# Operative Vaginal Delivery

Lindsey E. Zamora

**Introduction:**

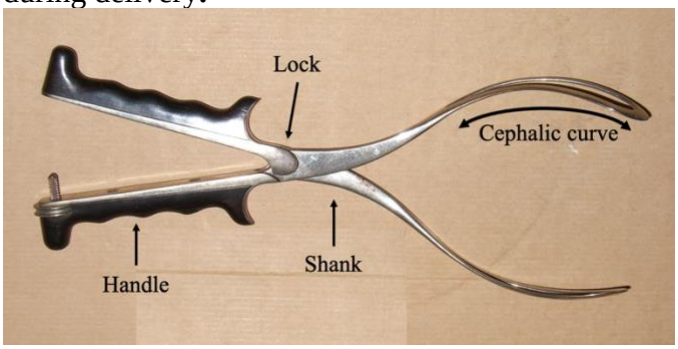
Operative vaginal delivery is when an obstetrician or other trained birth attendant uses a device to assist in the delivery in the second stage of labor. This can be done for either maternal or fetal indications using either forceps or a vacuum extractor. The use of either of these tools requires that the obstetric care provider be familiar with both proper use and the risks involved. To minimize harm, operative vaginal delivery should be performed only by an experienced operator.

Operative vaginal delivery may be recommended for the following indications:

- Prolonged second stage of labor
- Arrest of descent
- Suspicion of fetal compromise
- Maternal exhaustion and inability to push
- Maternal medical indications and need to avoid Valsalva (e.g. maternal cardiac disease)

Operative vaginal delivery, when successful, can help avoid the need for Cesarean birth and its resulting risks and complications. Also, it can often achieve a faster delivery than a Cesarean.

Standard forceps used for either an outlet or low forceps delivery (see Box 1) have the parts shown below: the handles, lock, shanks, cephalic curve which cups the fetal head, and the pelvic curve which navigates the curve of the maternal pelvis during delivery**.**




*Standard Forceps. Not shown, the pelvic curve is the angle between the handle and the cephalic curve, angulating toward or away from the viewer in this photo. Source: B. Seguy - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=12972140*

Operative vaginal deliveries are classified by the station of the fetal head at application and the degree of rotation necessary for delivery. In general, the lower the fetal head and the less rotation required, the less risk to the mom and the fetus. For the purposes of this document we will discuss outlet and low operative vaginal deliveries (see Box 1). We will not discuss rotational forceps, mid forceps or high forceps (operative deliveries involving a baby at a higher station in the pelvis,) all of which require additional skills and expertise and could potentially put both the mom and the fetus at higher risk.

Outlet Forceps

Fetal scalp is visible at the introitus without separating the labia

Fetal skull has reached the pelvic floor

Rotation does not exceed 45 degrees

Low forceps

Fetal skull is at station 2+ or more and not yet reached the pelvic floor

Rotation does not exceed 45 degrees

Forceps used for rotation of the fetal head are called Kielland forceps. These are different from the forceps described previously because they don't have a pelvic curve. They should not be used for delivery, just for rotation, thus will not be discussed here.

When compared to vacuum delivery, forceps are more likely to lead to a successful vaginal delivery (failure rate 9%), and less likely to cause a fetal cephalohematoma. Use of forceps is however associated with a higher rate of anal sphincter injury and associated fecal incontinence, and higher rate of 3rd and 4th degree perineal lacerations (20%). Forceps are also more technically challenging to use than a vacuum. Complications to the fetus of forceps-assisted birth include skin markings and lacerations, external ocular trauma, intracranial hemorrhage, subgaleal hemorrhage, retinal hemorrhage, facial nerve injury, skull fracture, and rarely, death.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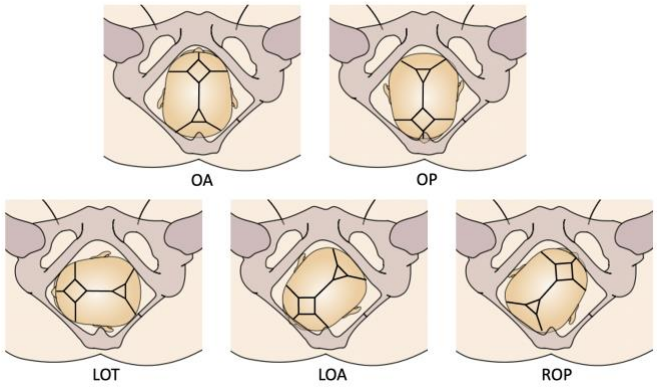
*Commercially available vacuum device which allows the operator to measure the vacuum pressure as it is being applied and to pull on the same handle.*

Vacuum delivery carries a decreased risk of 3rd and 4th degree lacerations compared to forceps (10%) and is easier to learn to use. The disadvantages and risks are that there is a greater risk of fetal cephalohematoma and higher failure rate in achieving a vaginal delivery (14%). Complications to the fetus of a vacuum assisted birth are intracranial hemorrhage (epidural, subdural, intraparenchymal, subarachnoid), intraventricular hemorrhage, and subgaleal hemorrhage.

**Steps:**

In both types of operative vaginal delivery, attend to the following steps before beginning:

- Determine the indication for operative vaginal delivery and obtain informed consent
- Assess for absolute contraindications: Operative vaginal birth is contraindicated if the fetal head is not engaged in the maternal pelvis or if the position of the vertex cannot be determined, if the fetal size is suspected to be too large for the maternal pelvis, or if the fetus is suspected to have a bleeding disorder or osteogenesis imperfecta
- Assess position: In order to determine the degree of rotation and thus ensure a patient can safely be offered an operative delivery, it is essential to identify the fetal position, or what direction the fetal head is oriented. The anterior fontanelle is larger and forms a cross – the posterior fontanelle is smaller and forms a Y. Another way to help assess position is to feel for which direction the fetal ear bends.




*Position of fetal head: In these diagrams, maternal sacrum is on the bottom and pubic symphysis is at the top. Fetal occiput is used as the reference point. The anterior fontanelle is larger and forms a cross; the posterior fontanelle is smaller and forms a "Y." OA – Occiput anterior, OP – Occiput posterior, LOT - Left Occiput Transverse, LOA - Left Occiput Anterior, ROP - Right Occiput Posterior*
*Source: By Mikael Häggström - Own work, Public Domain, https://commons.wikimedia.org/w/index.php?curid=8982011*

- Assess the final prerequisites checklist:
  - Cervix is fully dilated and membranes are ruptured
  - Fetal head is engaged
  - Position of fetal head is known
  - Estimated fetal weight has been performed and assessment that the pelvis is adequate for vaginal birth (if the fetus is estimated to be too large for the maternal pelvis, this can lead to a shoulder dystocia)
  - Maternal bladder has been emptied with an in-and-out catheterization.
  - Willingness to abandon the attempt, with back-up plan in place (i.e. Cesarean) in case of failure to deliver
  - Adequate anesthesia*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** Though regional anesthesia is ideal, we recognize this is often unobtainable in resource-limited settings; in this case, a pudendal block would be a good alternative option if available*

Choose your instrument: forceps vs. vacuum. This may simply depend on availability or on the comfort level and expertise of the practitioner. There are some special circumstances that would favor one method over the other:

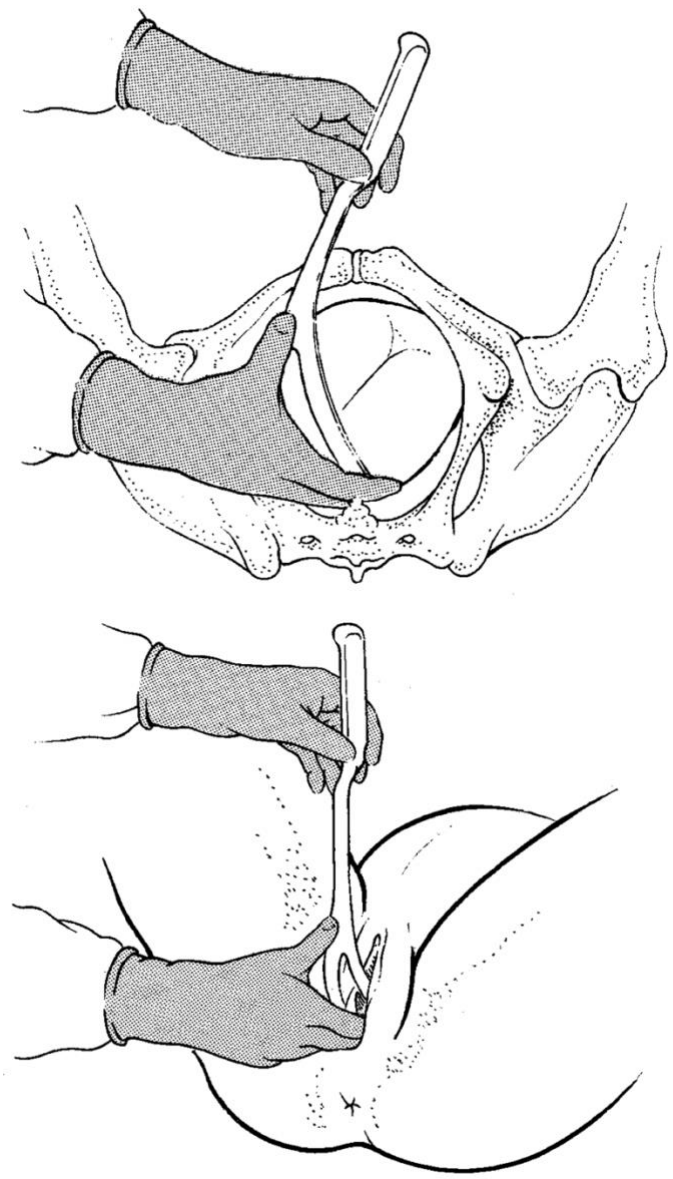
- In cases where the fetus is less than 34 weeks gestational age, vacuum delivery is contraindicated and forceps is the preferred option.
- In cases where the position of the baby is occiput transverse, standard forceps delivery would be contraindicated, and vacuum would be the preferred choice.

Ensure the mother is in dorsal lithotomy position in a bed where the bottom can come off or lower at the foot, allowing you easy access to the perineum while she still has footrests, such as stirrups.

Forceps Delivery:

Apply the forceps in the following manner:

1. Articulate the forceps together outside of the patient to make sure the set fits together correctly
2. Perform a "ghost application" outside of the patient to envision the way the forceps need to be applied depending on the position of the fetal head
3. Separate the forceps blade that will ultimately fall on the patient's left side (shown below). Dangle this forcep vertically in your left hand with the fingerguard facing the mother. This should be done with a very light touch. Using your right hand, place your hand in the vagina alongside the fetal parietal bone and guide the forcep to cup the fetal head.



*Place your right hand in the vagina alongside the fetal parietal bone and guide the forcep to cup the fetal head. Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology https://apps.who.int/iris/handle/10665/40002*

4. Using your left hand, gently bring the handle of the forceps in a large arc from 12:00 to 9:00 on a clock face while guiding the forcep around the fetal head with your right thumb.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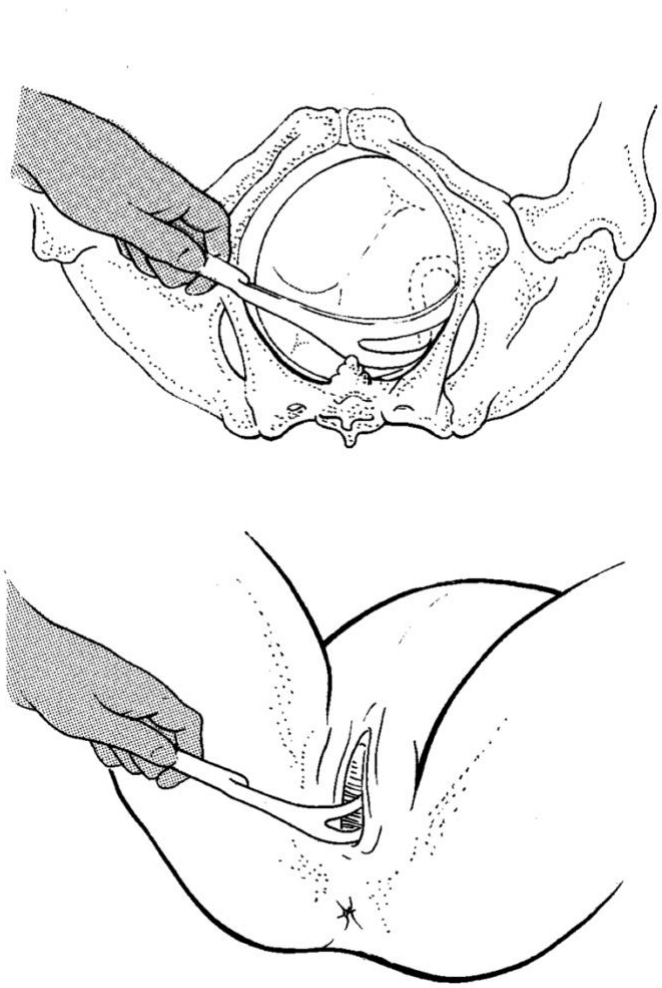
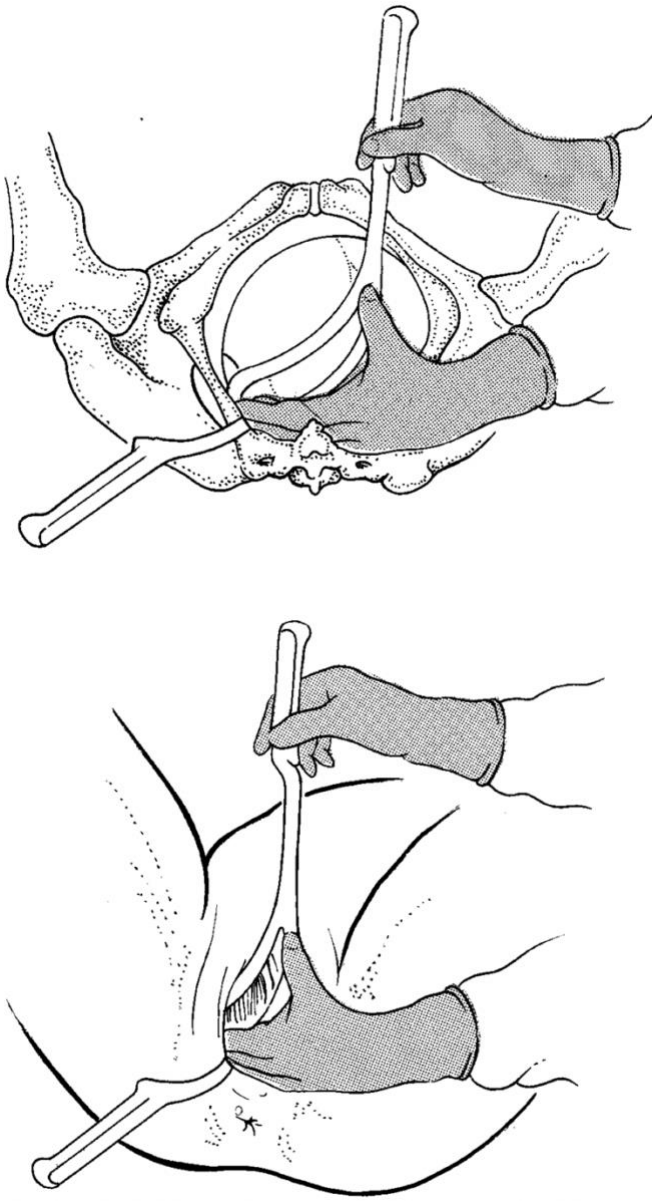


*With your left hand, gently bring the handle of the forceps downwards in a large arc from 12:00 to 9:00 positions while guiding the forcep around the fetal head with your right thumb (not shown.) Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology https://apps.who.int/iris/handle/10665/40002*

**CAUTION: Only light pressure should be necessary to insert forceps properly; use of any more pressure than this likely indicates incorrect placement and could cause fetal and maternal injury.**

5. Place the right forcep using your right hand to hold the handle while placing the forcep from 12:00 to 3:00 in a large arc on a clock face. The left hand should be used to place the forcep to cup the fetal head and thumb to guide the forcep into the vagina.



*Placement of the right forceps is the mirror image of the above: guide the forcep to cup the fetal head with your left hand, then bring the handle downward in a gentle arc proceeding from the 12:00 to 3:00 positions. As before, only light pressure is needed for this maneuver.Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology https://apps.who.int/iris/handle/10665/40002*

6. Once both forceps are placed, perform the following check to ensure they are placed correctly: fetal sagittal suture should lie midline between the forceps so that the forceps are lying on the parietal bones of the fetal head equally.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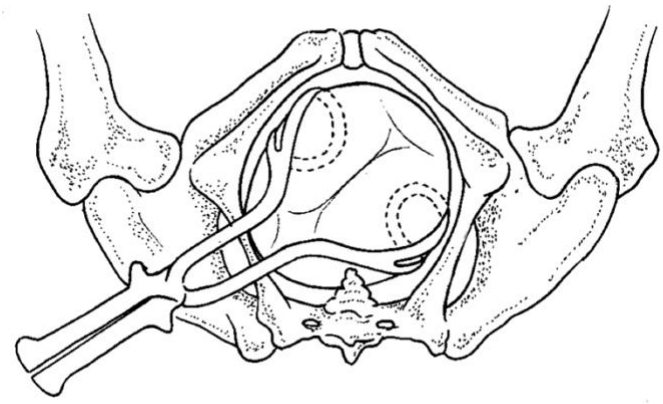
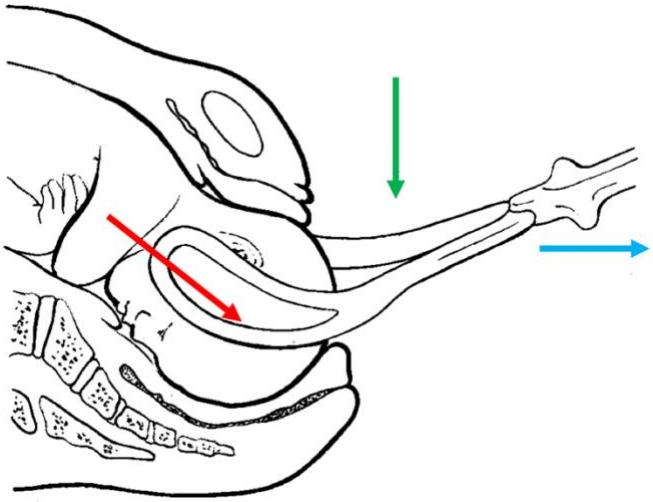


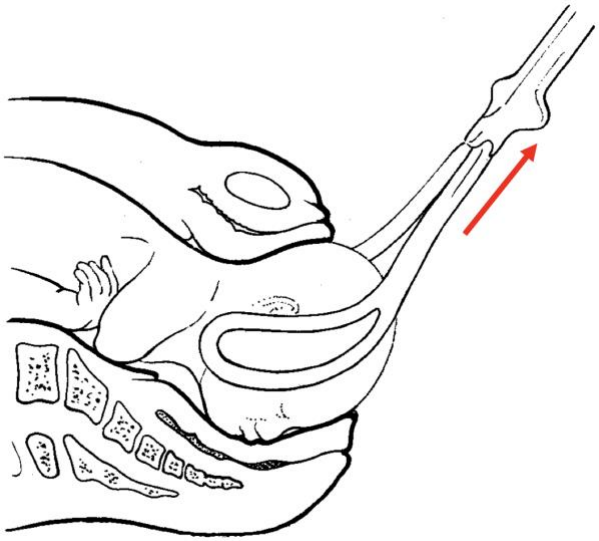
*As shown here, the fetal sagittal suture lies in the midline between the forceps. The cephalic curve of each side of the forceps engages the parietal bones equally. Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology* https://apps.who.int/iris/handle/10665/40002

7. Ensure the blades lock together correctly but do not squeeze them yet to apply force.
8. When prepared to deliver, instruct the mother to push while you use the forceps.
9. If right handed, use your right hand to grip both forceps handles with your palm facing upward and pull horizontally. Use your left hand to apply force downward on the shank of the forceps. The overall direction of the force should be slightly downward and out. The red arrow below shows what should be the overall direction of force and the caption describes the correct hand position for a right handed person. Hands should be reversed if the individual performing the delivery is left handed.



*At the Blue arrow, the operator's dominant hand grasps the handle with palm upwards. At the Green arrow, the operator's other hand exerts downward force. The resulting direction of fetal movement is shown by the Red arrow. Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology* https://apps.who.int/iris/handle/10665/40002

10. Once the head is crowning, stop pulling horizontally and start pulling upwards at an angle 45 degrees from the floor. Either the delivering practitioner or an assistant should guard the perineum to protect from tearing during delivery of the fetal head.



*Once the head is crowning, the direction of traction changes to upwards at 45 degrees. Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology* https://apps.who.int/iris/handle/10665/40002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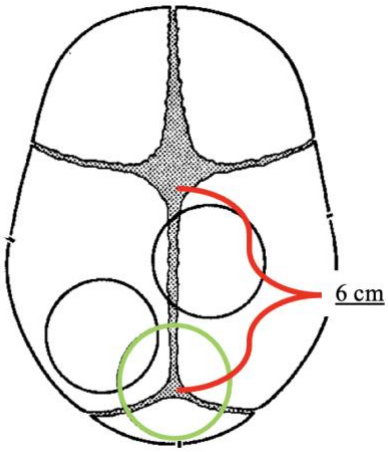
11. Once the fetal head is delivered, remove the forceps in the order and direction they were applied and complete the delivery in a standard fashion.

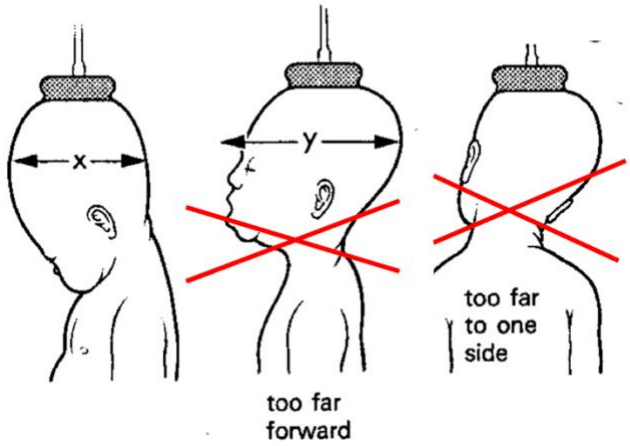
Vacuum Delivery:

Apply the vacuum in the following manner:

1. Determine the flexion point of the fetal head. To be most successful with a vacuum delivery and minimize any risk of trauma to the fetus or mother, placement of the vacuum on the flexion point is essential. To do this, feel for the fetal sutures and determine where the anterior and posterior fontanelles are located. The flexion point is directly over the sagittal suture and 6 cm behind the anterior fontanelle. In practical terms, the vacuum should be placed as far posterior as possible on the fetal head and not over the anterior fontanelle. This maintains the fetal head in flexed position and minimizes risk to the baby.

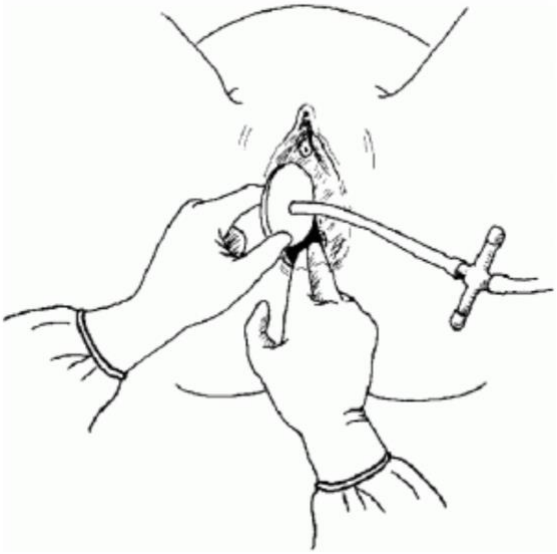



*Proper application of the vacuum cup relative to the sagittal suture and fontanelles. Practically, this should be in the midline, as far posteriorly as possible. Ideally it is in the area shown by the Green circle, or at least in the approximately 6cm space between the anterior and posterior fontanelles, not over the anterior fontanelle or to either side. Source: Primary Surgery Volume 1, https://global-help.org/products/primary-surgery/*




*Effect of proper vacuum cup placement on flexion of the head: when placed posteriorly, in the midline, the head flexes forward when traction is applied, facilitating passage through the birth canal. When traction is applied too far forward or to one side, the neck flexes in a way that is counterproductive. Source: Primary Surgery Volume 1, https://global-help.org/products/primary-surgery/*

2. Place the vacuum cup. When placing the cup, the practitioner should be careful to avoid trapping maternal tissue between the cup and the fetal head.



*Placement of the vacuum cup. Avoid entrapping maternal tissue here. Source: https://hetv.org/resources/reproductive-health/impac/Procedures/Vacuum_extraction_P27_P31.html*

3. After placement of the vacuum cup, suction should be applied. Cups that have the pump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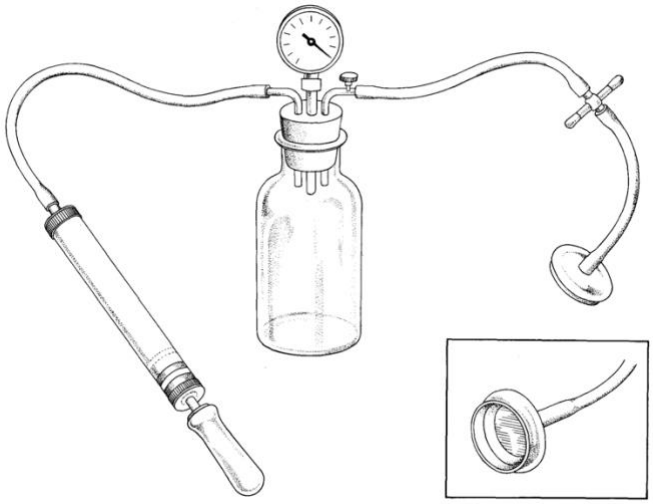
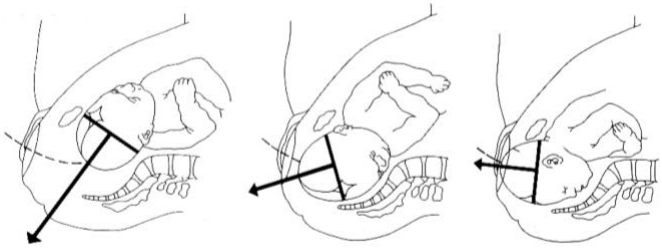
integrated into the handle of the device like the Kiwi® pictured in the introduction can be operated with one person. If the pump is not integrated into the handle, an assistant will need to be utilized to generate the suction. Suction should be generated rapidly within 1-2 minutes in order to reduce the total duration of the procedure. Vacuum suction pressures of 500 to 600 mmHg are recommended during traction, although pressures in excess of 450 mmHg are rarely necessary. Lower pressures can increase the risk of "pop-offs" but pressures beyond 600mm Hg increase the risk of fetal injury. The theory that the vacuum is "designed to pop-off before damage occurs" is false and should not be used to justify use of higher pressures. The maximum negative pressure should not exceed 600 mmHg.


*Commercially available suction devices such as the Kiwi ® can be operated by one person.*



*A suction device such as this one can be made using a pump, tubing, an airtight bottle, a pressure gauge, and a vacuum cup. This device needs two people to operate, one to maintain suction with the pump and the other to deliver using the vacuum cup. Source: World Health Organization Surgery at the District Hospital Obstetrics, Gynecology, Orthopedics and Traumatology https://apps.who.int/iris/handle/10665/40002*

4. Traction should be applied only during maternal pushing and in the direction of the pelvic axis, i.e. horizontally and slightly downward toward the maternal rectum similar to the direction of force recommended for a forceps delivery above. If the vacuum used has a central stem, the stem should be kept perpendicular to the plane of the vacuum cup to prevent pop offs.



*Traction, during maternal pushing, is horizontally and downwards. Once the head is crowning, traction, is upwards at 45 degrees, as described above with forceps delivery. Source: Sunday E. Adaji and Charles A. Ameh, "Operative Vaginal Deliveries in Contemporary Obstetric Practice" https://www.intechopen.com/chapters/33797*

5. Once vacuum is applied, the cup should not be twisted. This can lead to fetal scalp injury.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6. Traction can be maintained slightly between contractions or relieved. Neither tactic has been shown to change delivery outcomes or risks to the mother and fetus.
7. Once the head is crowning, stop pulling horizontally and start pulling upwards at an angle 45 degrees from the floor. Either the delivering practitioner or an assistant should guard the perineum to protect from tearing during delivery of the fetal head.
8. Once delivery of the fetal head has been achieved, release pressure from the vacuum and remove it. Complete the delivery in a standard fashion.
9. Vacuum delivery attempt should be abandoned if 3 pop offs occur, more than 20 minutes has elapsed regardless of number of popoffs, or there is any evidence of fetal scalp trauma. These are general guidelines. If steady progress is being made and delivery is imminent after 20 minutes, it may be prudent to continue with vacuum delivery. Similarly, if less than 20 minutes has passed and no progress has been made, the attempt should be abandoned and preparations made for a Cesarean birth.

Cautions:

If forceps delivery attempt is unsuccessful after application and attempt at traction, vacuum delivery should not be attempted. Similarly if vacuum delivery is unsuccessful after application and attempt at traction, forceps should not be attempted. Attempt at another method is not recommended due to increased risk to the fetus. If an attempt at placing either forceps or vacuum is unsuccessful and no traction has occurred, it is reasonable to attempt the other technique.

After delivery with either forceps or vacuum, both mother and baby should be examined for injuries:

- Mother: Examine cervix and vagina
- Baby: Examine for scalp lacerations and bruising as well as symptoms of internal bleeding

Ensure that complete records of delivery are kept including length of operative delivery, type of instrument used, pressure applied in the case of vacuum and number of pop-offs.

**Pitfalls:**

- Failure of operative vaginal delivery necessitates prompt Cesarean birth. Failure of either method, as mentioned above, necessitates Cesarean, not attempt at the other method.
- In the case of any operative vaginal delivery, there should be someone in attendance who is trained in neonatal resuscitation.
- Vacuum traction and torsion can cause life-threatening complications. For this reason, it is important to familiarize yourself with the device prior to use, and not utilize more pressure than recommended.
- If forceps are not able to be placed properly and articulated properly at the lock, no attempt should be made to delivery. Incorrect placement of forceps increases risk of injury to the fetus.
- It is no longer recommended to perform a prophylactic episiotomy in the case of operative vaginal delivery. If episiotomy is performed, it is reasonable to give prophylactic antibiotics.
- If 3$^{rd}$ or 4$^{th}$ degree laceration occurs, it is reasonable to give prophylactic antibiotics.
- In the case of an occiput transverse (OT) position, head can be manually rotated and forceps attempted if successful, or vacuum can be applied. If a vacuum delivery is attempted, ensure vacuum is placed on the flexion point of the fetal head; head will often autorotate to occiput anterior during delivery.

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