempt was made to replace the cord in the uterus, and to retain it there by drawing down the thigh to occupy the lower straitest of the uterine cavity, but it failed chiefly in account of the length of cord prolapsed. The thigh was therefore left to dilate the cervix as far as possible, and no further interference was made for half an hour, except to feel the pulsations of the cord.
The os having now become almost fully dilated, and the right foot being easily accessible, the latter was clear and brought to the vulva beside its neighbors.

Chloroform was then administered, and the wine was drawn off by a catheter. The patient lay midway between the back and left side positions, with the right thigh raised, and both knees flexed towards the abdomen.

A single strong pain aided by slight traction suffices to expel the child's body from the uterus. Both arms were found extended above the head, and the head itself was in the position of retention; so that it was needless to persever in attempts at extraction until those conditions should have been remedied.

The pulsations of the cord were 60 per minute, giving indication for rapid completion of delivery. The arms were with difficulty reached and brought down but still the head would not yield to the combined force of traction and pressure exerted from the abdomen. The chin was found high up on the right side, and without using much force it was brought down into such a position that the head now lay directly in the transverse diameter of the pelvis, neither extended nor flexed in the trunk. It resisted further attempt at flexion.
I now enveloped the child's body in a towel to prevent my hands from slipping, and allow of more effectual traction being made. The body was grasped by the right hand in the region of the great bone, while the left hand laid hold on the shoulders. Pressure on the abdomen was maintained constantly during the pains by a trained nurse whom I had previously instructed as to how it should be applied; while continuous strong traction was also at such times kept up, with the child's body now drawn backwards on the perineum, now pulled forwards towards the pubis. No lateral traction was employed. On the last occasion, after less than four minutes' continuous application of this traction, the head yielded somewhat suddenly. Toward rotation of the occiput took place abruptly, and delivery of the head was easily and quickly completed.

Artificial respiration was needed to supplement weak spasmodic inspiration of the child, who cried for the first time seven minutes after birth.

The placenta and membranes were soon afterward expelled entire. A straight tear, 3 an inch in depth, was found to have taken place in the left side of the cervix, which allowed the anterior lip to hang very loosely into the vagina, but no other injury to the
Mother's parts was found.

Thus the labour was completed 6½ hours after its onset, 1½ hours after admission, and 10 minutes after the head engaged at the brim.

Half an hour after delivery, the mother had fallen into a sound sleep from which she did not awake for several hours.

The child was a female, 19 inches long, and weighed 6½ lbs. It had all the appearance of a foetus at full term. The bones of the head were well ossified, and of normal rigidity. The head was somewhat elongated, and there was a reddened contused band on the scalp of the right side, extending from near the root of the zygoma upwards over the right parietal bone towards the greater fontanelle. There was no hum

auricular depression, but the head was generally flattened on that side. A red line round the left side of the head indicated the level where it had been

compressed previous to its-yielding at the brim of the pubis. This line passed from the upper margin of the left orbit, across the root of the zygoma, and compressed the left ear about 4 or an inch from its summit. There was no abrasion of the skin on any part of the head.

I regret that as my calipers was broken at the time,
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no accurate measurements of the child's head were made immediately after birth, but the following are the measurements of the head taken 12 hours after birth, when the bones of the head had regained their natural conformation:

**Diameters.**
- Occipito-frontal: 4 1/8
- Biparietal: 3 3/8
- Bitemporal: 3 1/4
- Bimastoid: 3 1/8
- Suboccipito-bregmatic: 3 7/8
- Occipito-mental: 5 1/2

**Circumferences.**
- Occipito-frontal: 13 1/2
- Suboccipito-bregmatic: 12

On the morning of the second day after birth, the right upper eyelid of the child was found to have become quite black. The discolouration was mostly on the inner half of the eyelid, and was accompanied by little swelling. It went through the ordinary stages of a black eye.

Without following out in detail the subsequent history of the mother, I shall merely select one or two prominent facts to enable me to form some connected idea of the circumstances of her death which occurred on the 8th day after delivery. The bedside chart of the case is submitted with the same view.
Nine hours after delivery the patient felt herself comfortable; her temperature and pulse were normal. For the first two days she suckled her child, but the quantity of milk in her breasts was very small. By degrees the temperature had reached 103° on the morning of the fourth day, and then for the first time the lochia were noted. There had been no rigor. The bowels were well moved with oil, and the vagina was washed out every four hours with 1:60 carbolic water solution, but no fall of temperature resulted.

On the 5th day the fever persisted and the strength of carbolic solution was increased to 1:40. So offensive was the odour that the vagina and cervix were explored to ascertain whether there might not be some sloughing of their tissues, but no such condition was discovered. The cervix was found contracted so as to admit but one finger with ease; and it had a fissure about 1/2 an inch deep in its left side. The uterus extended to within an inch of the umbilicus, and could be and could be moved without causing pain.

In the evening of the 5th day the patient vomited some dark coffee ground material. The abdomen had become more distended, but was still free from tenderness. The lochia, which were not entirely suppressed, had a
highly offensive gas-producing action. Opium was given freely, and a blisters was applied to the lower part of the abdomen.

On the morning of the 5th day vomiting renewed, and tympanitis had increased. The patient was removed to the isolation ward and had 10% of saltpeter carbonate of soda given her every four hours. Opium had the usual with caution as she seemed unusually susceptible to its influence. Pain on making water was complained of and the bladder was emptied with difficulty. About 4 0'clock the same day were drained off by catheter.

In spite of careful nursing and liberal nourishment the pulse had steadily fallen off in strength, until on the 6th day the administration of stimulants was considered necessary. Delirium had also supervened, and hiccough was a troublesome symptom.

The patient indeed seemed to be entirely devoid of rallying powers, and died exhausted on the 8th day.

Post Mortem Examination, performed 24 hours after death, disclosed the following facts.

External appearance. The body is well nourished. The inferior of the vulva has a somewhat gangrenous aspect, with brown fluid escaping from it.

On opening the belly there is observed a small quantity of
purulent fluid lying amid the coils of the intestine around the uterus; and there is some lymph adhering to these coils, and to the surface of the uterus and broad ligaments. The uterus is large and soft, reaching half way to the umbilicus.

After removal of the pelvic organs the length of the body of the uterus is found to be 4 ½ inches, its breadth 4 inches. On opening into the uterus by longitudinal incision its walls are found to be placid. The thickness of the posterior wall is 3 ½ Jain inch at its middle part. The lining of the uterus is soft and irregular, covered with more or less of greyish looking material. At the upper part of the right side of the anterior wall there is a large spongy looking layer 2 Jain inch thick beneath which the uterine wall is honeycombed with open veins.

The cervix is about 1 ½ inches in length, and 2 inches in breadth when slit open and unfurled. The inner 2/3 is marked off from the lining of the uterum by a distinct transverse line somewhat raised and injected. The inner 2/3 presents a notch ½ inch deep on the left side, and a still smaller one on the right side. The lining of the vagina is rugose and of a dark slate colour mottled with yellow. It feels rough and
hard to the finger.

The right ovary has been the seat of purulent hæmorrhage, and is coated with lymph. The left ovary on being cut into exhibits an injected interior, in which there is a yellow solid irregular deposit.

The bladder is in places injected especially at the base where there are purulent hæmorrhagers in the submucous tissue, and where also there is a patch as large as a halfpenny of a dark red colour coated with a thin grey slough.

The spleen is large, soft, almost pulpy, dark maroon in color.

The kidneys are pale, their cortex slightly thickened, and on their surface are a few radiating venous radicles. The right kidney is smaller than the left.

The other organs as far as examined showed nothing abnormal.

Being interested in the pelvis, and having a desire to examine it more minutely than was possible of the cotid, I had it removed in the manner described by Dr. Hark. Without disterning the surface of the body more than is done by the ordinary pelvic peritoneum incision. It is an example of the simple flat Pouchiæ variety of pelvis.
Its brim might be well described as reniform, or bluntly heart-shaped, the prominence of the sacro-vertebral angle appearing to be the main element in its deformity.

Its measurements are:

At Brim

- Conjugate diameter: 2 3/4 in
- Transverse: 5 in
- Oblique: 4 1/2 in

At Outlet

- Conjugate diameter: 4 1/2 in
- Transverse: 5 1/2 in
- Oblique: 4 1/2 in

The cavity of the pelvis is capacious, and is so much wider from side to side than anteroposteriorly. The coccyx points rather abruptly forwards, owing to a sharp bending which has taken place chiefly at the point of union of the 5th and 4th sacral spines. The inferior tuberosities are markedly bent outward, the subpubic angle measures about 120°.

With regard to the mechanism of delivery in such cases of flat pelvis, a few additional remarks might be made.

Continuous traction on the body of the child for a period of four minutes was kept up at one time in the axis.
of the bini, as another in the axis of the inlet of the pelvis. More time however was devoted to traction in the axis of the bini. The head was thus made to advance in the one direction with the left parietal bone rotating round the promontory of the sacrum as centre, in the other with the right parietal rotating round the pubis as centre; the abdominal pressure serving to retain the advantage gained by each of these movements. The mechanism might be compared to the working of the appliance known as the weighing winch of a ship, or more familiarly to that of the chain hoist. The effect of traction however is not uniform on the two sides of the head. In front the head lies against the smooth flat inner aspect of the pubic bones, while behind it is in contact with a sharply projecting angle which would tend to indent it and prevent its recession. For this reason abdominal pressure will be most advantageous if applied to the anterior side of the head and directed at first in the axis of the inlet. As the head advances through the bini, and is doubling over the promontory, the pressure should be gradually altered to a direction perpendicular to the axis of the body, so as to take advantage of the unusually abrupt recession of the sacrum.
To facilitate this task, and at the same time allow of traction being carried out in the desired directions, the best position to place the patient in would be the lithotomy decubitus, with the thighs brought to the edge of the bed. The assistant standing or kneeling over the patient, and facing the operator will be less likely to injure the bladder by applying the palms of his hands from either groin, one on the forehead, the other on the occiput of the child. Moderate pressure, if well directed, will probably prove as effectual as powerful propulsion.

Abdominal pressure in a very limited degree may also be exerted alternately on the fore and hind parts of the child's head, but no attempt need be made to produce the same effect by traction.

As to the advantages or disadvantages of this mode of delivery, it is evident that had the child presented its head in the case described, instead of a lower extremity, its birth would have been at all events greatly delayed. The head would have rolled from side to side of the pelvic brim in vain attempts to enter it, and thus a more accurate conception of the amount and nature of the deformity of the pelvis would have forced itself on my mind, leading to
an internal measurement of the conjugate diameter. Having ascertained that the conjugate of the brim was contracted to about 2 3/4 inches, and that a normally developed head was presenting, a consultation would have been called. Then either the child would have been forthwith consigned to Craniotomy; or the choice would have lain between Forceps and Version.

The teaching of the present time in regard to the comparative merits of these two operations—Forceps and Version—in flat pelvis is still far from uniform in different schools.

Many authorities advise that, as a general rule, the practitioner should be guided in his choice chiefly by the relative amount of his experience and dexterity in each.

Barnes maintains that although an unusually compressible head may be drawn (after version) through a pelvis with 3 inch conjugate, the chances of the child being born alive under such circumstances, must necessarily be small, and that 3 1/2 inches must be the limit of the operation.

Playfair states that when the anteroposterior diameter of the brim measures 3 inches or less, the destruction of the child is inevitable, unless the pelvis be so small as to necessitate Caesarean Section.

Leichman affirms that when the conjugate diameter is less than 3 inches, to attempt to turn would be to subject the woman to needless risk, while we may be confident that nothing injurious could attend on that
Some hold that the forceps operation involves less risk to both mother and child, at least in the lesser degrees of conjugate contraction.

Others again admit that, Cœperis paribus, version offers a better prospect of saving the child without increasing the danger to the mother, at least in the more extreme degrees of pelvic contraction.

There is as yet no generally established belief that version is applicable to a lower range of contraction than forceps, i.e., that a child may be made to pass alive by version through a pelvis that would not permit of its safe delivery by forceps.

The case above described must, I think, be looked upon as lending support to such belief. If a stillborn child could be procured with a head of similar dimensions to the one which passed safely, vertex first, through the pelvis in Encehm, it would be interesting to know whether such a head could be drawn, vertex first, by forceps through the same pelvis. Such experiment would not of course be free from fallacies. Any advantage, such as the greater compressibility of the head of a dead child, and the absence of the soft structures of the pelvis, would be in favour of the success of forceps.
But the question has been already abundantly answered in the writings of Simpson, Schroeder, Braxton Hicks, Goodell, Taylor of New York, and many others, where instances are recorded of version having been resorted to with success after forceps had failed.

Against such evidence several possible arguments might be adduced by those holding opposite opinions. Namely, first, that in these cases the forceps had not been sufficiently or fairly tried, of which there is no evidence; and secondly, that with the present improved forms of axis-traction forceps no such failures shall occur. I know of no instance where forceps version has been resorted to with or without success after an axis-traction forceps had failed, but obviously some time must elapse before such an objection is valid.

Further, it might be said in support of the superior advantage of forceps that they have been applied to the accompanying head to complete a case of version.

In Professor Simpson’s paper on axis-traction forceps he mentions a case where the forceps succeeded in effecting delivery, and where in a former labor version had failed, and Caesarean section had been performed.

Since writing the above, I have heard with much interest that a case occurred in the experience of Dr. Ronaldson of Edinburgh, where after axis-traction forceps had been assiduously applied without success, a live child was, with comparative ease delivered by version.
that would otherwise have failed. There is reason, however, to believe that the traction employed as in the case described gives one as much command over the completion of delivery as does traction by the forceps.

The amount of traction force that can be exerted on a child's head by forceps applied to it has been estimated at 80 to 100 lbs.

The amount of force that can be put on the neck of a child by traction on its body, without yielding of the spinal column has been estimated at an average over 100 lbs, while provided traction be uniform and exerted in the proper direction; while decapitation was found to take place when the weight was increased to 120 lbs.

The amount of force that can be applied to the expulsion of the child by pressure on the abdomen has been described as comparable with the weight of the body of the operator.

The combined force of traction and propulsion that has been exerted, without injury to either mother or child has been estimated by Goodell at not less than 200 lbs. Such extreme propulsive force appears to be unnecessary in order to obtain the maximum advantage of the method, and to tend

Durean's Experiments - Mechanism of natural and morbid perforation, p. 140.
even to delay the passage of the head, as will be afterwards pointed out.

But there are other and more important reasons for rejecting the aid of forceps whichever head or breech present.

If forceps be applied in the place of the head coming last, the mechanism will be but slightly modified from that described, most clearly by Goddard, as occurring in the head first application.

The blades must grasp the head in either (a) its antero-posterior diameter, (b) its transverse diameter, or (c) its oblique diameter.

(a) If the grasp be antero-posterior, the head is compressed in that direction at the expense of widening of its transverse diameters, however much elongation of the head is produced. It has also been stated that this grasp necessitates flexion of the chin on the sternum, whereby the biparietal diameter, instead of the shorter occipitofrontal has to engage the conjugate of the brim. This movement however need not necessarily take place, at least in head last cases.

(b) The biparietal grasp of the head is theoretically more advantageous for the head is there made to assume an hourglass constitution at the very first
where constriction needed; but in addition to other 
practical difficulties, the most obvious one is that 
even supposing the instrument to be applied directly 
in the axis of the pelvis, no ordinary forceps, though 
suitably closed could pass such a diameter, as 
pointed out by Professor Simpson.

(c) If the head is seised in the oblique diameter, 
precipitous forward rotation is thereby induced. The 
temple adjacent to the mental prominence is apt to be 
"above in" being caught between the prominence 
and the blade applied to the opposite temple, and 
hence the indentation which is familiar to most 
practitioners.

In children delivered by version, indentations must 
be less frequent, of less depth, and placed further 
back on the head, as a rule, than when forceps 
have been used.

The absence of indentation in the present case 
might be accounted for by the theory, that probably 
sufficient time was not given for its development, 
as is usual in forceps cases, of the same kind. The 
prominence also as seen in the specimen is well 
rounded transversely, not funnel-shaped as is 
formerly the case in flat pelvis.

Sir James Simpson mentions a case where he delivered by turning a full-grown child through pelvis of birth, engaging 
the head passing through in a flattened and compressed form, but without any depression or indentation upon it.
When it is considered that many (50 per cent as stated by Schlesinger) of the children whose heads have been so indented die either immediately or shortly after birth, the advantages of dispensing with forceps if possible must be apparent.

The injury to the child's eye in the case related, would at first appear somewhat anomalous, it being the right eye, which of all other parts was least affected by injury. Most probably however the discoloration did not result from direct injury, but was due to extravasation of intraocular or intraorbital origin.

To compare still further, the two methods of delivery, it is well known how fruitless a procedure it is to attempt to push a mouldable mass, such as a cerebral protuberance through a rigid ring (and that the difficulty is greater in proportion to the smallness and rigidity of the ring) if the force be applied a tang. This might be given as an argument against infraorbital forceps, seeing that the head is partially mouldable and the brain rigid. But if the pressure employed is sufficient only to retain the advantage gained by traction, as previously recommended, this argument is not applicable. On the other hand it may, I think, be used as an argument against forceps.
And in the first place it must be shown that the forceps acts not merely as a tractor in these cases, but also as a propeller, so far as the head is concerned. When the forceps grasps the head, before traction is made its effect is purely that of a compressor of the head, or more correctly, of part of the head; the force of compression is conducted at right angles to the various tangents of the forceps curves. These forces may be resolved into their vertical and horizontal components, when it will be seen that the vertical forces exactly counterbalance each other. In other words, the force exerted on the head is equal at every point of the forceps. The forceps blades are thus so welded into the head that when traction is made, and little resistance is met with, the head moves forwards acted on purely by its a fronte. When however great resistance is met with, as in a contracted pelvic brim, the pelvis being closed and there being no means of exerting further compression, the head must recede, to a degree depending on the amount of resistance, towards the distal end of the forceps blades, and is thus compressed vertically.

The variety of forceps which is best calculated to prevent such recession is that of Sir James Simpson with its long, lightly curved blades, but even these will be found inadequate
to a greater or lesser degree, in cases where there is great disproportion between the size of the passage and that of the child's head. It might be said that such forceps have been constructed so as to allow of the highest degree of compression and elongation of the head being made that is compatible with the safety of the child, and that therefore recession of the head cannot occur without injury to the child. In reply, I would state that I have on frequent occasions observed a considerable part of the proximal side of the forceps grasp unoccupied by the head while strong traction was being made.

The rigidity of the blades (necessary to prevent their slipping) is such that their tips cannot be separated, under great strain more than 3 inch from their normal position, the handle remaining closed, so that recession beyond the tips cannot take place to any great extent.

The head must thus behave as if acted on by a vis a tergo. The head therefore not only expands excessively in one direction to compensate for the compression of the group in anterio, but the parts outside the grasp are made still more to double over the brain by the propelling force, which further increase the obstruction.

When forceps are applied in vertex presentation, the tips of the blades are in contact with the rigid base
of the skull, which, as it were, complete the arch of their grasp, and gives them more efficient propulsive power.

It is not maintained that this vis a tergo is such as to have a powerful influence in preventing the head from passing the brim of a moderately contracted pelvis, but there seems reason to believe that it is an element in the explanation of those failures of the forceps in cases where the contraction has been found not insuperable to the method of version.

When the head is passing the brim, vertex last, by traction on the body, it is compressed equally at nearly every part of its circumference by a force acting at right angles to the surface engaged. This force is directed more or less upwards according to the amount of resistance; and as there is nothing compressing it above, elongation of the head is freely permitted.

Another circumstance unfavorable to the success of forceps, in flat pelvis more especially, might be added. If we consider the relation between the available area of the brim and the area of the section of the head that has to pass it, it is plain that any encroachment on the former directly increases the difficulty of passage of the latter. The forceps blades, applied at either side of the pelvis
not only of themselves occupy space in this available area, but when they grasp the head they necessarily leave behind them a still greater space unoccupied by the passing head. The blades of the forceps in ordinary use, when closed, are only 3 inches asunder at their widest part, and are so rigid as to admit of further separation, under strong force to not more than half an inch. When we remember, that the measurement from side to side of the flat pelvis is normal, or above normal, the amount of available area wasted in the application of forceps is seen to be considerable; in the present case it would have been presumably not less than one square inch at either side.

Thus far the question of preferring Verein and avoiding forceps in the more exaggerated forms of flat pelvis has been considered solely in regard to the interest of the child. It has still to be shown how much traction on the child’s body coupled with supra-pubic manipulation is warranted in the interest of the mother.

It will be readily admitted that any amount of traction on the neck of the child that is consistent with its own safety is warranted consistently with the
interests of the mother. In the four cases reported by
Braxton Hicks, already referred to where version succeeded
after forceps had failed, no abdominal pressure seems
to have been employed. Three children were born alive
and no damage was done to any of the mothers.

Goodall states that using all the manual strength
(for traction) he could command he has never seen
the body part from the head. In 9 cases of version re-
orded by him in major degree of contracted pelvis
eight children lived and one died.

In 10 cases of version for considerable contraction
recorded by Lachapelle, all the children died, and
four mothers died. Of five such cases, with slight
contracture, all the children were saved, one mother
died of peritonitis.

"It will scarcely be believed," says Deman, in ad-
voating version, "how seldom this operation (Craniotomy)
is necessary under such circumstances, nor have I
ever found any ill consequences follow the compression
of the soft parts between the head of the child and the
side of the pelvis, if proper attention were afterwards
paid to the state of the bladder and urethra."

It is not difficult, in view of the history and post-

Guy's Hospital Reports 1870.
Fursten appearance, in the case described, I believe that the operation had no direct influence in bringing about a fatal issue to the mother; that the result would probably have been the same whatever means had been adopted for her relief. The question to be solved is - can the operation be looked upon as the immediate cause of the peritonitis, or is the peritonitis to be regarded as of septic origin? The latter view derives strong support from the facts that for two days after delivering the patient remained well the temperature keeping within limits that might be considered normal. The lochia also were healthy for the same period; then the lochia became fetid the temperature rose, and when the former became more healthy the latter also became normal. vomiting began on the evening of the 5th day, which does not favour a traumatic view. Moreover the gangrenous condition of the lining membrane of the genital tract, from which most probably the septic material was introduced into the system, must be attributed not so much to trauma of the part, as to the existing defect in the trophic condition of the tissues, as an important predisposing cause.

The moral element alluded to, amounting in this case almost to insanity, was not to be overlooked in forming an estimate of the chances of recovery of the patient.
It would be interesting, and in a case such as this, I think it practicable, to determine approximately the amount of alteration that has taken place, by compression and elongation, in the area of a horizontal section through the child's head at its widest part.

Randorothami has estimated that a full grown foetal head may be lessened from side to side, without endangering the child's life, one-seventh of its own extent, or from 32 inches to 3 inches.

In Delmar's Midwifery a statement is made that the extreme degree of diminution and change which the head is generally capable of undergoing (in its passage through the pelvis) is perhaps impossible to be determined, but it does not seem unreasonable to conjecture that it may be reduced by one-third of its original size, without the destruction or even injury of the child by compression.

There is nothing in the remarks preceding or following this statement to enable one to know what form of compression is meant, whether diminution in one diameter or another, or in the entire bulk of the head, to the extent of one-third.

To does the author support this statement by evidence of any kind.

The rigidity of the bones of the head in children at full term varies considerably, and their capacity for being moulded will vary accordingly. The head of the child in the present case was not more moulded than the average of mature foetal heads.

In the accompanying outlines, there are represented as accurate tracings of the pelvic trim, and of a horizontal section of the child's head, at its widest part, as the nature of the case will permit. The area enclosed by each outline, in square inches, has been estimated approximately in the following manner:

Area of section of head = area of outline $E K S T H L$

= area enclosed by semicircle with radius $N F$ (which is equal to half the biparietal diameter) + area enclosed by semi-circle with radius $E M$ (which is equal to half the bitemporal diameter) + area of space $K H$ (which is equal to area of a square angular space $MN \times$ the mean between the biparietal and bitemporal diameters.

Area enclosed by pelvic trim = area of outline $A D B C$

= area enclosed by semicircle with radius $\frac{AD + CD}{2} + 2$ area enclosed by semicircle with radius $PD$, + 2 (an area which has been accurately measured, and estimated at about 58 in.)
Area of Semicircle $GH = \frac{R^2}{2} = \frac{3.1416 \times (\frac{1}{3})^2}{2} = 5.52 \, \text{sq in.}$

Area of Semicircle $KL = \frac{R^2}{2} = \frac{3.1416 \times (\frac{1}{3})^2}{2} = 4.14 \, \text{sq in.}$

Area of Space $HH = MN \times \frac{KL + GH}{2} = \frac{1}{3} \times 3\frac{1}{2} = 3.93 \, \text{sq in.}$

Total area

Area of Semicircle $ACB = \frac{R^2}{2} = \frac{3.1416 \times (2\frac{1}{2})^2}{2} = 10.824 \, \text{sq in.}$

2 Area of Semicircle with radii $PQ = PR^2 = 3.1416 \times (\frac{3}{2})^2 = 1.224 \, \text{sq in.}$

Estimated surplus area

Total area

Thus the area enclosed by the bony brim of the pelvis is 1.209 sq inches less than the area of the section of the head.

The available area of the brim, which excludes the space occupied by the soft parts, and also a great part of the cushions of the rami, might be estimated as approximately equal to the area of the Semicircle $ACB$. That is, the available area is less than the area of the section of the head which engaged by 2.766 sq inches. From these calculations the head must have had its engaging area altered by elongation and compression, to the extent of fully one fifth part.

(As it should be mentioned that the child was born two months after birth in the City Workhouse, in a very thin and emaciated condition.)