Operative vaginal delivery

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INTRODUCTION

Operative vaginal delivery refers to a delivery in which the operator uses forceps, a vacuum, or other devices to extract the fetus from the vagina, with or without the assistance of maternal pushing. The decision to use an instrument to deliver the fetus balances the maternal, fetal, and neonatal impact of the procedure against the alternative options of cesarean birth or expectant management.

This topic will provide an overview of issues related to operative vaginal delivery. The technique for vacuum-assisted operative delivery is reviewed separately. (See "Procedure for vacuum-assisted vaginal delivery".)

PREVALENCE

In the United States, 3.1 percent of all deliveries in 2017 were accomplished via an operative vaginal approach [1]. Forceps deliveries accounted for 0.5 percent of vaginal births, and vacuum deliveries accounted for 2.6 percent of vaginal births. However, there is a wide range in the prevalence of operative vaginal delivery both across and within geographic regions in the United States, which suggests that evidence-based guidelines for operative vaginal delivery are either inadequate or randomly applied, or familiarity and expertise with the technique is declining in some areas [2]. In the United States, the Midwest has the highest rates for both forceps and vacuum-assisted deliveries, the Northeast has the lowest forceps rate, and the South has the lowest vacuum rate [2]. Overall, the rates of operative delivery have been decreasing both nationally and regionally in the United States [3].

Prevalence rates also vary worldwide depending on local practice patterns and availability of trained clinicians and other necessary resources [4]. Instrumental deliveries were not taught or performed in some regions [5]. In a large prospective study of low- and middle-income countries, the operative delivery rate declined from 1.6 to 0.3 percent, while the cesarean rate more than doubled to reach 14.4 percent [6].

INDICATIONS

Overview — Use of either forceps or vacuum is reasonable when an operative intervention to complete labor is indicated and operative vaginal delivery can be safely and readily accomplished; otherwise, cesarean delivery is the better option.

We agree with an American College of Obstetricians and Gynecologists (ACOG) practice bulletin that considers the following scenarios potentially appropriate reasons for operative vaginal delivery [7]:

- Maternal exhaustion and an inability to push effectively.
- Maternal medical indications, such as maternal cardiac disease and a need to avoid pushing in the second stage of labor.

- Prolonged second stage of labor.
- Suspicion of immediate or potential fetal compromise.

However, no indication is absolute, and cesarean delivery is also an option in these clinical settings.

Although one can never be certain of a successful outcome, we attempt an operative vaginal delivery when we believe success is likely since the rate of birth trauma may be higher after failed attempts at operative delivery [8,9]. The decision to proceed with operative vaginal delivery is an ongoing process with constant reconsideration based on assessment of the success of sequential steps in the procedure. Preprocedure risk factors do not accurately predict whether an operative vaginal delivery attempt will succeed or fail [10].

Prolonged second stage of labor — To reduce the rate of cesarean delivery for failure to progress in the second stage, ACOG and the Society for Maternal-Fetal Medicine recommend allowing three hours of pushing for nulliparous women and two hours of pushing for multiparous women before diagnosing arrest of labor, when maternal and fetal conditions permit [11]. They also opined that longer durations may be appropriate on an individual basis (eg, epidural anesthesia, fetal malposition) as long as progress is being documented but did not provide specific criteria for the upper limit of the second stage. Many obstetric providers allow an extra hour of pushing for women with epidural anesthesia when the fetal heart rate pattern is reassuring of fetal well-being. These criteria are also useful for deciding when to perform an operative vaginal delivery.

For patients whose second stage is prolonged by these criteria and who have a normal fetal heart tracing and no other indication for expediting delivery, we evaluate the relative value of an operative delivery versus expectant management. We favor expectant management when we believe a spontaneous delivery is likely because fetal descent is progressing, albeit slowly, or because there has been a recent favorable change in the clinical situation, such as rotation from occiput posterior to occiput anterior, oxytocin augmentation, or more effective pushing. We favor operative vaginal delivery when further progress seems unlikely, and we believe operative vaginal delivery is the least morbid operative strategy, given the fetal station, position, and estimated size. Many of these cases appear to be related to ineffective pushing due to maternal exhaustion or, less commonly, to a maternal neurologic or muscular disease. Women with a prolonged second stage who are not good candidates for operative vaginal delivery are delivered by cesarean. (See 'Prerequisites' below.)

Fetal compromise — Use of forceps or vacuum is appropriate when expeditious delivery is indicated because of fetal compromise or probably imminent fetal compromise (eg, acute abruption) and operative vaginal delivery can be safely and readily accomplished; otherwise, cesarean delivery is the better option. (See "Intrapartum category I, II, and III fetal heart rate tracings: Management".)

Maternal medical disorder — Forceps or vacuum can be used to shorten the second stage of labor if the Valsalva maneuver is contraindicated or exertion should be minimized because of maternal medical disorders (typically cardiac or neurologic disease, also cystic lung disease). As discussed above, maternal neurologic or muscular disease can impair effective pushing and can be a reason to shorten the second stage. Operative intervention is performed when uterine contractions descend the fetus to a station where the clinician believes forceps or vacuum extraction can be performed safely and effectively.

CONTRAINDICATIONS

Instrumental delivery is contraindicated if the clinician or patient believes that the risk to mother or fetus is unacceptable. Examples include, but are not limited to [7,12]:

- Extreme fetal prematurity. (See 'Minimum and maximum estimated fetal weight' below.)
- Fetal demineralizing disease (eg, osteogenesis imperfecta). The safety of forceps or vacuum delivery has not been established in disorders that result in demineralization of the skull. There is a theoretic risk for intracranial

bleeding, extracranial bleeding, and other brain injuries due to cranial deformation or fracture from these instruments.

- Fetal bleeding diathesis (eg, fetal hemophilia, neonatal alloimmune thrombocytopenia [13]).
- Unengaged head. (The head is engaged when the widest diameter [the biparietal diameter] has reached or passed through the pelvic inlet. This typically occurs when the leading bony part has reached or passed through the ischial spines).
- Unknown fetal position.
- Brow or face presentation.
- Suspected fetal-pelvic disproportion. (See "Normal and abnormal labor progression", section on 'Cephalopelvic disproportion'.)

Relative contraindications to vacuum extraction — Relative contraindications to use of vacuum devices, but not forceps, include gestational age <34 weeks or prior scalp sampling (which is rarely performed in contemporary United States practice). (See "Procedure for vacuum-assisted vaginal delivery", section on 'Contraindications'.)

CLASSIFICATION

The American College of Obstetricians and Gynecologists' classification system for forceps deliveries is based on station and extent of rotation, as these factors correlate with the level of difficulty and procedure-related risk (eg, lower fetal station and smaller degree of head rotation are associated with less risk of maternal and fetal injury [14]) [7]. Fetal station is measured using the -5 to +5 centimeter classification system (figure 1).

- **Outlet forceps**
  - The leading point of the fetal skull has reached the pelvic floor, and at or on the perineum, the scalp is visible at the introitus without separating the labia.
  - The sagittal suture is in anteroposterior diameter or a right or left occiput anterior or posterior position.
  - Rotation does not exceed 45 degrees.
- **Low forceps**
  - The leading point of the fetal skull is ≥2 cm beyond the ischial spines but not on the pelvic floor (ie, station is at least +2/5 cm).
  - Low forceps have two categories that are based on whether rotation of the head is more or less than 45 degrees from the median sagittal plane:
    - Without rotation – Rotation is 45 degrees or less (right or left occiput anterior to occiput anterior, or right or left occiput posterior to occiput posterior).
    - With rotation – Rotation is greater than 45 degrees.
- **Midforceps**
  - The head is engaged (ie, at least 0 station), but the leading point of the skull is not ≥2 cm beyond the ischial spines (ie, station is 0 to +1/5 cm).

Vacuum deliveries do not have a separate classification system. The clinician should document the station at which the vacuum was applied. Rotational maneuvers should not be performed with vacuum because of the risk of severe scalp lacerations and concern for causing subgaleal hemorrhage. (See "Procedure for vacuum-assisted vaginal delivery".)

PREREQUISITES

Overview — The operator should be experienced in operative vaginal delivery and responsible for determining that the following prerequisites are met prior to application of instruments:

- Cervix is fully dilated.
- Membranes are ruptured.
- Head is engaged (at least 0/5 cm station). Forceps should never be used when the head is not engaged.
- Fetal presentation, position, station, and any asynclitism are known, and extent of molding is estimated. The fetus must be in a cephalic presentation (unless the purpose is to use Piper forceps to assist in delivery of an after-coming head in a breech presentation).

  Large infants, extreme molding, extension of the fetal head, pelvic deformities, and asynclitism may falsely suggest engagement. In these cases, the leading bony part is at the ischial spines, although the biparietal diameter has not passed through the pelvic inlet. No more than one-fifth of the fetal head should be palpable abdominally above the symphysis pubis if the vertex is engaged [15].
- Fetal size is neither too large nor too small. (See 'Minimum and maximum estimated fetal weight' below.)
- Clinical pelvimetry suggests an adequate pelvis relative to estimated fetal size. A flat sacrum, a narrow subpubic angle, or a narrow distance between the ischial spines may prevent the fetal head from descending to fill the sacral hollow. Significant molding and caput may suggest some degree of pelvic obstruction.
- The patient consents to the procedure. The medical record should document the indication for the procedure, relevant clinical assessment of mother and fetus, and a summary of the informed consent discussion (specific risks, benefits, alternatives) [16].
- The option of performing an immediate cesarean delivery is available if complications arise. Personnel for neonatal resuscitation are available, if needed.
- The patient has adequate anesthesia for the planned procedure.
- The maternal bladder is empty, as this may provide more room for fetal descent and possibly reduce injury to the bladder.

Minimum and maximum estimated fetal weight — The minimum and maximum estimated fetal weights for operative vaginal delivery depend on the choice of instrument (vacuum versus forceps), size of available instruments, and patient-specific factors (eg, progress of labor, previous pregnancy history).

- **Upper threshold** – We believe that estimated fetal weight is one of several factors to assess when considering operative delivery of a suspected macrosomic infant. Multiple maternal factors (eg, diabetes, body mass index [BMI], prior infant size in successful vaginal deliveries, clinical pelvimetry, progress in the second stage) and fetal factors (eg, head position and station, caput and molding, estimated abdominal circumference compared with head circumference) can influence the decision to attempt an operative delivery.

  In general, patients with severe obesity (defined as a BMI >40 kg/m^2), diabetes, slow progress in the second stage of labor with significant caput/molding, or an infant estimated to be over 4000 grams are not ideal candidates for operative vaginal delivery, but these cases must be individualized. An example of a case with estimated fetal weight 4000 grams where we would consider operative vaginal delivery might be a patient with fetal compromise at +3 station who has a normal BMI, no gestational or other diabetes mellitus, and a history of a prior spontaneous vaginal delivery of an infant of similar size. (See "Shoulder dystocia: Risk factors and planning delivery of high-risk pregnancies".)

Instrumental delivery of the macrosomic infant may be associated with an increased risk of injury. As an example, in a study including almost 3000 newborns ≥4000 grams, the risk of persistent significant injury at six months of age was 1.5 percent (4/261) after forceps delivery, 0.24 percent (4/1666) after spontaneous delivery, and 0 (0/862) after cesarean delivery or vacuum delivery (0/135) [17]. The authors estimated that a policy of planned cesarean birth for macrosomia would necessitate 148 to 258 cesarean deliveries to prevent a single persistent injury; avoidance of operative vaginal delivery would require 50 to 99 cesarean births per injury prevented. However, these estimates are imprecise because of the small number of observed injuries and the poor performance of intrapartum identification of macrosomic fetuses. (See "Fetal macrosomia".)

The American College of Obstetricians and Gynecologists practice bulletin on operative delivery suggests that judicious use of forceps or vacuum extraction is not contraindicated for most fetuses suspected to be macrosomic, if the maternal pelvis and progress of labor are adequate [7]. However, the obstetrician should be aware of the risk of shoulder dystocia, especially when the second stage of labor is prolonged.

- **Lower threshold** – Use of vacuum devices is limited to deliveries ≥34 weeks of gestation because the risk of intraventricular hemorrhage appears to be increased above baseline when these devices are employed at earlier gestational ages.

  "Baby" Elliot and "baby" Simpson forceps have smaller dimensions than standard forceps and have been used to deliver fetuses as small as 1000 grams [18]. We were unable to identify any studies or manufacturer guidelines regarding prerequisites for estimated fetal weight or gestational age for use of these instruments. When clinically indicated, we would generally consider using forceps for fetuses estimated to weigh at least 2000 grams. We apply standard forceps if the head size is near or at the size of a term infant, and baby forceps for smaller heads. (See "Delivery of the low birth weight singleton fetus", section on 'Spontaneous vaginal versus assisted vaginal' and "Delivery of the low birth weight singleton fetus", section on 'Use of episiotomy, vacuum, and forceps'.)

PATIENT PREPARATION

Anesthesia — Before beginning an operative vaginal delivery, maternal anesthesia should be satisfactory. Neuraxial anesthesia provides more effective analgesia than pudendal block and is the only effective regional option for forceps delivery [19]. Pudendal block may be adequate for vacuum extraction because, unlike forceps blades, the vacuum cup does not significantly displace the walls of the birth canal or increase the cephalic diameter.

Ancillary procedures

Ultrasound — We often use ultrasound to determine fetal position and station before operative vaginal delivery to confirm our diagnosis from physical examination and to assess its chances of success as well as its risks. We always perform an ultrasound examination when we are uncertain of the head position.

Intrapartum sonographic visualization of fetal intracranial structures, including the cerebellum, orbits, and midline falx, can be used to determine fetal head position and station and may reduce morbidity of improperly placed instruments at the time of an operative vaginal delivery [20,21]. Multiple studies comparing ultrasound with digital vaginal examination of head position have shown digital examination is incorrect in approximately 20 to 40 percent of cases, regardless of the experience of the person performing the examination, whereas ultrasound is incorrect in only 1 to 2 percent of cases [20-22]. Ultrasound measurements of fetal station using perineum to skull distance or angle of progression appear to be reproducible, can diagnose lack of engagement, and are predictive of difficult operative vaginal deliveries [23]. In a prospective study, angle of progression and head circumference measurements done just prior to operative delivery were 87 percent predictive of more complicated deliveries (ie, ≥3 pulls and/or significant maternal or neonatal morbidity) [24].

Use of ultrasound to determine fetal position during late labor when cervical dilation is ≥8 cm may have unanticipated consequences. In a randomized trial comparing digital examination versus both ultrasound and digital examination at ≥8 cm dilation, occiput posterior and occiput transverse positions were under-detected on digital examination alone and knowing correct fetal position actually increased the likelihood of cesarean delivery [25].

Antibiotics — Prophylactic antibiotics are not routinely administered before operative vaginal delivery because unnecessarily exposing mothers and fetuses to antibiotics has potential adverse effects (eg, emergence of antimicrobial resistance, selection of pathogenic organisms such as *Clostridioides* [formerly *Clostridium*] *difficile*, and drug toxicity). However, a trial of 3427 women randomized to a single dose of intravenous co-amoxiclav versus placebo as soon as possible after any operative vaginal delivery reported that the intervention resulted in a 42 percent reduction in suspected or confirmed infection in the six-week postpartum period (11 versus 19 percent, relative risk [RR] 0.58, 95% CI 0.49-0.69) [26]. The primary outcome was defined by a new prescription of antibiotics for presumed perineal wound-related infection, endometritis or uterine infection, urinary tract infection with systemic features or other systemic infection, or confirmed systemic infection on culture.

Importantly, the secondary outcomes of superficial and deep incisional infections were both reduced in the antibiotic group (4 versus 8 percent [RR 0.53, 95% CI 0.37-0.75] and 2 versus 5 percent [RR 0.46, 95% CI 0.28-0.77]). This appeared to translate into less perineal discomfort and less need for additional at-home or in-office perineal evaluation and care.

Some factors that limit the generalizability of this trial to United States and other populations include higher rate of operative vaginal delivery in the United Kingdom than the United States (13 versus 3 percent [1]), higher episiotomy rate (89 versus 8 percent [27]), higher proportion of forceps use (2/3 versus 1/5 operative vaginal deliveries performed [1]), and the different approach to group B streptococcus (GBS) chemoprophylaxis (risk-based rather than culture-based). Other limitations of the trial are the higher observed than expected rate of infection in the placebo group (19 versus 10 percent) and a change in an outcome metric during the trial from "any antibiotics" to "antibiotics only for the indication of perineal infection." The finding that antibiotics administered at a median time of 3.2 hours after birth were effective is also surprising since tissue concentrations would not be optimal at the time of the procedure and repair.

Therefore, we believe additional trials are needed to confirm a benefit in other populations before recommending prophylactic antibiotics for all women who undergo an operative vaginal delivery. A 2020 systematic review [28] found only one additional trial [29], which was small (394 participants) and only evaluated the incidence of postpartum endometritis. Until such data are available, when an operative vaginal delivery is performed with an episiotomy, we believe it is reasonable to administer a single dose of intravenous co-amoxiclav immediately after the delivery, given that most of the patients in this trial had an episiotomy.

We routinely administer prophylactic antibiotics before repairing a third- or fourth-degree laceration. The American College of Obstetricians and Gynecologists recommends a single dose of prophylactic antibiotics at the time of repair of obstetric anal sphincter injuries, regardless of mode of delivery [30].

Episiotomy — We do not routinely perform an episiotomy. The only randomized trial comparing routine versus restrictive episiotomy at operative vaginal delivery found no significant differences between groups in the rate of anal sphincter tear, postpartum hemorrhage, neonatal trauma, or pelvic floor symptoms until 10 days postpartum; however, this was a pilot study with only 200 participants (the type of episiotomy was not described, but mediolateral episiotomy is preferred in Europe, where the trial was performed) [31].

Observational studies suggest that a median (or midline) episiotomy increases, rather than decreases, the risk of perineal trauma in operative vaginal deliveries [32-37]. Some population-based observational studies suggest that a mediolateral episiotomy performed in certain situations may reduce anal sphincter lacerations, specifically with forceps deliveries in women who have no history of prior vaginal deliveries or when there is persistent occiput posterior presentation [37,38]. As these observational data may have inherent biases, episiotomy should be performed selectively and with shared patient decision making. If performed, a mediolateral or lateral episiotomy appears preferable as it reduces the number of apparent anal sphincter injuries [38,39], although initial postpartum discomfort is greater than with a median/midline incision and early complaints of flatal incontinence are common (9 percent) [40-44]. (See "Approach to episiotomy", section on 'Mediolateral versus median (midline) episiotomy'.)

CHOICE OF INSTRUMENT

Both forceps and vacuum are acceptable instruments for operative vaginal delivery. Our approach depends on patient-specific factors, as described below.

When to choose vacuum versus forceps — We choose vacuum extraction when a relatively easy extraction is anticipated (eg, occipito-anterior position with no signs of relative cephalopelvic disproportion). Because success is likely, the primary consideration in these cases is to minimize the risk of maternal and fetal injury. If a difficult extraction is anticipated, we choose forceps despite a slightly higher risk of maternal injury because vacuum extraction is likely to fail [45].

The choice of instrument is determined by the clinician's expertise with the various forceps and vacuum devices, availability of the instrument, level of maternal anesthesia, and knowledge of the risks and benefits associated with each instrument in various clinical settings. Vacuum delivery is generally less traumatic for the mother than forceps delivery. Vacuum devices are easier to apply and require less maternal anesthesia than forceps. Fetal head rotation may occur passively during fetal extraction. The advantages of forceps are that they have a significantly higher success rate, are unlikely to detach from the head during a difficult extraction, can be used on premature fetuses or to actively rotate the fetal head, and do not aggravate bleeding from scalp lacerations. It is not clear which procedure is safer for the fetus; the complication profiles for the two procedures are different. (See 'Complications' below.)

Choice of vacuum cup — All vacuum extraction devices consist of a soft or rigid plastic cup, a vacuum pump to provide suction between the cup and fetal scalp, and a traction system. A soft vacuum cup is appropriate for most deliveries. Rigid cups may be preferable for occiput posterior, occiput transverse, and difficult occiput anterior deliveries because they are less likely to detach. A more detailed discussion regarding the choice of an extractor cup can be found separately. (See "Procedure for vacuum-assisted vaginal delivery", section on 'Extractor cup'.)

Choice of forceps — The type of forceps selected for a particular procedure depends on several factors, including:

- The size and shape of the fetal head and maternal pelvis, which should match the size, cephalic curve, and pelvic curve of the forceps. A good head application is a key goal in choice of forceps.
  - Simpson type forceps, which have long tapered blades, tend to be the best fit for a molded head (picture 1) because of the less concave cephalic curve.
  - Elliott type forceps (picture 2) or Tucker-McLane type forceps (picture 3) are better suited to a round, unmolded head as the cephalic curve of the forceps is more concave.

  Fenestrated blades (picture 4) allow for a better grip and therefore are less likely to slip, but the fenestrations increase the risk for tissue laceration when greater forces are applied. Solid blades (picture 3) are less likely to lacerate the fetal head but may be more likely to slip with increased traction. Pseudo fenestrated blades have a shallow indentation rather than a true fenestrated, which may reduce slippage while also reducing risks of laceration.

- Fetal head position and whether rotation is planned. Choosing the right forceps for the direction of traction and type of rotation is another key goal.

    - Kielland forceps are useful for rotations because of their minimal pelvic curve and sliding lock (picture 4). A sliding lock is helpful when there is asynclitism.
    - Piper forceps are used to deliver the aftercoming head in vaginal breech deliveries (picture 5).
- Station.
    - Midpelvic deliveries are facilitated by an instrument that can be used with a traction handle (eg, Bill's axis traction handle or Irving forceps). Traction is applied in the axis of the pelvis, which is curved in most women. If the fetal head is at a station that requires an axis of traction that is not feasible with a standard manual method of axis traction (the Pajot-Saxtorph maneuver), then an instrument with axis traction is helpful.
- Operator experience and preference.

Application of forceps is more difficult, requires more manipulation for a good application, and is more likely to result in maternal or fetal trauma with higher stations, head asynclitism, non-anterior positions, rotations beyond 45 degrees, and unusual pelvic types; therefore, choice of the correct instrument is particularly important in these settings. A detailed discussion of the hundreds of types of instruments available for forceps delivery and their application is beyond the scope of this review. The classic resource is Dennen's Forceps Deliveries, but books on operative obstetrics are also helpful.

Novel devices

Thierry or Teissier spatula — The Thierry and Teissier spatulas consist of two independent and symmetric branches which include a shank, handle, and wide solid blade [46]. The shanks do not articulate; thus, each branch acts as an independent lever and the head is not compressed between the blades. Outcome data are limited and primarily published in French, but neonatal complication rates appear to be similar to, or slightly lower than, rates with other instruments [47,48]. In one large study, the rate of severe perineal injuries was equivalent to that reported with other extraction instruments, but vaginal tears were more common [47].

Odon device — The Odon device was developed by the World Health Organization for use in areas that have limited or no access to cesarean birth. It is undergoing the first phase of testing for safety and feasibility in Argentina and rural South Africa [49]. It is a low-cost device made of film-like polyethylene material that creates a sac filled with air that surrounds the entire head and enables extraction when traction is applied. There are no randomized trials evaluating its safety and efficacy. It has the potential to be safer and easier to apply than forceps or a vacuum extractor. Videos showing application of the device and fetal extraction are available online.

PROCEDURE

Use of a checklist for preparation, performance, and documentation of operative vaginal delivery can help to ensure that the important elements of the procedure have been addressed and documented (table 1) [50].

Forceps

- **Application** – Appropriately applied forceps grasp the occiput anterior (OA) fetal head such that:
    - The long axis of the blades corresponds to the occipitomental diameter (figure 2).
    - The tips of the blades lie over the cheeks (figure 3).
    - The blades are equidistant from the sagittal suture, which should bisect a horizontal plane through the shanks.
    - The posterior fontanelle should be one finger breadth anterior to this plane.

  - Fenestrated blades should admit no more than one finger breadth between the heel of the fenestration and the fetal head.

  - No maternal tissue has been grasped.

- **Midforceps** – Midforceps deliveries are generally avoided because they are associated with a higher rate of severe perinatal morbidity/mortality compared with cesarean deliveries performed in the second stage, especially when the indication for delivery is dystocia. They are also associated with higher rates maternal trauma. (See 'Complications of midpelvic deliveries' below.)

  However, clinicians highly experienced with forceps deliveries may choose to attempt a midforceps delivery in select circumstances, such as sudden severe fetal or maternal compromise, if the clinician believes that he/she can safely expedite and effect a safe operative vaginal delivery. Simultaneous preparation for cesarean delivery should be underway. We suggest performing midforceps deliveries in the operating room so that cesarean delivery can be performed promptly, if necessary.

  When attempting a midforceps delivery, the leading point of the skull should be at or just beyond the ischial spines (0 to +1/5 station) to ensure the head is engaged. It would be rare to have an engaged head when the leading point is at -1/5 cm station and extraordinarily unlikely at -4 or -5 station.

- **Rotation** – A rotational delivery is an appropriate option in select clinical circumstances [7], as neonatal morbidity is not increased compared with appropriate controls when intervention is indicated and when performed by experienced clinicians [51-54]. Rotation, when needed, is performed between contractions. Rotation followed by extraction is more difficult and associated with a higher risk of maternal and fetal complications than simple traction applied to the non- or minimally-rotated head. Forceps application and rotation when the fetal head is not directly OA is beyond the scope of this topic review.

- **Traction** – Traction should be steady (not rocking) and in the line of the birth canal, rotating under the symphysis pubis, along the curve of Carus (ie, pelvic axis). It should be exerted with each contraction and in conjunction with maternal expulsive efforts. In most cases, progress is noted with the first or second pull, and delivery occurs by the third or fourth pull [55]. The procedure should be abandoned if descent does not occur with appropriate application and traction.

  The forceps pressure on the fetal head can be relaxed between contractions to reduce fetal cranial compression.

- **Removal** – To reduce the risk of laceration, forceps are disarticulated and removed when expulsion is certain, but before the widest diameter of the fetal head passes through the introitus. The head can then be delivered with no or minimal maternal assistance.

Vacuum — The procedure for vacuum extraction is reviewed separately. (See "Procedure for vacuum-assisted vaginal delivery".)

When to abandon the procedure — Operative vaginal delivery should be abandoned if it is difficult to apply the instrument, descent does not easily proceed with traction, or the fetus has not been delivered within a reasonable time [15]. Some experts suggest abandoning the procedure if delivery has not occurred within 15 to 20 minutes or after three pulls. A cohort study found that 82 percent of completed operative deliveries (vacuum or forceps) occurred with one to three pulls and that pulling more than three times was associated with infant trauma in 45 percent of such deliveries [56]. A secondary analysis of a multicenter observational cohort study found that increasing duration of operative vaginal delivery time was more strongly associated with adverse neonatal outcomes than the number of forceps pulls or vacuum cup pop-offs, but the optimum threshold for abandoning the procedure was not identified [57]. Durations greater than 12 minutes had the strongest association with both adverse neonatal outcomes and failed operative deliveries. Based on these and other data, we believe it is prudent to abandon the procedure if good instrument placement and adequate traction are followed by no descent with three attempts. The duration of the procedure should be monitored and used as an additional factor for consideration when deciding whether to continue with an operative vaginal delivery. If descent has occurred and delivery is clearly imminent, then proceeding with instrumental delivery after three pulls or a longer duration may be appropriate and less morbid than a cesarean delivery of an infant with its head on the perineum.

The operator should not be fixated on achieving a vaginal delivery. It is essential that the operator be willing to abandon a planned or attempted operative delivery and have the ability to perform a cesarean birth if evaluation or reevaluation of the clinical status shows that an instrumental delivery is contraindicated (eg, the fetal head is not engaged, the position is uncertain, the procedure is not succeeding).

The most common and highest risk clinical factors associated with failed operative vaginal delivery are occiput posterior position, macrosomia, prolonged second stage, primiparity, and maternal obesity [8,58-65]. Other characteristics that have been associated with failure include higher station and excessive molding of the fetal head. (See "Occiput posterior position", section on 'Management' and "Shoulder dystocia: Risk factors and planning delivery of high-risk pregnancies", section on 'Planning delivery in high-risk pregnancies'.)

Higher rates of neonatal morbidity have been observed when cesarean delivery was performed after a failed operative vaginal delivery than when performed during labor without such attempts (table 2) [66,67]; there are many limitations to these observational data, including confounding by indication for intervention and lack of appropriate controls.

Second attempt with a different instrument — Sequential attempts with different instruments should not be performed routinely. For a procedure to be considered sequential, traction is applied sequentially by two different instruments. Situations in which an instrument is placed, but no traction applied, should not be considered a sequential attempt: for instance, when proper placement of forceps cannot be achieved, or a vacuum device fails to achieve suction and no traction has been applied. Sequential instrumentation might occur in the rare situation of potential or immediate fetal compromise when a vacuum attempt by a less experienced provider has failed and a more experienced provider believes that delivery can be safely achieved with forceps more quickly than with cesarean delivery. We believe that sequential use may be avoided if less experienced providers consult more experienced providers **before** attempting challenging operative vaginal delivery. This facilitates both a reduction in sequential instrument use and ongoing learning for less experienced providers.

The American College of Obstetricians and Gynecologists recommends against routinely performing sequential attempts at operative vaginal delivery using different instruments due to the greater potential for maternal and/or fetal injury [7]. Population-based data have reported increased maternal and neonatal morbidity from sequential application of vacuum and forceps [66,68,69]. Although a few studies have not demonstrated adverse effects from sequential use of vacuum and forceps, even when vaginal delivery was not achieved, a type II error may have resulted from the small number of participants and events in these studies [70,71].

For the mother, sequential use of vacuum and forceps has been associated with increased rates of third-/fourth-degree lacerations and postpartum hemorrhage [69]. For the neonate, sequential use of these instruments has been associated with increased rates of subdural hematomas and intracranial hemorrhage. In one large study, the incidence of subdural or cerebral hemorrhage in infants delivered by vacuum and forceps, vacuum alone, or forceps alone was approximately 21, 10, and 8 per 10,000 births, respectively [66]. These findings were corroborated by another analysis based upon statewide birth certificate data [68] and a small study of asymptomatic term infants who underwent routine magnetic resonance imaging within 48 hours of birth [72]. In the latter, 9 of 111 asymptomatic infants had a subdural hematoma, and the highest proportion was in the group exposed to failed vacuum followed by successful forceps delivery (five subdural hematomas among 18 infants [28 percent]) [72]. In comparison, 3 subdural hematomas occurred in 49 infants spontaneously delivered from vertex presentation (6 percent), 1 subdural hemorrhage occurred among 13 successful vacuum deliveries (8 percent), and 0 subdurals occurred among 4 successful forceps deliveries. All hematomas had resolved without clinical sequelae when reevaluated four weeks later.

Maternal and newborn examination — The lower genital tract, peritoneum, and anus/rectum should be examined after delivery for lacerations. It is important to remember to perform this examination in women who undergo cesarean delivery after a failed attempt at operative delivery.

The neonatal care provider should be informed that vacuum or forceps were used to assist delivery. Since most serious complications, such as a subgaleal hematoma, occur within hours of delivery [73], it is important to inform infant care providers by either a reliable charting method, direct notification, or both.

SUCCESS RATE

In a systematic review of randomized trials, failed delivery occurred in approximately 9 percent of forceps deliveries and 14 percent of vacuum deliveries (relative risk 0.65, 95% CI 0.45-0.94; seven trials, n = 2419 deliveries) [45]. Birth certificate data including over two million deliveries in the United States suggest that attempted operative vaginal delivery (forceps, vacuum) failed in approximately 18 percent of cases in which an instrument was applied [74]. When unsuccessful, 60 percent of women went on to have a vaginal delivery, and 40 percent had a cesarean delivery.

Midforceps delivery is more likely to fail than low forceps delivery; failure rates were 8.9 and 0.3 percent, respectively, in one large prospective study [75].

Historically, failed forceps was more likely to lead to cesarean delivery than failed vacuum since failed vacuum extraction was sometimes followed by a successful trial of forceps, but the converse rarely occurs. As sequential use of instruments carries much higher morbidities, it is no longer considered acceptable to perform sequential instrument use. (See 'Second attempt with a different instrument' above.)

COMPLICATIONS

Overview — Maternal and fetal/neonatal complication rates vary widely in published series and depend on a number of factors, which are not independent. These factors include type of instrument, head position at application, station, indication for intervention, and operator experience. Rotation, higher station, longer active second stage of labor, and operator inexperience variably increase the risk of complications. However, complications can occur even when instruments are correctly applied and used. Virtually all complications associated with operative vaginal delivery can also occur in the course of a spontaneous vaginal delivery, but the incidence is lower in the latter.

Birth trauma is the major potential complication of operative vaginal delivery. A population-based analysis of over 11 million singleton births in the United States provided crude comparative morbidity/mortality data for unassisted (spontaneous), forceps-assisted, and vacuum-assisted births (table 3) [76]. Although based on far fewer births, state-based data for California and New Jersey provide a more detailed description of the specific types of injuries associated with different instruments and modes of delivery (table 4 and table 5 and table 6) [66,76]. These data should be interpreted with respect to appropriate control groups and reasonable alternative procedures. For example, second stage cesarean delivery is an alternative to operative vaginal delivery, but prelabor cesarean delivery and spontaneous vaginal delivery are not realistic alternatives in the setting of second stage labor complications. Bias in patient selection is also an important factor; the vacuum approach is often favored over forceps in patients most likely to delivery readily. When considering the morbidity of operative vaginal versus cesarean delivery, it should be noted that, when dystocia is the indication, forceps and vacuum deliveries were associated with higher rates of perinatal morbidity and mortality than cesarean deliveries performed in the second stage [77].

Neonatal complications

Vacuum-assisted deliveries — Torsion and traction by the vacuum cup can cause life-threatening complications following use of vacuum-assisted devices [78]. These complications include intracranial hemorrhage (epidural, subdural, intraparenchymal, subarachnoid), intraventricular hemorrhage, and subgaleal hemorrhage (figure 4). (See "Neonatal birth injuries".)

Other potential complications include fetal scalp abrasions and lacerations, cephalohematoma, retinal hemorrhage, and brachial plexus injury [45,66,79-82]. In a prospective study of retinal hemorrhage in healthy newborns, the incidence was higher for vacuum-assisted than for spontaneous vaginal or cesarean deliveries (75, 33, and 7 percent, respectively) [83]. The hemorrhages typically resolved without sequelae within four weeks of birth. Cephalohematoma was almost twice as common after vacuum-assisted extraction than forceps delivery (9.4 versus 5.2 percent) in a systematic review, but the difference was not statistically significant [45]. The majority of cephalohematomas resolve spontaneously over the course of a few weeks without any intervention. Shoulder dystocia is more common with vacuum-assisted than forceps deliveries [76,84]. For this reason, vacuum-assisted deliveries are at higher risk of brachial plexus injury than forceps-assisted deliveries or cesarean delivery [82].

Forceps-assisted deliveries — Complications of forceps delivery include skin markings and lacerations, external ocular trauma, intracranial hemorrhage, subgaleal hemorrhage, retinal hemorrhage, lipoid necrosis, facial nerve injury, skull fracture, and, rarely, death [12,66,85,86]. Facial palsies [82,86], other facial injuries, and depressed skull fractures [86] are more common with use of forceps than vacuum devices. In a meta-analysis of randomized trials, facial injury was fivefold more likely with forceps than vacuum (relative risk [RR] 5.10, 95% CI 1.12-23.25) [45].

Maternal complications — Maternal complications associated with operative vaginal delivery include lower genital tract laceration, vulvar and vaginal hematomas, urinary tract injury, and anal sphincter injury [87-96]. Occiput posterior position is a risk factor for maternal trauma during operative vaginal delivery [97-99], particularly third-/fourth-degree perineal lacerations (spontaneous delivery 2 percent, vacuum extraction 10 to 11 percent, forceps delivery 17 to 20 percent [94,100]).

Increasingly complex operative intervention is associated with increasing maternal morbidity such that spontaneous vaginal delivery is least morbid, followed by vacuum extraction, then forceps delivery, and lastly cesarean delivery, where venous thromboembolism, endometritis, and wound infection are particular concerns. Although cesarean delivery protects the genital tract from forceps/vacuum-related trauma, the long-term risk of urinary incontinence, anal incontinence, and prolapse symptoms was not lower with second stage cesarean delivery compared with operative vaginal delivery in longitudinal cohort studies [101,102].

Vacuum-assisted deliveries — Randomized trials generally report less maternal genital trauma with vacuum versus forceps extraction (refer to data below), which is not unexpected given that a correctly applied vacuum cup does not take up additional space between the fetal head and the birth canal and does not make contact with maternal soft tissue [45].

This difference has not been proven to impact long-term maternal outcomes, such as urinary and anal dysfunction and pelvic organ prolapse. In a trial that randomly assigned 75 women to forceps or vacuum delivery and then surveyed them five years postpartum, long-term morbidity rates were similar for both instruments; 47 percent had some degree of urinary incontinence and 20 percent had loss of bowel control "sometimes" or "frequently" [103]. This trial was limited by the small number of subjects.

Vacuum deliveries have been associated with lower rates of maternal morbidity and mortality than cesarean delivery in the second stage [77]. (See "Fecal and anal incontinence associated with pregnancy and childbirth: Counseling, evaluation, and management" and "Effect of pregnancy and childbirth on urinary incontinence and pelvic organ prolapse".)

Forceps-assisted deliveries — Randomized trials generally report a higher risk of maternal genital trauma with forceps versus vacuum extraction (third-/fourth-degree laceration: 14 versus 7.5 percent, RR 1.89, 95% CI 1.51-2.37; vaginal trauma: 26 versus 12 percent, RR 2.48, 95% CI 1.59-3.87) [45].

Rotational and midforceps operations have been considered major risk factors for serious maternal trauma during operative vaginal delivery. In case reports and small series, direct bladder injury, ureteral lacerations/transections, and uterine rupture have been reported [104]. Although a direct comparison meta-analysis of observational studies found no statistically significant difference in the risk of adverse maternal outcomes between rotational vaginal delivery with Kielland forceps and rotational vacuum (sphincter injury RR 1.46, 95% CI 0.84-2.52; vaginal/cervical tear RR 1.52, 95% CI 0.95-2.42) [105], this may have been due to bias in selection of cases for each method of delivery and the increased risk of trauma with rotational vacuum compared with nonrotational vacuum extraction.

Complications of midpelvic deliveries — A study of perinatal and maternal morbidity and mortality associated with attempted operative midpelvic vaginal delivery compared with cesarean delivery reported the following observations [106]:

- Among women with dystocia and a prolonged second stage, midpelvic operative vaginal delivery (n = 7521) was associated with higher risks of severe perinatal morbidity/mortality than cesarean delivery (n = 9300):
  - Forceps adjusted odds ratio (aOR) 1.81, 95% CI 1.24-2.64 (1.1 versus 0.7 percent)
  - Vacuum aOR 1.81, 95% CI 1.17-2.80 (1.2 versus 0.7 percent)
  - Sequential instruments aOR 3.19, 95% CI 1.73-5.88 (2.0 versus 0.7 percent)

  In particular, midpelvic operative vaginal delivery was strongly associated with a high risk of severe newborn birth trauma compared with cesarean delivery:
  - Forceps aOR 5.01, 95% CI 2.75-9.15 (0.7 versus 0.2 percent)
  - Vacuum aOR 4.47, 95% CI 2.27-8.80 (0.7 versus 0.2 percent)
  - Sequential instruments aOR 9.46, 95% CI 4.11-21.8 (1.4 versus 0.2 percent)

  The overall risk of severe maternal morbidity and mortality was similar for midpelvic operative vaginal and cesarean delivery, but midpelvic operative vaginal delivery was associated with a high rate of maternal obstetric trauma (eg, third- and fourth-degree perineal lacerations, cervical laceration, high vaginal laceration: 22.9 percent with forceps, 15.4 percent with vacuum), which significantly exceeded the 6.3 percent rate of obstetric trauma (injury to pelvic organ/joint, pelvic hematoma and extension of uterine incision) with cesarean delivery.

- Among women with fetal distress and prolonged second stage, the difference in severe perinatal morbidity/mortality between routes of delivery was not statistically significant, but midpelvic operative vaginal delivery was still associated with significantly higher rates of severe newborn birth trauma and maternal obstetric trauma.

These data underscore the importance of case-by-case assessment of the relative risks and benefits of midpelvic operative delivery versus cesarean delivery.

NEURODEVELOPMENTAL OUTCOME

Operative vaginal delivery, whether by forceps or vacuum extraction, does not appear to have an adverse effect on neurodevelopment when evaluated in school-aged children.

In two randomized trials, forceps- and vacuum-assisted births were associated with similar neurodevelopmental outcomes [103,107]. Both of these trials lacked a comparison with infants delivered spontaneously or by cesarean delivery. A third trial compared neurodevelopmental outcome at age five for children born by successful instrumental vaginal delivery, failed instrumental delivery, and cesarean delivery in the second stage of labor [108]. Neurodevelopmental morbidity was low with no significant differences among the three groups, but the study was underpowered.

One of the few follow-up evaluations comparing outcome at school age after operative or spontaneous delivery in over 3000 five-year-olds found no differences in cognitive testing [109]. This series included 1192 forceps deliveries, of which 114 were midforceps. Another study compared the neurologic outcome of 295 10-year-old children delivered by vacuum extraction with that of 302 children delivered spontaneously in the same hospital by the same doctors and matched for maternal age, gestational age, and birth weight [110]. Both groups had similar results for tests of fine and gross motor control, perceptual integration, behavioral maturity, scholastic performance, speech ability, and self-care. In addition, a national cohort study of 126,032 16-year-olds born as nonanomalous vertex singletons ≥34 weeks of gestation to Swedish-born parents noted that those delivered by vacuum extraction had slightly lower mean mathematics test scores than children born vaginally without instruments after adjustment for major confounders, but similar scores to those born by intrapartum cesarean delivery [111].

RATE OF RECURRENT OPERATIVE VAGINAL DELIVERY

Approximately 5 percent of women who have an operative vaginal delivery will have a second operative vaginal delivery [112,113].

USE OF VACUUM OR FORCEPS AT CESAREAN DELIVERY

(See "Cesarean delivery: Management of deeply engaged, impacted and floating fetal presentations".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Delivery".)

SUMMARY AND RECOMMENDATIONS

- The risks and benefits of operative vaginal delivery for each patient need to be balanced against those for cesarean delivery and less invasive interventions. Use of forceps or vacuum is reasonable when an intervention to complete labor is indicated and operative vaginal delivery can be safely and readily accomplished; otherwise, cesarean delivery is the better option. Situations where operative vaginal delivery may be preferable to cesarean delivery or less invasive interventions include prolonged second stage when maternal exhaustion impedes further progress, fetal compromise where expeditious delivery is desirable, and maternal medical disorders where pushing (Valsalva) needs to be avoided or minimized. Nonmedically indicated shortening of the second stage is not an indication for operative vaginal delivery. (See 'Indications' above.)

- Before resorting to an operative vaginal delivery, the clinician should ensure that prerequisites are met (eg, head is engaged, membranes ruptured, presentation and position known, anesthesia is satisfactory, the fetus is of appropriate gestational age and size, maternal bladder is empty) and there are no contraindications. (See 'Prerequisites' above and 'Contraindications' above.)

- Forceps deliveries are classified as outlet, low, or mid, depending on the fetal station and degree of head rotation. (See 'Classification' above.)

- Midforceps deliveries are generally avoided because they are associated with a higher rate of severe perinatal morbidity/mortality compared with cesarean deliveries performed in the second stage, especially when the indication for delivery is dystocia. They are also associated with higher rates maternal trauma. However, clinicians highly experienced with forceps deliveries may choose to attempt a midforceps delivery in select circumstances, such as sudden severe fetal or maternal compromise, if the clinician believes that he/she can safely expedite and effect a safe operative vaginal delivery. Simultaneous preparation for cesarean delivery should be underway. (See 'Forceps' above.)

- In general, vacuum extraction is generally less traumatic for the mother than forceps delivery and the devices are easier to apply and require less maternal anesthesia than forceps. The advantages of forceps are that they are associated with a higher success rate, are unlikely to detach from the head, can be sized to a premature cranium, may be used for a rotation, and do not aggravate bleeding from scalp lacerations. (See 'When to choose vacuum versus forceps' above.)

- The maternal bladder is emptied before operative delivery. We recommend not performing an episiotomy routinely (**Grade 1B**). If performed in selected patients (eg, forceps delivery in a patient with no prior vaginal birth, operative delivery of persistent occiput posterior), we suggest a mediolateral or lateral episiotomy (**Grade 2B**). If fetal presentation or position is uncertain, intrapartum sonographic visualization of fetal intracranial structures can be used to determine fetal head position and is more accurate than digital examination. (See 'Patient preparation' above.)

- For women who are to undergo an operative vaginal delivery at >34 weeks and have a high likelihood of success (eg, outlet procedure), we suggest use of vacuum over forceps (**Grade 2C**). Maternal morbidity is lower with vacuum than forceps, and neonatal morbidity is likely to be low in this setting with either approach. When success is uncertain, primary use of forceps may reduce the likelihood of failure, as use of sequential instruments should be avoided. (See 'Choice of instrument' above and 'Second attempt with a different instrument' above.)

- The decision to proceed with operative vaginal delivery is ongoing and decided moment by moment based on assessment of the success of the various steps in the procedure. Operative vaginal delivery should be abandoned if it is difficult to apply the instrument, descent does not easily proceed with traction, or the baby has not been delivered within a reasonable time (eg, 15 to 20 minutes) or after three pulls with no progress. (See 'When to abandon the procedure' above.)

- Maternal and fetal/neonatal complication rates vary widely and depend on a number of factors, which are not independent. Virtually all complications associated with operative vaginal delivery can also occur in the course of a spontaneous vaginal delivery, but the incidence is lower in the latter. (See 'Complications' above.)

- For patients who are going to have an operative vaginal delivery, we suggest not administering prophylactic antibiotics before delivery (**Grade 2C**). We do not routinely administer antibiotic prophylaxis before or after operative vaginal deliveries as most patients in our practice do not have an episiotomy.

  After an operative vaginal delivery in which an episiotomy was performed, we suggest administering a broad spectrum antibiotic (**Grade 2C**). Antibiotic administration in this population appears to reduce the risk for perineal infection and wound breakdown. We use a single dose of intravenous co-amoxiclav. However, use of a different broad spectrum antibiotic or no antibiotic prophylaxis is also reasonable, given limited data of efficacy, no comparative data from use of other antibiotics, and no long-term data regarding harms. (See 'Antibiotics' above.)

- Vacuum-assisted deliveries are associated with an increased risk of neonatal cephalohematomata and retinal hemorrhage compared with forceps or spontaneous deliveries. These complications generally resolve without sequelae. Forceps-assisted deliveries cause more acute maternal injury and fetal facial nerve injury than vacuum-assisted operative deliveries or spontaneous deliveries. (See 'Vacuum-assisted deliveries' above and 'Forceps-assisted deliveries' above.)

- Although short-term neonatal morbidity varies between procedures, developmental outcome appears to be equivalent for both forceps- and vacuum-assisted births. (See 'Neurodevelopmental outcome' above.)

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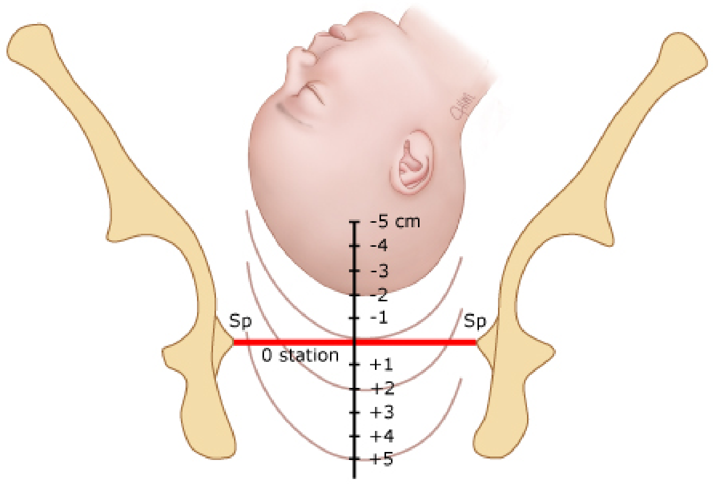
Topic 4474 Version 58.0

GRAPHICS

Assessing descent of the fetal head by vaginal examination

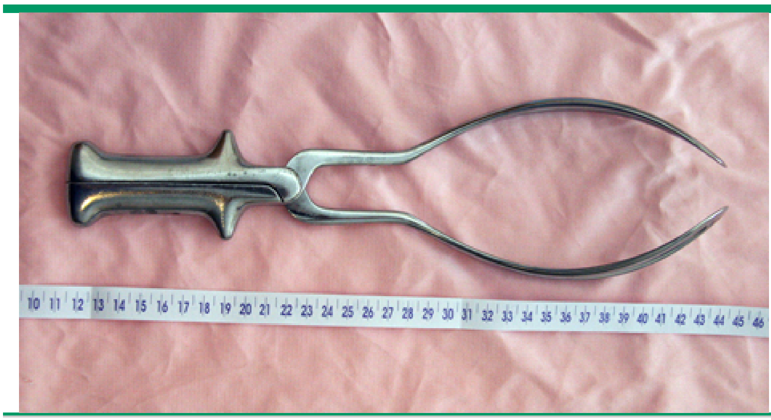


The fetus is at -2 station signifying that the leading bony edge of the presenting part is 2 centimeters above the ischial spines. The head is engaged at 0 station.

Sp: ischial spine.

Graphic 67068 Version 5.0

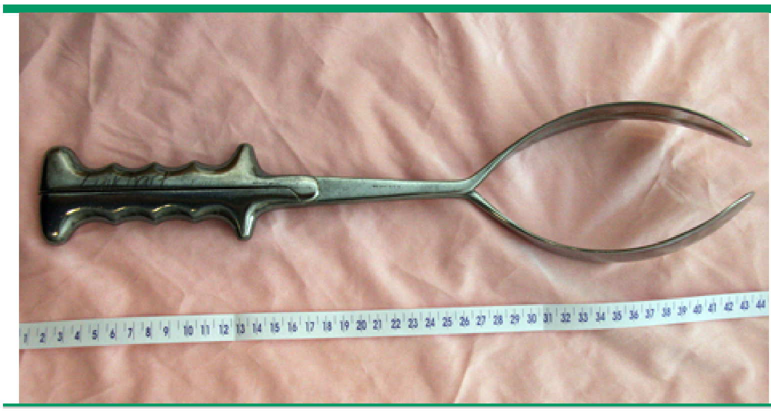
Delee Simpson type forceps



Simpson type forceps have parallel separated shanks with blades that have a long and tapered cephalic curve.

Graphic 79792 Version 6.0

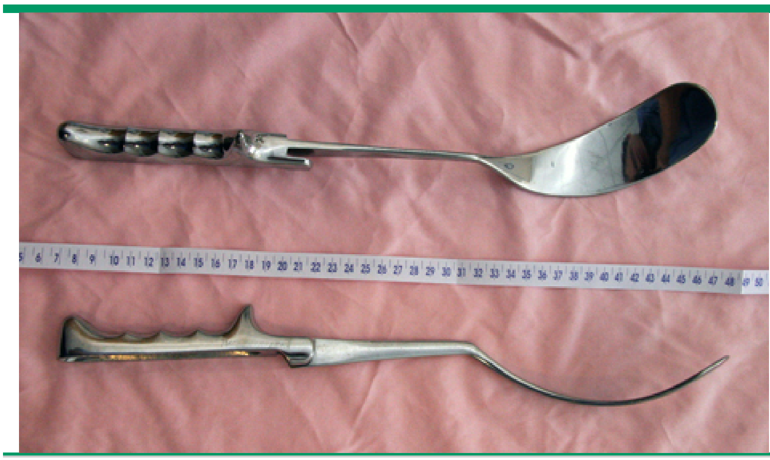
Elliott type forceps



Elliot type forceps have overlapping shanks with blades that are short and have a roundish cephalic curve.

Graphic 73043 Version 3.0

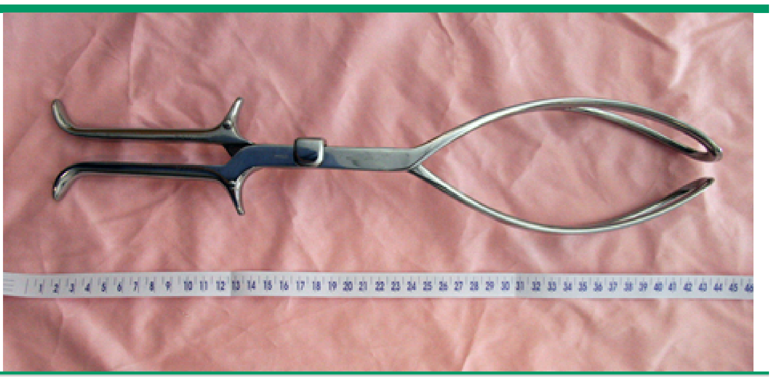
Tucker-McLane forceps



The Tucker-McLane forceps are Elliott type with blades that are smooth and solid.

Graphic 58167 Version 4.0

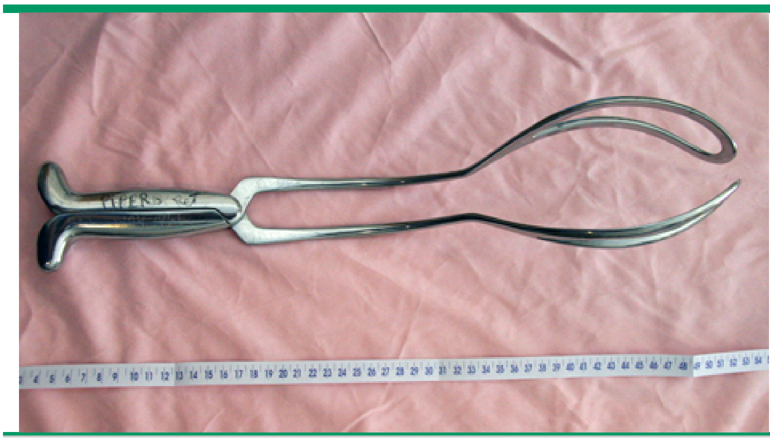
Kielland forceps



Kielland forceps have a sliding lock to correct for asynclitism.

Graphic 80795 Version 3.0

Piper forceps



Piper forceps have long shanks that are separated and slightly curved beyond the lock in order to manage delivery of the aftercoming head in breech presentation.

Graphic 56439 Version 4.0

Checklist for operative vaginal delivery[1,2]

Operative vaginal delivery procedural form (check all that apply)

Are any contraindications present?

- ☐ No
- ☐ Yes: ☐ Fetal osteogenesis imperfecta ☐ Thrombocytopenia ☐ Hemophilia ☐ Other ________________

Indication for operative vaginal delivery:

- ☐ Suspicion of potential or immediate fetal compromise
- ☐ Prolonged second stage
- ☐ Maternal exhaustion
- ☐ Shortening of the second stage of labor for maternal benefit
- ☐ Breech after-coming fetal head
- ☐ Other

Gestational age (weeks and days): ________________

Fetal heart rate pattern:

- ☐ Category 1
- ☐ Category 2
- ☐ Category 3

Patient consent for operative vaginal delivery was: ☐ Verbal ☐ Written

Patient has agreed to undergo operative vaginal delivery after being informed of:

- ☐ Alternatives (continued pushing, cesarean delivery)
- ☐ Fetal risks:
  - For vacuum delivery: Laceration; cephalohematoma; subgaleal, intracranial hemorrhage or retinal hemorrhage; brachial plexus injury
  - For forceps delivery: Facial lacerations, facial nerve palsy, skull fracture, intracranial hemorrhage, brachial plexus injury
- ☐ Maternal risks: Perineal lacerations, 3rd and 4th degree lacerations, vaginal sulcal tears or lacerations, need for episiotomy or emergency cesarean delivery
- ☐ Benefits: Avoid cesarean delivery, expedite delivery, long-term fetal outcomes are the same as for 2nd stage cesarean delivery

Preprocedure assessment and procedures:

- ☐ Cervix is fully dilated and retracted
- ☐ Membranes are ruptured
- ☐ Fetal head is engaged (fetal skull is at or below 0 station)
- Position of the fetal head:
  - Circle one: OA, LOA, ROA, LOT, ROT, LOP, ROP, OP, after-coming head is flexed on breech presentation
  - Asynclitism: ☐ Anterior ☐ Posterior ☐ None
  - Caput: ☐ None ☐ Minimal ☐ Significant
  - Molding: ☐ None ☐ Present
- Ultrasound confirmation of position performed: ☐ Yes ☐ No
- Estimated fetal weight: ________________ grams or ________________ pounds
- ☐ Pelvis is thought to be adequate for vaginal delivery
- ☐ Adequate anesthesia present (check one: ☐ Epidural ☐ Pudendal ☐ Spinal ☐ Vacuum assisted with no anesthesia ☐ Other ________________)
- ☐ Maternal bladder has been emptied

Procedure:

- Location: ☐ Labor room ☐ Operating room
- Station at time of application: ☐ +5 ☐ +4 ☐ +3 ☐ +2 ☐ +1 ☐ 0
- (Outlet forceps/vacuum = fetal-presenting part at perineum; low forceps/vacuum = fetal-presenting part +2 or lower but not at perineum; midforceps/vacuum = head engaged with fetal-presenting part between 0 and +2)
- Forceps procedure:
  - Type: ☐ Simpson-Luikart ☐ Tucker-McLane ☐ Simpson ☐ Kielland ☐ Piper ☐ Baby Elliot ☐ Baby Simpson ☐ Other ________________
  - Number of pulls: ☐ 1 ☐ 2 ☐ 3 ☐ Other ________________
  - Rotation of head: ☐ None ☐ 0 to 45 degrees ☐ 45 to 90 degrees ☐ >90 degrees

Traction: ☐ Easy ☐ Moderate ☐ Strong

Maternal effort: ☐ None ☐ Minimal ☐ Moderate ☐ Strong

Total time instrument applied to fetal head (minutes and seconds): ________________

Successful extraction? ☐ Yes ☐ No (explain: ________________)

Vacuum procedure:

☐ Gestational age is ≥34 + 0 weeks

Type: ☐ MityOne MitySoft (bell) ☐ MityOne M-Style (mushroom) ☐ Kiwi ☐ Other ________________

Maximum pressure: ________________

Number of pulls: ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ Other ________________

Number of pop-offs: ________________

Rotation of head: ☐ None ☐ 0 to 45 degrees ☐ 45 to 90 degrees ☐ >90 degrees

Traction: ☐ Easy ☐ Moderate ☐ Strong

Maternal effort: ☐ None ☐ Minimal ☐ Moderate ☐ Strong

Total time instrument applied to fetal head (minutes): ________________

Successful extraction? ☐ Yes ☐ No (explain: ________________)

Newborn status:

Sex: ☐ Male ☐ Female

Birth weight: ________________ grams or ________________ pounds

Shoulder dystocia: ☐ No ☐ Not applicable ☐ Yes (minutes: ________________; maneuvers used to deliver: ________________)

Pediatric service present: ☐ Yes ☐ No

Apgar: 1 minute: ________________; 5 minutes: ________________ (If <7 at 5 minutes, document additional Apgar scores at 10 minutes or more: ________________)

Arterial and venous cord blood gases, if obtained (should be obtained if 5-minute Apgar <5): ________________

Newborn examination: ☐ Normal ☐ Abnormal (describe abnormalities, including injuries [eg, scalp laceration, scalp hematoma]: ____)

Maternal status:

Episiotomy: ☐ No ☐ Yes: ☐ Mediolateral ☐ Midline

Lacerations: ☐ No ☐ Yes: ☐ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ Periurethral ☐ Vaginal

Antibiotic given if 3rd or 4th degree: ☐ No ☐ Yes (describe: ____)

Estimated blood loss: ________________ mL

Postpartum hemorrhage? ☐ No ☐ Yes (describe: ____)

Complications and other issues: ____

Clinician completing form: ____

Date: ____

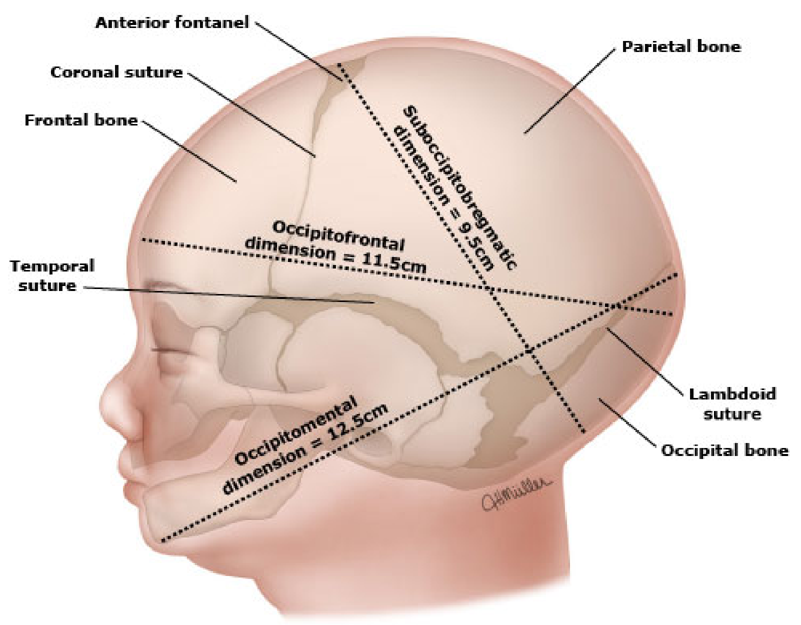
OA: occiput anterior; LOA: left occiput anterior; ROA: right occiput anterior; LOT: left occiput transverse; ROT: right occiput transverse; LOP: left occiput posterior; ROP: right occiput posterior; OP: occiput posterior.

References:

1. *CRICO Clinical Guidelines for Obstetrical Services: OB Guidelines Appendix B: Sample Documentation of Operative Vaginal Delivery, 2017.*
2. *Patient Safety and Quality Committee, Society for Maternal-Fetal Medicine, Staat B, Combs CA. SMFM Special Statement: Operative vaginal delivery: checklists for performance and documentation. Am J Obstet Gynecol 2020; 222:B15.*

Graphic 128953 Version 2.0

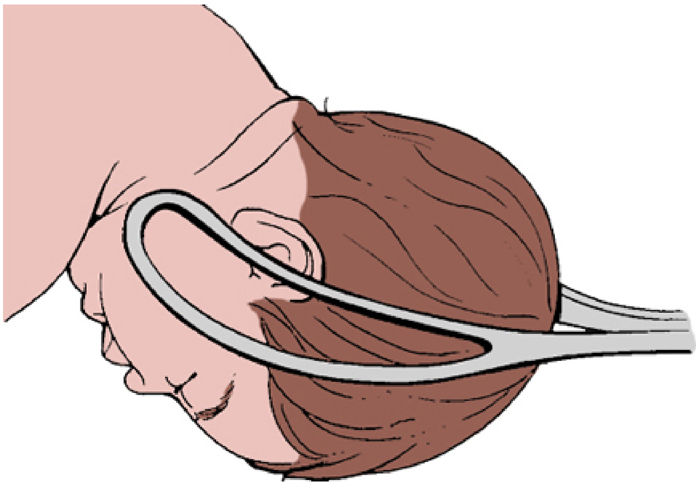
Diameters of the fetal head at term



Measurements from: Williams Obstetrics, 23rd ed, Cunnigham FG, Leveno KJ, Bloom SL, et al (Eds), McGraw-Hill, New York 2010.

Graphic 62883 Version 6.0

Correct placement of the forceps blades on the fetal head



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Graphic 72994 Version 2.0

Neonatal morbidity after intrapartum cesarean delivery, with or without a trial of operative vaginal delivery

Morbidity	Cesarean delivery after attempts at operative vaginal birth*	Cesarean delivery with no attempts at operative vaginal birth*
Subdural or cerebral hemorrhage	25.7	6.8
Facial nerve injury	12.8	2.8
Convulsions	68.8	19.9
CNS depression	17.1	9.4
Mechanical ventilation	156.1	101.7

CNS: central nervous system.
* Number of cases per 10,000 infants.

Data from: Towner D, Castro MA, Eby-Wilkens E, et al. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. N Engl J Med 1999; 341:1709.

Graphic 69438 Version 5.0

Neonatal morbidity and mortality data by delivery type for the United States, 1995 to 1998 (rates are per 10,000 deliveries)

Outcome	Spontaneous	Forceps delivery	Vacuum delivery
Neonatal death	3.7	5.0	4.7
Birth injury	21.4	109.1	76.1
Neonatal seizures	5.0	8.7	6.5
Assisted ventilation <30 minutes	147	293	250

Data from: Demissie K, Rhoads GG, Smulian JC, et al. Operative vaginal delivery and neonatal and infant adverse outcomes: population based retrospective analysis. BMJ 2004; 329:24.

Graphic 70509 Version 5.0

Frequency of birth trauma related to mode of delivery cases per 10,000 births

Trauma	Spontaneous birth	Vacuum assisted	Forceps assisted	Cesarean no labor	Cesarean with labor
Subdural or cerebral hemorrhage	2.9	8.0	9.8	4.1	7.4
Intraventricular hemorrhage	1.1	1.5	2.6	0.8	2.5
Subarachnoid hemorrhage	1.3	2.2	3.3	0.0	1.2
Facial nerve injury	3.3	4.6	45.4	4.9	3.1
Brachial plexus injury	7.7	17.6	25.0	4.1	1.8
Convulsions	6.4	11.7	9.8	8.6	21.3
CNS depression	3.1	9.2	5.2	6.7	9.6
Feeding difficulty	68.5	72.1	74.6	106.3	117.2
Mechanical ventilation	25.8	39.1	45.4	71.3	103.2

CNS: central nervous system.

Data from: Towner D, Castro MA, Eby-Wilkens E, et al. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. N Engl J Med 1999; 341:1709.

Graphic 63989 Version 7.0

Neonatal morbidity and mortality data by delivery type, New Jersey 1989 to 1993, rate per 10,000 deliveries

Outcome	Unassisted (spontaneous) delivery	Forceps delivery	Vacuum delivery	Vacuum plus forceps
Cephalohematoma	167	635	1117	1361
Facial nerve injury	2.4	37.0	5.2	52.9
Intracranial hemorrhage	3.7	17.0	16.2	26.5
Mechanical ventilation	23.5	31.3	40.3	74.1
Retinal hemorrhage	18.2	19.3	15.7	31.8

Data from: Demissie K, Rhoads GG, Smulian JC, et al. Operative vaginal delivery and neonatal and infant adverse outcomes: population based retrospective analysis. BMJ 2004; 329:24.

Graphic 50159 Version 5.0

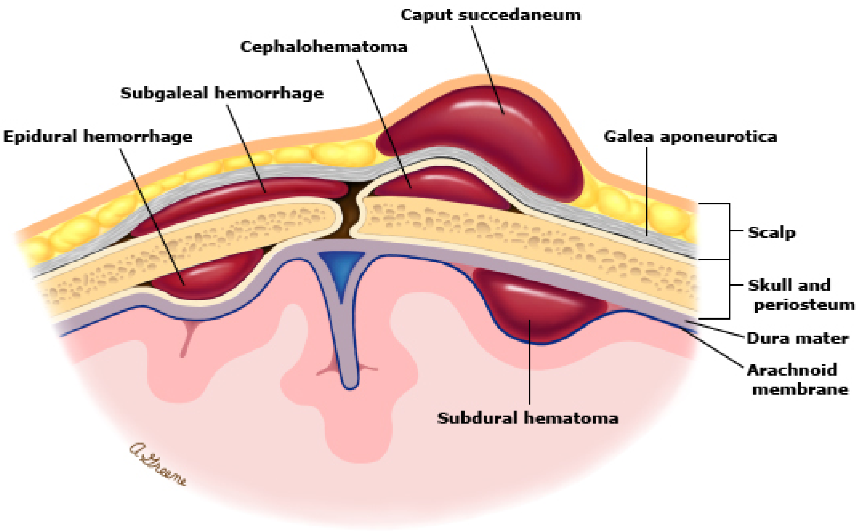
Incidence of intracranial hemorrhage by mode of delivery

Delivery type	Incidence
Forceps	1 in 664
Vacuum extraction	1 in 860
Cesarean delivery with labor	1 in 907
Spontaneous vaginal birth	1 in 1900
Cesarean delivery without labor	1 in 2750

Data from: Towner D, Castro MA, Eby-Wilkens E, Gilbert WM. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. N Engl J Med 1999; 341:1709.

Graphic 50481 Version 6.0

Neonatal extracranial and intracranial birth injuries



Modified from: Volpe JJ. Neurology of the Newborn, 4th ed, WB Saunders, Philadelphia 2001.

Graphic 53176 Version 11.0

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Elisabeth K Wegner, MD Nothing to disclose **Ira M Bernstein, MD** Nothing to disclose **Vincenzo Berghella, MD** Consultant/Advisory Boards: ProtocolNow [Clinical guidelines]. **Vanessa A Barss, MD, FACOG** Nothing to disclose

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