Opinion Article

VACUUM AS INSTRUMENT OF CHOICE

Abstract

Although there is a declined use of instruments during vaginal delivery in modern obstetrics, vacuum device has recently gained popularity over the forceps. The need for instrumental delivery is especially important in low socio economic countries, where the necessary expertise is not always available for caesarean section. Vacuum device should only be used when indicated, commonly for prolonged 2nd stage, non reassuring fetal heart. In addition, operator experience is of utmost importance.

The vacuum is a safe and effective device for instrumental vaginal delivery, associated with less maternal injury, lesser analgesia and need of less expertise. This article reviews in detail the indications, contraindications, patient selection and procedure for vacuum-assisted vaginal delivery. It is always important that a clinician is well versed with maternal and fetal risks associated with the device and the alternate options available.

Key words

Vacuum, Forceps, Instrumental delivery, Fetal injury

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INTRODUCTION

Instrumental vaginal delivery refers to application of either forceps or vacuum device to assist the mother in process of vaginal birth. The incidence of instrumental vaginal delivery in the United States is 4.5% and that in United Kingdom is between 10%-15% (1). The incidence varies from country to country and even from hospital to hospital. Controversy concerns as to when operative delivery is to be conducted and which instrument to use. Although there is a decreasing trend throughout the globe of instrumental deliveries, Vacuum device has recently gained popularity, reason being ease of application, need of less expertise, lesser analgesia and low maternal morbidity. The key to avoid complications is proper assessment and application of instrument.

INDICATIONS FOR VACUUM DELIVERY

American college of obstetrician and

gynaecologists (ACOG) recommended guidelines for the operative delivery in the year 2000, as listed below (2) in Table 1.

Table 1:ACOG Guidelines

Prolonged 2nd stage of labor: In nulliparous women, defined as lack of progress for 3 hours with regional anaesthesia and 2 hours without regional anaesthesia. In multiparous women defined as lack of progress for 2 hours with regional anaesthesia and 1 hour without regional anaesthesia.
Non-reassuring fetal heart: Suspicion of potential or immediate fetal compromise (non-reassuring fetal heart pattern, abruption) when an expeditious delivery can be accomplished.
Elective shortening of 2nd stage of labor: If pushing is contraindicated, like in cardiovascular or neurological disease.
Maternal exhaustion: Largely subjective and not well defined.

Duration of 2nd stage has been revised, for nulliparous women, a protracted second stage can be defined as no progress (descent, rotation) after about four hours with epidural anaesthesia and about three hours without epidural anaesthesia (3). For multiparous women, a protracted second stage can be defined as no progress (descent, rotation) after about two hours with epidural anaesthesia and about one hour without epidural anaesthesia.

For patients with prolonged 2nd stage, reassuring fetal heart and no other reason for expediting delivery, evaluation of the risks of operative delivery versus expectant management should be undertaken. If favourable changes occur in presence of reassuring fetal heart then expectant management can be continued but if there is no progress and patient is not able to continue then operative delivery may be an option (4). Thus prolonged 2nd stage should not be regarded as absolute indication for vacuum delivery. Suspected fetal compromise is probably the most common indication. When prompt delivery is to be undertaken, the station and position of the fetal head, the fetopelvic relationship, operator skill, and clinical judgment dictate the mode of delivery. Vacuum delivery can be performed to shorten 2nd stage of labour in maternal medical problems, where Valsalva maneuver is precluded like New York heart association III/IV cardiac disease, glaucoma and intracranial vascular malformation. Maternal exhaustion is an indication for operative delivery, but is highly subjective.

CONTRAINDICATIONS

Vacuum delivery is contraindicated in varied clinical situations. Neither the vacuum nor the forceps should be applied when the fetal or maternal risk is perceived to be high. Vacuum delivery should not be attempted in uncertain fetal position, fetal malpresentation, (brow, face, breech, transverse presentation) and suspicion of cephalopelvic disproportion (5). Fetal bone demineralizing disease or blood clotting disorder are an absolute contraindication. The use of vacuum delivery is contraindicated at <34+oweeks of gestation as there is a risk of intracranial haemorrhage, subgleal haemorrhage. Most guidelines state that safety between 34 and 36 weeks is still insufficient. And fetal scalp sampling and fetal scalp electrode application are relative contraindications for vacuum delivery (6). The various contraindications are summarized in Table 2.

Table 2:Contradictions

A. <u>Absolute contraindications</u> • Fetal bleeding disorder (haemophilia, alloimmune thrombocytopenia) • Fetal demineralizing bone disorder (osteogenesis imperfect)
B. <u>General contraindications</u> • Incompletely dilated cervix • Intact fetal membranes • Non-engaged head • Cephalopelvic disproportion (excessive moulding, caput) • Fetal malpresentation • Gestational age less than 34 weeks or fetal weight less than 2500grams • Failure to obtain consent
C. <u>Relative contraindications</u> • Suspected fetal macrosomia (defined as weight of > 4500grams) • Uncertainty about fetal position • Inadequate anaesthesia • Prior scalp sampling or multiple attempts at fetal scalp electrode placement

TYPES OF VACUUM CUPS

The original metal cup developed by Malstorm was a mushroom shaped device. It varied from 40-60 mm in diameter, attached to metal chain for traction. Suction device was attached to vacuum cup via a peripherally located vacuum port. The metal cup has high success rate but is associated with more scalp injuries, therefore are rarely used now. Generally, cup with larger diameter should be applied.

Modern day vacuum pumps can be soft or rigid and can be of different shapes and sizes. Examples of different types include soft or rigid (anterior and posterior) cups. Posterior cups (Kiwi omnicup, Mityvac M –cup, Bird cup) have been designed for occipitoposterior positions. Soft cups are bell or funnel shaped device, can be used with manual or electric suction device. They are associated with less scalp injuries but higher failure rates. Modern devices allow for a user to hand pump suction with a single handheld device.

Figure 1, soft cup

PREREQUISITES FOR VACUUM DELIVERY

Inform consent is needed for any surgical procedure including instrumental deliveries. Discussing possible obstetric interventions during routine antenatal care is the need to be addressed. In general, discussing possible risks and benefits, alternative mode of delivery and brief explanation of the procedure is important. The prerequisites for operative delivery whether by vacuum or forceps is the same, as given in table 3. The classification of operative deliveries in given in table 4.

Table3: Prerequisites for vacuum delivery

A. <u>Full abdominal and vaginal examination</u>

- Head is ≤1/5th palpable per abdomen
- Vertex presentation.
- Cervix is fully dilated and the membranes ruptured.
- Exact position of the head can be determined so proper placement of the instrument can be achieved. Assessment of caput and moulding.
- Pelvis is deemed adequate. Irreducible moulding may indicate cephalo–pelvic disproportion.

B. Preparation of mother

- Clear explanation should be given and informed consent obtained.
- Appropriate analgesia is in place for mid-cavity rotational deliveries. This will usually be a regional block. A pudendal block may be appropriate, particularly in the context of urgent delivery.
- Maternal bladder has been emptied recently. In-dwelling catheter should be removed or balloon deflated. Aseptic technique.

C. Preparation of staff

- Operator must have the knowledge, experience and skill necessary.
- Adequate facilities are available (appropriate equipment, bed, lighting).
- Back-up plan in place in case of failure to deliver. When conducting mid-cavity deliveries, theatre staff should be immediately available to allow a caesarean section to be performed without delay (less than 30 minutes).
- A senior obstetrician competent in performing mid-cavity deliveries should be present if a junior trainee is performing the delivery.
- Anticipation of complications that may arise (e.g. shoulder dystocia, postpartum haemorrhage)
- Personnel present that are trained in neonatal resuscitation

Adapted from the Society of Obstetricians and Gynaecologists of Canada 2004 and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists 2009 (8,9)

Table 3: Classification of Operative Vaginal Deliveries

Type	Criteria
Outlet	(1) Scalp is visible at the introitus without separating the labia
	(2) Fetal skull has reached the level of the pelvic floor
	(3) Sagittal suture is in the direct anteroposterior diameter or in the right or left occiput anterior or posterior position
	(4) Fetal head is at or on the perineum
	(5) Rotation is $\leq 45^0$
Low	Leading point of the fetal skull (station) is station +2/+5 or more but has not as yet reached the pelvic floor
	(a) Rotation is ≤ 45°
	(b) Rotation is > 45°
Mid	The head is engaged in the pelvis but the presenting part is above +2 stations
High	(Not included in this classification)

Adapted from The American College of Obstetricians and Gynaecologists. (7)

PROCEDURE

After informed consent, patient is placed in dorsal lithotomy position, bladder is emptied. Position, and station are confirmed before application of vacuum device. Analgesia can be obtained by perineal infiltration or pudendal

block with 1% lignocaine. Vacuum cup and suction apparatus should be assembled and checked before.

The point located in the midline along the sagittal suture, approximately 3cm anterior to posterior fontanelle and 6cm posterior to anterior fontanelle is called Flexion or pivot point. This point is important in maintaining flexion and promoting traction. Cup should be applied on flexion point such that edge of the cup is 3cm from anterior fontanelle and posteriorly over the edge of posterior fontanelle, with sagittal suture central to the vacuum cup. Generally, the cup is placed more posteriorly toward the occiput. Further the cup is placed from flexion point, greater the chances of failure.

Before suction, a finger is swept around the cup to ensure that no maternal tissue is interposed between cup and scalp. Initially vacuum of 100-150mg is applied to fix the cup. This is followed by full traction force of 450mmhg to 600mmhg in less than 2 minutes. Gentle traction is given intermittently at right angles to the plane of the cup and coordinated with uterine contractions. The traction should be in line with pelvic axis and can be relieved or maintained between contractions with no difference in maternal or fetal outcome (10). The fetal head may rotate during decent noted by rotation of handle, under no circumstances should operator try to manually rotate the vacuum, as it may lead to classic cookie cutter injury in the scalp. Should the cup dislodge, fetal scalp is to be checked before reapplication. Use of vacuum should be halted after three pop offs/detachments, or more than 20 minutes have elapsed with no progress or delivery. Once head is delivered, suction is released and cup is removed and delivery proceeds as usual.

Figure 2 Application of cup

MATERNAL AND FETAL COMPLICATIONS

A. Fetal complications

The complications associated with vacuum extraction include those related to scalp e.g caput saccucedeum, cephal haematoma, sub galeal haemorrhage, intracranial hemorrhage, scalp laceration and bruise. The total incidence of such complications is 5%. Cephal haematoma, bleeding in fetal scalp, located in subperiosteal space, is clinically unimportant. Subgleal hemorrhage, bleeding in subaponeurotic space from rupture of emissary veins is a dangerous complication. (11 ,12) The life-threatening complication is intracranial haemorrhage which may be subarachnoid, subdural, intaventricular, intraparenchmyal.

In addition, facial nerve injuries, retinal haemorrhages, hyperbilirubinemia can be a consequence of vacuum extraction. Most of these complications including retinal hemorrhage are of benign nature. Pediatrician should be notified in advance when an operative delivery has been attempted as serious consequences can present several hours after birth.

B. Maternal complications

Maternal morbidity increases after instrumental delivery. The most common complications include perineal pain, laceration, hematoma, urinary retention and

few long-term problems. Most significant tears are associated with episiotomy. The more frequent and severe laceration are associated with forceps than with vacuum extraction. Women who sustain laceration in previous delivery are at greater risk of repeat laceration in present delivery. Delivery technique, fetal bulk, prior scars are an important factor in perineal laceration. The risk of trauma is greater for deliveries involving rotation greater than 45 degrees and for occipitoposterior position (13).

Urinary incontinence, anal dysfunction and pelvic organ prolapse may occur as a late consequence of instrumental delivery. Febrile morbidity after instrumental delivery is a less common occurrence than after caesarean section but long-term incidence of urinary incontinence is more common after instrumental delivery.

EPISIOTOMY

Episiotomy should not be routinely made during vacuum extraction. In fact routine use of episiotomy with vacuum extraction is associated with increased rather than decreased risk of perineal and rectal injuries.

VACUUM VERSUS FORCEPS

Vacuum exposes baby to less traction force in comparison to forceps delivery. Vacuum is easy to apply once the baby head is visible. The soft pliable cups can easily be inserted and folded inside birth canal. Less anaesthesia is required. Vacuum extraction can be applied after local anaesthesia that numbs the lower vagina. It is associated with less maternal injury than forceps as the vacuum does not increase the diameter of the presenting part compared with forceps.

Vacuum operations are more likely to fail than forceps procedures. The higher failure rate reflects a number of factors, poor instrument application, improper methods of applying traction, fetal malpositioning, poor selection of patient and operator inexperience as well as the inherent inability of the vacuum to exert sufficient force to fetal head as compared to forceps (14).

SEQUENTIAL USE OF INSTRUMENT

Most studies do not support the sequential use of instrument because of concerns about maternal and neonatal injury. ACOG advises against the sequential use of instruments. The incidence of haemorrhage is higher among those delivered by both vacuum and forceps. (15,16)

CONCLUSION

The vacuum is a safe and effective device for instrumental vaginal delivery, associated with less maternal injury. The clinician must know indications and contraindications for the procedure and apply instrument with proper technique to maximize the chance of success, while limiting the chances of maternal and fetal injury. There is a need to reinvent the training of vacuum application. Informed consent with routine notification of pediatrician is important. In all cases, the risks and benefits must be balanced against alternate options including oxytocin augmentation and caesarean section.

Compliance with ethical standards

Conflict of interest

The author have declared that no competing interests exist.

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