

SOME EARLY EXPERIENCE IN THE USE OF VACUUM EXTRACTOR IN KANDANG KERBAU HOSPITAL, SINGAPORE

A REVIEW OF 193 CASES

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In 1961, following the publication of many enthusiastic reports in both the European and the English medical press on the wider range of applicability and the greater safety of the Vacuum Extractor, as compared with the conventional obstetric forceps, the University Department with the co-operation of the Government Unit of the hospital undertook a trial to assess the usefulness of this new instrument in this hospital and to determine the nature and extent if any, of maternal and neonatal complications following its use.

At the conclusion of the trial, Dr. Wong Hock Boon, paediatrician in charge reported at a hospital meeting the results of the trial. He described some very serious injuries sustained by the neonates, the like of which had never been reported before (H. B. Wong 1961). It is the purpose of this paper to review the cases involved and to discover the underlying obstetric factors responsible for the unusually high incidence of neonatal complications.

THE MATERIAL

Over a 10 week period commencing 15th May 1961, 193 cases were selected for delivery with the vacuum extractor. These included cases either in the first or second stage of labour in whom indications were present for immediate termination of labour and in whom no contra-indication existed for delivery via the vaginal route. Alternative methods of delivery such as forceps or Caesarean section were only considered after the vacuum extractor had failed.

THE OPERATOR

Because of the great simplicity in the use of the instrument and the wide margin of safety claimed in the medical press at that time, all ranks of doctors including house officers were permitted to use the instrument during the trial period.

TECHNIQUE

The technique employed by Chalmers and Fothergill (1960) was followed in this trial. Briefly, the largest cup compatible with the state of cervical dilatation was chosen, the negative pressure within the cup was gradually increased over a period of 10 to 15 minutes to a point not exceeding 0.8 kg/cm². Traction was applied intermittently, synchronous with uterine contractions. The negative pressure within the cup was reduced in between uterine contractions. No restriction on the total duration of traction was imposed.

POSITION AND ANESTHESIA

All patients were delivered in the lithotomy position. As a rule no anesthesia of any sort was employed except when an episiotomy had to be done, for which, ½% Lignocain was employed to infiltrate the perineum.

PAEDIATRIC CARE

All babies delivered with the vacuum extractor were examined by the paediatrician, usually within 24 hours of birth. He was also in charge of the follow-up of such babies at the post-natal clinic.

RESULTS

Parity

Of 193 cases in this series, 96 were primigravidae, 37 para 8 and over, the parity of the remaining 46 patients ranged from 2 to 7.

Indications

In general, the indications for the use of vacuum extractor were the same as those for forceps delivery. In addition, the instrument was also used in certain selected cases in the first

stage of labour. Gross prematurity and abnormal presentations such as face, brow, breech and shoulder were excluded in this trial.

Indications	No. of Cases
Delay or no progress in labour	96
Foetal distress - -	39
Maternal distress - -	24
Pre-eclamptic toxæmia -	23
Delay in delivery of second twin - -	13
Previous Caesarean section in second stage - -	10
Elderly primigravidae - -	4
Eclampsia - - -	3
Mitral stenosis in second stage	3
Pulmonary tuberculosis in second stage - -	3
Prolapsed cervix - -	2
Prolapsed cord - -	1
Pneumonia - - -	1
Accidental hæmorrhage -	1

(Multiple indications were present in many of above cases).

Vacuum Extractor in the First Stage of Labour

Thirty-nine cases, twenty per cent of the series were delivered with the vacuum extractor in late first stage of labour. The commonest indication in this group was foetal distress. This was the sole indication in 17 cases including one case of cord prolapse. The other indications included maternal distress in 11 cases, and delay or no progress in labour in the remaining 11 cases. There were 3 failures in this group. The following table shows the state of cervical os at the time of intervention.

State of os	No. of Cases
$\frac{1}{2}$ dilated	1
$\frac{2}{3}$ dilated	14
$\frac{3}{4}$ dilated	11
Only a thin rim remained	10
Almost fully, except palpable ant. lip of Cx.	1

Vacuum Extractor in the Second Stage of Labour

The commonest indication for intervention in the second stage of labour was delay or no progress in labour. In fact this was the sole indication in nearly 50% of cases in the entire series. In over one-third of patients in this group the presenting foetal head remained at or above the mid-cavity level with the occiput incompletely rotated.

Vacuum Extractor in Malrotation of the Head

There were 18 cases of persistent occipito-posterior. In 12 of these anterior rotation of the occiput was achieved with the aid of vacuum extractor. In the remaining 6 cases delivery was effected with the occiput in the direct posterior position.

Vacuum Extractor in Delay of Second Twin

The vacuum extractor was used 13 times to expedite delivery of second twins. Although in most cases the level of the presenting head was still high when the vacuum cup was applied, little difficulty was encountered in delivery.

Failed Vacuum Extraction

There were altogether 14 failures in the present series. Delivery was finally achieved with forceps in 11 cases and Caesarean section in 3 cases.

Failures were attributed to:-

1. repeated slipping of cup - 7 cases
2. no progress despite continuous traction - 3 cases
3. unco-operative patient - 2 cases
4. mechanical failure of the instrument - 1 case
5. unspecified - 1 case

An analysis of the obstetrical factors in these patients revealed the following pertinent points:-

1. Primiparity (11 out of 14 cases)
2. Persistent occiputo-posterior (7 out of 14)
3. Border-line pelvis (5 out of 14)

MATERNAL INJURIES

The chief advantage of the vacuum extractor over the obstetric forceps is that it does not encroach on any space between the foetal head and the birth passage so that injury to the maternal soft tissue is virtually impossible. However, minor degrees of cervical tears occurred in 3 cases when vacuum extractor was applied in late first stage of labour. In 2 other cases a rim of the anterior lip of the cervix was sucked into the cup during traction and was avulsed. In none was there any significant hæmorrhage and their puerperia were uneventful. At a subsequent post-natal examination 6 weeks later all cervixes had healed normally except in the latter 2 cases in whom the anterior lip of the cervix was somewhat shorter than the posterior one.

PERINATAL MORTALITY

There were 8 stillbirths and 3 neonatal deaths in the present series. The over all perinatal mortality is 5.7 per cent with a corrected perinatal mortality of 1.5 per cent (7 intrauterine deaths plus case 3, a neonatal death excluded) (Corresponding figures for forceps in this hospital is 3.2%).

Stillbirths:

Of the 8 stillbirths, 7 were intra-uterine deaths which occurred before the vacuum extraction. The remaining stillbirth occurred in a multipara aged 34, admitted in premature labour at 34th week, and complicated by severe pre-eclamptic toxæmia. A fresh stillborn infant weighing 4 pounds 3 ounces was delivered with vacuum extractor easily. Autopsy was not permitted.

Neonatal Deaths:

1. The first case occurred to a para 8 aged 36 with a normal previous obstetric history and a normal antenatal record in the present pregnancy. She was in inert labour for about 35 hours with very slow progress. The vacuum extractor was applied when the cervical os was 4 fingers' dilated. A feeble 7 pound-8 ounce infant was delivered with some difficulty. It died 2 days later. Autopsy revealed a fairly extensive cephalhaematoma at the site of application of vacuum cup. There was no intracranial haemorrhage. The lungs showed signs of aspiration pneumonia.
2. The second case occurred to a primigravida aged 24 who was admitted as an emergency from a private nursing home where she had been in labour for nearly 36 hours. On admission she was in a state of exhaustion and was already in second stage of labour. There was marked caput formation and the lowest bony present part was still at the level of ischial spines. The pelvis was considered to be 'border-line'. A 7 pound-10 ounce feeble and apnoeic infant was delivered with some difficulty using the vacuum extractor. It died 11 hours after delivery. Autopsy revealed massive intracranial haemorrhage due to a tentorial tear.
3. The third case occurred to an unbooked multipara aged 30. She made little progress in the second stage for over an hour when the vacuum extractor was applied.

The infant weighing 6 lb. 2 oz. was vigorous at birth but developed respiratory distress 3 hours after delivery. Several hours later a chest roentgenogram revealed massive diaphragmatic hernia in the left hemi-thorax. The child died before an emergency thoracotomy could be carried out. Autopsy was not permitted.

NEONATAL INJURIES

Most of the publications made little mention of non-lethal injuries inflicted with the vacuum extractor. The present series has perhaps the highest incidence of neonatal injuries and also some of the worst examples of neonatal head injuries attributable to the vacuum extractor. Out of a total of 196 cases in series only 160 case-records contained adequate neonatal notes. The following is a summary of neonatal injuries: (After H. B. Wong, 1961).

1. Cephalhaematoma—30% (one-third were severe with jaundice and anaemia)
2. Scalp abrasions—25% (half of these were severe with scalp necrosis)
3. Neurological sequelae—9.5% (including 2 with cerebral palsy)
4. Bony injury of skull—6.5% (all had neurological sequelae)
5. Jaundice and anaemia—4% (2 had severe cephalhaematoma)
6. Air crepitus of scalp—2% (including 1 with cerebral palsy)

The incidence of cephalhaematoma is high in the present series. With the exception of Chang (31%) and Meinrenken and Schieferstein (29.6%) most other centres reported less than 10 per cent incidence. What is more disturbing is the fact that in nearly one-third of the affected cases abnormal neurological signs were present.

Most cases with scalp abrasions healed without complication. In a few cases with severe abrasions a ring of scalp corresponding to the size of cup used necrosed and healed with a ring of alopecia which became more and more pronounced as the children grew older.

The most serious injury is the damage inflicted to the brain. Out of the 15 cases showing abnormal neurological signs 2 cases showed unequivocal evidence of cerebral palsy; the remaining 13 cases however, showed only transient neurological sequelae which disappeared after a few days and showed no resi-

dual effects when reviewed at subsequent follow-up. The following is an analysis of these 15 cases:

1. *Purity*
 - Primigravidae - - 14 cases
 - Multipara - - - 1 case
2. *Indications for obstetric intervention*
 - No progress in labour - 7 cases
 - Foetal distress - - 4 cases
 - Maternal distress - - 1 case
 - Pre-eclamptic toxæmia - 2 cases
 - Mitral heart disease - - 1 case
3. *Maternal pelvis*
 - Adequate - - - 8 cases
 - Border-line - - - 6 cases
 - Unspecified - - - 1 case
4. *Birth weight of infants*
 - 7½ pounds and over - 8 cases
 - 6½ pounds to 7½ pounds - 6 cases
 - 6 pounds to 6½ pounds - 1 case
5. *Position of the foetal head when cup applied*
 - Occiput anterior - - 8 cases
 - Occiput posterior - - 5 cases
 - Occiput transverse - 1 case
6. *Level of foetal head in the pelvis when cup applied*
 - High cavity - - - 1 case
 - Mid-cavity - - - 12 cases
 - Low-cavity - - - 1 case
 - Unspecified - - - 1 case
7. *Failed vacuum extraction* - 5 cases
8. *Duration of traction and neonatal injury*
(Tow & Cheng 1965)

70 consecutive cases in the present series were studied.

Duration of traction in minutes	No. of cases	Injuries	Rate
5 & under	28	Nil	Nil
6 to 10	20	1 cephalhaematoma 1 transient stiff limbs	10%
11 to 15	12	1 cephalhaematoma 1 scalp abrasion 1 jaundice	25%
16 to 20	6	1 cephalhaematoma 1 scalp abrasion	33%
20 to 25	3	1 cephalhaematoma 1 scalp abrasion 1 skull erosion	100%

COMMENTS

The outcome of the present trial has demonstrated 3 major advantages of vacuum extractor not possessed by obstetric forceps, namely:

1. no great skill or experience is required to operate the instrument.
2. severe maternal trauma is virtually impossible.
3. vaginal delivery can be effected with vacuum extractor even before full cervical dilatation or complete rotation of the occiput to the anterior.

These advantages notwithstanding, the vacuum extractor has also proved to be a dangerous instrument when its safety limits were not appreciated and unsafe conditions for its use were not recognised. Two factors govern the amount of force directed at the foetal head viz. (a) the amount of negative suction force on the foetal scalp, (b) the duration of traction applied on the foetal head. Most centres employed a pressure of not exceeding 0.8 kg/cm². In the vast majority of cases however, a suction force of between 0.5 to 0.7 kg/cm² appeared to be quite sufficient. At a given pressure the frequency and severity of neonatal head injury is directly proportional to the duration of traction. The results of present trial show that the safety limit is under 10 minutes. Traction in excess of 20 minutes is associated with one hundred per cent morbidity rate.

Failure to recognise unfavourable conditions for vaginal delivery was largely to be blamed for the more severe injuries sustained by the neonates. Further analysis of the 15 more severely damaged neonates confirmed this. For example:

1. Occult cephalo-pelvic disproportion was not recognised in many of these cases. Fourteen out of 15 cases were primigravidae, of whom nearly half were judged to have border-line pelvis. In over two-thirds, the infants were above average in size (over 7½ pounds.) That the degree of disproportion was more than minor finds further support in the fact that nearly half the cases made no progress in labour despite adequate uterine contractions and that one-third of the cases failed to advance even with persistent traction with the vacuum extractor.
2. High level of head in the pelvis was found in 12 out of 15 cases in this group. In this situation frequently the foetal occiput

had not yet completely rotated to the anterior position thus making accurate application of the vacuum cup to the vertex difficult. Consequently, this resulted in the application of the cup to one side of the midline or over the anterior fontanelle. This could have a deleterious effect on the intracranial contents. Moreover, with the head high in the pelvis the axis of pull of the cup may be wrongly directed against the pubic symphysis. This may produce a shearing effect on the scalp and epicranium, thus causing extensive cephalhaematoma. Finally, the high position of foetal head frequently necessitated stronger and longer traction to be made against the foetal head thus causing further damage.

3. Malrotation of head in borderline pelvis occurred in 6 out of 15 cases in this group. It is more than likely that in these cases traction had been prolonged and moreover, because of the deflexed attitude in such cases the vacuum cup could have easily been applied over the anterior fontanelle.

SUMMARY AND CONCLUSIONS

1. One hundred and ninety three cases delivered with the vacuum extractor have been reviewed.
2. Maternal injuries due to the use of vacuum extractor have been negligible.
3. There was an unprecedented high incidence of neonatal head injuries, 15 of the cases were associated with varying degrees of neurological sequelae.
4. The possible causes for this high and severe neonatal morbidity were discussed.

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