THE VACUUM EXTRACTOR IN THE FIRST STAGE OF LABOUR*

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The concept of foetal delivery by means of a suction apparatus is by no means new, and if we pass down the years we find that James Yonge (1646 - 1721), surgeon to the Naval Hospital at Plymouth and Mayor of Plymouth, recorded a case of prolonged labour in 1707 where 'a cupping glass fixt to the scalp with an air pump failed to draw out the head. In this extremity I directed my son to open the child's head. This was soon and easily done and delivery completed'—possibly a case of hydrocephalus.

Neil Arnott (1788 - 1874) entered the service of the East India Company as surgeon. In 1829 he published the first edition of his *Elements of Physics in Natural Philosophy* in which he advocated the use of a pneumatic tractor.

It was left, however, to James Young Simpson to invent *and* use in 1849, what he called a 'suction tractor'. His first instrument was primitive, and consisted merely of a common metallic vaginal speculum fitted with a piston. Its broad trumpet-shaped end was covered with leather and greased with lard. Although he improved on this instrument and apparently used it with some success it inevitably met with criticism notably from the editor of the *London Medical Gazette* (1849). At this time John Heddy James (1788 - 1869), who was surgeon to the Royal Devon and Exeter Hospital, reported in the same issue of the *London Medical Gazette* that he had independently devised a suction instrument, although there is no record of his having actually constructed such an instrument.

As the suction tractor was obviously by no means an ideal one Simpson later abandoned the innovation and his last published words on this subject were: 'I believe that the construction of the "Air Tractor" is still so very far from being so perfect as it will yet be rendered.'[3]

One hundred years was to elapse before Maelstrom was able to perfect his instrument and thus realize Simpson's prophecy.

Although the Maelstrom Vacuum Extractor (or ventouse) has now been in use for the past 8 years or so, there is still much controversy as to whether it should have a place in modern obstetric management and if so, what the indications are.

Now widely used in certain parts of the Continent of Europe, it is more commonly employed in the second stage of labour; in fact it would appear to have largely displaced the obstetric forceps in these countries. An advantage that the vacuum extractor has over the forceps is that it can be used in certain cases where the cervix is not fully dilated,[1,2,4,5] and provided that conditions are favourable for a vaginal delivery, it is a suitable alternative to what would most likely be a caesarean section.

The present paper is based on an analysis of 199 cases admitted to the Peninsula Maternity Hospital, Cape

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Town, during the 3-year period ending 31 March 1965, where the vacuum extractor was used to effect delivery in the first stage of labour. I wish to emphasize that these operations were performed by different members of the staff at varying levels of experience.

MATERIAL AND METHODS

During the period under consideration there was a total of 7,931 deliveries and the vacuum extractor was used on 317 occasions, i.e. an incidence of 4%. In 199 cases the patient was in the first stage of labour, and in 103 cases the second stage. In 15 patients the obstetric history was not available and the information, which was inadequate, was obtained from the nurses' labour ward records. Since it was not possible to determine whether the operation was performed in the first or second stage of labour, these cases have been excluded from the analysis.

In the series of 199 cases, 104 of the patients were primigravidae and 95 were multigravidae. Twenty-three of the latter had had 10 or more children. There were 41 emergency admissions.

Indications

The most frequent indication (Table I) for employing the vacuum extractor was prolongation of the first stage of labour, the result of a lateral or posterior position of the foetal head and complicated by incoordinate action of the uterus. The latter indication was present in 68 cases; and in a further 31 the prolonged first stage was complicated by foetal distress. For the purpose of this paper I have classed all primigravidae patients over 24 hours in labour, and all multigravidae over 18 hours, as being cases of a prolonged first stage: this definition is not the generally accepted one.

TABLE I. INDICATIONS FOR USE OF VACUUM EXTRACTOR

Indication	*Number of cases*
Prolonged labour	68
Prolonged labour + foetal distress	31
Foetal distress	34
Essential hypertension	11
Pre-eclamptic toxaemia	18
Eclampsia	3
Cardiac disease	5
Prolapse of the cord	4
Accidental haemorrhage	6
Placenta praevia	1
Hydrocephalic foetus	4
Maternal distress	5
Brow presentation	1
Other causes	8

Foetal distress alone was the indication in 34 of the cases.

Many obstetricians contend that foetal distress is a contraindication to the use of the ventouse; however, this objection is based mainly on the grounds of delay in delivery. While it may apply to the case of second stage dystocia where the obstetric forceps can possibly effect delivery more rapidly, the objection largely falls away in the first stage when there is no contraindication to a vaginal delivery. As far as the present series is concerned foetal distress has not proved to be a contraindication to the use of the instrument.

The 4 cases of hydrocephaly are of interest. All 4 patients (one a primigravida who had been in labour for 60 hours) were showing signs of maternal distress following a prolonged labour. The diagnosis having been made and the cervix being sufficiently dilated, cerebrospinal fluid was first withdrawn from the head; the vacuum extractor was then applied and the labour terminated without undue difficulty.

There were 5 cardiac patients in the series—2 primigravidae and 3 multigravidae—4 were classified as being stage 3-4 cardiac patients, while one was a stage 1, who had had a previous caesarean section. Labour was terminated as dilatation was tardy and the patients were showing obvious signs of distress.

One of these patients is worth describing more fully since she was the first one to be delivered by a vacuum extractor at this hospital, thus proving the usefulness of the instrument in certain selected cases. The patient, Mrs. J.G., a primigravida aged 24, was assessed as a grade 3 cardiac patient and had spent the 10 weeks before the onset of labour in the antenatal ward. She came into spontaneous labour 25 days after the expected date of delivery. Labour was unsatisfactory from the commencement, having a typically incoordinate action, in association with an occipito lateral lie. After 48 hours the cervix, though thinned, was still only $3\frac{1}{2}$-4 fingers dilated. The presenting part had reached the spines. The case was now causing some worry and after consultation it was decided to try the vacuum extractor. After 40 minutes of traction an infant weighing 7 lb. 5 oz. and with an Apgar of 8/10 was delivered. Subsequent progress of mother and infant was satisfactory.

Method of Delivery

Table II shows the method of delivery. The vacuum extractor alone was successful in 160 cases (this includes one set of twins). In 30 patients the delivery was completed by forceps after full dilatation of the cervix. In a number of these cases the forceps was only used when the vacuum extractor became detached at the introitus. This should not occur if the delivery is effected slowly and traction applied in the direction of the pelvic curve—thus gaining a forward tilt as the head approaches the perineum. In the remaining 10 cases the vacuum failed (in 2 a failed vacuum was followed by a failed forceps) and a lower segment caesarean section was performed.

TABLE II. TYPE OF OPERATION

Operation	*Number*
Vacuum extractor alone	158
Vacuum + forceps	30
Failed vacuum — caesarean section	8
Failed vacuum — failed forceps — caesarean section	2
Failed vacuum — failed forceps — vacuum	2
Total	200*

*Includes 1 case of twins.

The majority of the patients were delivered following pudendal block anaesthesia. In the multigravidae, however, a local infiltration of the perineum usually sufficed. One patient was delivered under caudal anaesthesia, while one—an almost unmanageable woman—required a general anaesthetic.

Relation of Presenting Part to Ischial Spines

The station of the presenting part in relationship to the ischial spines is shown in Table III. The cervical dilatation in the series varied between 3 fingers and a rim. In my opinion the operation should not be attempted in a primigravida unless the presenting part is at the level of or below the ischial spines, and the cervix is at least 8-8·5 cm. dilated.

TABLE III. STATION OF PRESENTING PART IN RELATION TO ISCHIAL SPINES

Level	*Number*	%
Below spines	34	17
At spines	83	41
Above spines	64	32
Well above spines	14	7
Not recorded	4	2

In former times an obstetrician may well have considered performing a high forceps operation in the type of case where the head was above the ischial spines and only a rim of cervix was present. Today an operation of this type definitely would not be contemplated; therefore, why should a vacuum extraction be attempted? One must not allow the twin factors of cervical dilatation and the station of the presenting part to obscure the possibility of pelvic disproportion, and therefore the inadvisability of attempting to drag the head through a pelvis which is too small. Failure to observe these rules not only increases the hazards for the foetus but it also brings the ventouse into disrepute. These criteria, however, need not necessarily apply in the case of the multigravida where the os

is more easily dilatable and the cause of the delay is due to factors other than that of disproportion.

Autorotation of the head occurred in 89 of the patients where the occiput was either lateral or posterior; in 34 the head was delivered as a persistent occipito posterior. Spontaneous rotation of the head usually takes place at the vaginal introitus—hence, the importance of taking care that the vacuum does not become detached at this stage in the delivery. Rotation is also favourably influenced by an early episiotomy.

Although the maternal mortality was nil, there were 15 maternal injuries, including 7 vaginal lacerations, 4 cervical tears and one rupture of the uterus. The latter occurred when, in addition to a failed vacuum extraction, attempted rotation and delivery with the obstetrics forceps also failed. Laparotomy performed for a caesarean section showed a tear extending into the right broad ligament. Although the vacuum extraction featured in this case, it appears more than likely that the uterine trauma was precipitated by the attempted forceps extraction.

Avoidance of Maternal Injuries

The maternal injuries described above indicate the importance of a careful vaginal and cervical examination following delivery and, if circumstances warrant it, an intra-uterine examination should also be carried out. However, these lacerations can be avoided if care is taken to exclude the cervix and vagina from the cup. It is advisable, after applying the cup, to create a small vacuum of 0·2 kg./cm., i.e. just sufficient to allow the cup to adhere to the scalp. The application should then be examined to ensure that no maternal tissue has been incorporated. The importance of intermittent traction which synchronizes with the uterine contraction has been emphasized.

Continuous traction should be avoided since it is dangerous to the foetus and is also an added factor in the production of the cervical lacerations seen above. The incidence of lacerations can also be minimized, and the foetal prognosis improved, if instead of attempting to extract the foetus from the pelvic canal one rather assists the uterine contractions by exerting a pull just sufficient to apply the foetal head adequately to the cervix.

FOETAL RESULTS

One hundred and thirty-five of the infants showed no apparent ill-effects. There were 11 cases of cephalhaematoma and minor trauma in the nature of small abrasions and areas of erythemia occurred in 25 cases. Jaundice of a mild nature developed in 29 of the infants and persisted for 3 - 5 days. Eight infants were classed as being 'cerebral' at birth. In 6 of these the condition was temporary and improvement was satisfactory, but in 1 case there was definite evidence of permanent damage, although the foetus survived. The mother of this infant was a primigravida aged 19. After 17 hours of labour a vacuum extraction was attempted by the house surgeon on duty, as an associated pre-eclamptic toxaemia was becoming more marked. The vacuum was attempted through an os of 3½ fingers with the occiput lateral; this failed and was followed by an attempted application of forceps which also failed. A re-applied vacuum eventually delivered an infant which took 25 minutes to resuscitate. Inability to formulate a correct judgement, owing to lack of experience, was the cause here and it is certainly not the type of case within the province of a house obstetrician. The 8th infant died after 12 hours and this is discussed under the foetal deaths.

The total foetal mortality was 17; in 11 of the cases the infant had died before delivery; of 2 others, one, a hydrocephalic infant, died after 48 hours, while in the other, the foetal heart suddenly ceased during labour for no obvious reason. The unsuccessful outcome in the remaining 4 patients (a corrected foetal mortality of 2%) was probably preventable. It must be ascribed to errors of judgement and the failure to observe the rules which have been mentioned previously.

DISCUSSION

This paper is presented in an attempt to clarify the position with regard to the use of the vacuum extractor in the first stage of labour. As stated earlier, recorded opinions have varied from absolute antagonism to marked enthusiasm. Eastman,[5] in a comment on a series of cases performed by Huntingford,[6] adopts the former view and states: 'True, the instrument is less traumatic than the cranioclast; but that is about the best you can say about it for use in the first stage.' One is familiar with the frequent association of incoordinate uterine action complicating an occipito or lateral position, resulting in prolongation of labour (almost 50% in this series) and it is here, provided that the criteria I have mentioned are fulfilled, that the instrument may have a definite place and the incidence of caesarean section be thus reduced. Again, there are other indications, especially in the multigravida, where it may prove of great value.

Lancer,[7] who is an enthusiast, has stated that 'the simplicity of the application allows its use by relatively young and inexperienced physicians, if the rules of its correct application are kept'.

In my opinion this is a misleading statement since the application can prove exceedingly difficult; and if inexperience is added to this the result may well prove disastrous. The one important factor is obstetric experience; and here I would go further and say that a second opinion at consultant level should always be obtained before the instrument is used in the first stage. This would tend to limit the abuse to which the vacuum extractor may be exposed. Furthermore, all attempted extractions in the first stage should be considered as being in the nature of trial vacuum extractions, and therefore all operating facilities should be available in the event of the attempt failing and a caesarean section becoming necessary. For this reason the instrument is not suitable for domiciliary practice.

The question of cerebral trauma has engaged the attention of many obstetricians and here again opinion has been equivocal, e.g. Snoeck[8] has calculated that the intracranial tension created by the vacuum extractor in the least favourable circumstances is one-twentieth of the intracranial tension created by the forceps in the most favourable circumstances. While this contention of Snoeck may be correct, there is no doubt that the vacuum extractor is not without risk to the foetal head. It is difficult to believe that traction on the scalp, with its consequent alteration in shape due to the resistance of the pelvic walls, does not increase the intracranial tension. This view would tend to be supported by the fact that prolonged or strong traction is definitely prejudicial to the infant; further, the instrument is contraindicated where the foetus is premature. It has been suggested that attempted extraction should be abandoned if the cervix fails to dilate fully within 15 minutes of commencing treatment. However, this arbitrary time limit should not necessarily be adhered to if the contractions are satisfactory and progress is being maintained.

From the maternal point of view a successful extraction is eminently satisfactory. The mortality is nil and trauma to the cervix and vagina should be minimal if care and patience is exercised in the performance of the operation. As Chalmers says, 'the psychological advantage of permitting the active cooperation of the mother in her own delivery and the physiological one of augmenting the maternal forces promoting dilatation of the cervix is of great importance'.[10]

Questions have been raised as to whether the use of the instrument can predispose to an incompetent os or to prolapse of the uterus, but it is still too early to be dogmatic on this score.

Conclusion

In answer to the question, 'has the vacuum extractor a place in the management of the first stage in modern obstetrics?' I would definitely say 'yes'; and provided that the instrument is not lightly nor frivilously used, it will be of undoubted value in certain complications affecting this stage of labour. It will continue to be used in the larger obstetric institutions; but I doubt very much if it will attain much popularity in private practice. Here I feel that the alternative, namely caesarean section, will always take precedence—whether this will always be in the interest of the patient is debatable.

SUMMARY

A brief historical account of the vacuum extractor is given.

A series of 199 cases in which the instrument was used in the first stage of labour at the Peninsula Maternity Hospital during a 3-year period ending 31 March 1965 is analysed, discussed and criticized.

The advantages and disadvantages of the use of the vacuum extractor are discussed.

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