Operative Vaginal Delivery

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Course Description:

Operative vaginal birth is the use of forceps or a vacuum device to assist with a vaginal delivery. The laboring woman may or may not push during the assistance. The health care provider will learn when an operative device is used and how it will be selected. The health care provider will be aware of the risks and benefits of use and complications that may occur to mother and fetus. This education course will keep maternal and fetal safety a priority.

Approximate Time to Complete: 55 minutes

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By the end of the module, knowledge gained will:

- Help the participant develop sound clinical judgment in the delivery of health care in a setting when an operative vaginal birth occurs.
- Enable the participant to develop, implement, and evaluate health care delivery in a practice setting prior to an actual event. This will allow for early recognition of an actual event.
- Enhance the participant's ability to put knowledge into active health care delivery. This will allow for rapid implementation of the necessary steps needed to assist with an operative vaginal birth.
- Prepare the participant to address issues and implement changes in the health care setting as necessary to ensure a safe environment. Equipment and supplies needed when an operative vaginal birth occurs will be available.

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Operative Vaginal Delivery

To expedite or achieve a safe vaginal delivery, for maternal or fetal indications. An assisted delivery that is performed to expedite a safe vaginal delivery for maternal or fetal indications [9].

The health care provider uses an instrument to extract the fetus, using traction, during a contraction with or without maternal pushing efforts.

- In 2017, 3.1% of all deliveries in the United States were operative vaginal births [1].
- The rate of vacuum assisted births is 2.6% of vaginal births and forceps deliveries 0.5% of vaginal births [4]. Overall, 80% of operative vaginal deliveries in the United States are vacuum extraction [1].
- As the rate of cesarean sections has risen, the rate of operative vaginal deliveries has fallen [33].

- When operative delivery is attempted, 9% of forceps deliveries fail to achieve vaginal delivery, as compared to 14% of vacuum deliveries [11].

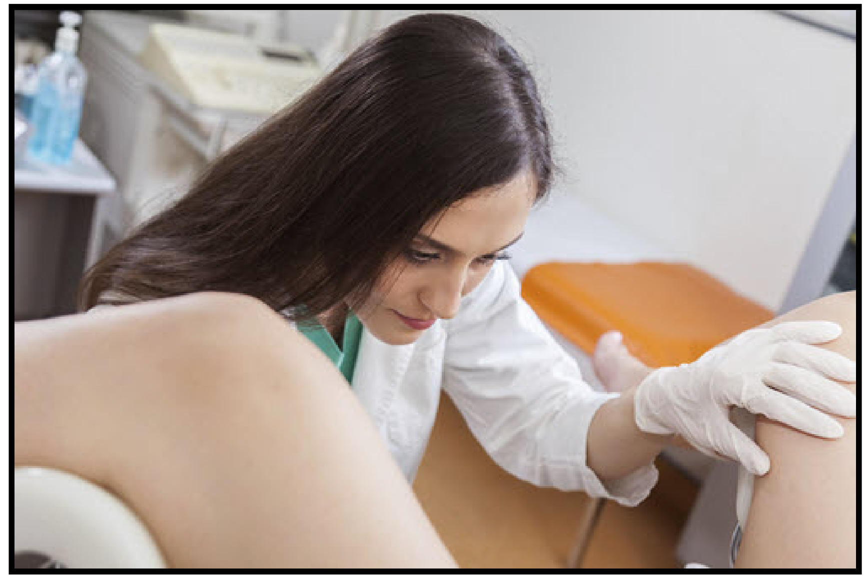
Indications for operative vaginal delivery:

- Maternal
    - Maternal medical indications
    - Maternal exhaustion
    - Prolonged second stage of labor
    - Arrest of descent
- Fetal
    - Non-reassuring fetal status

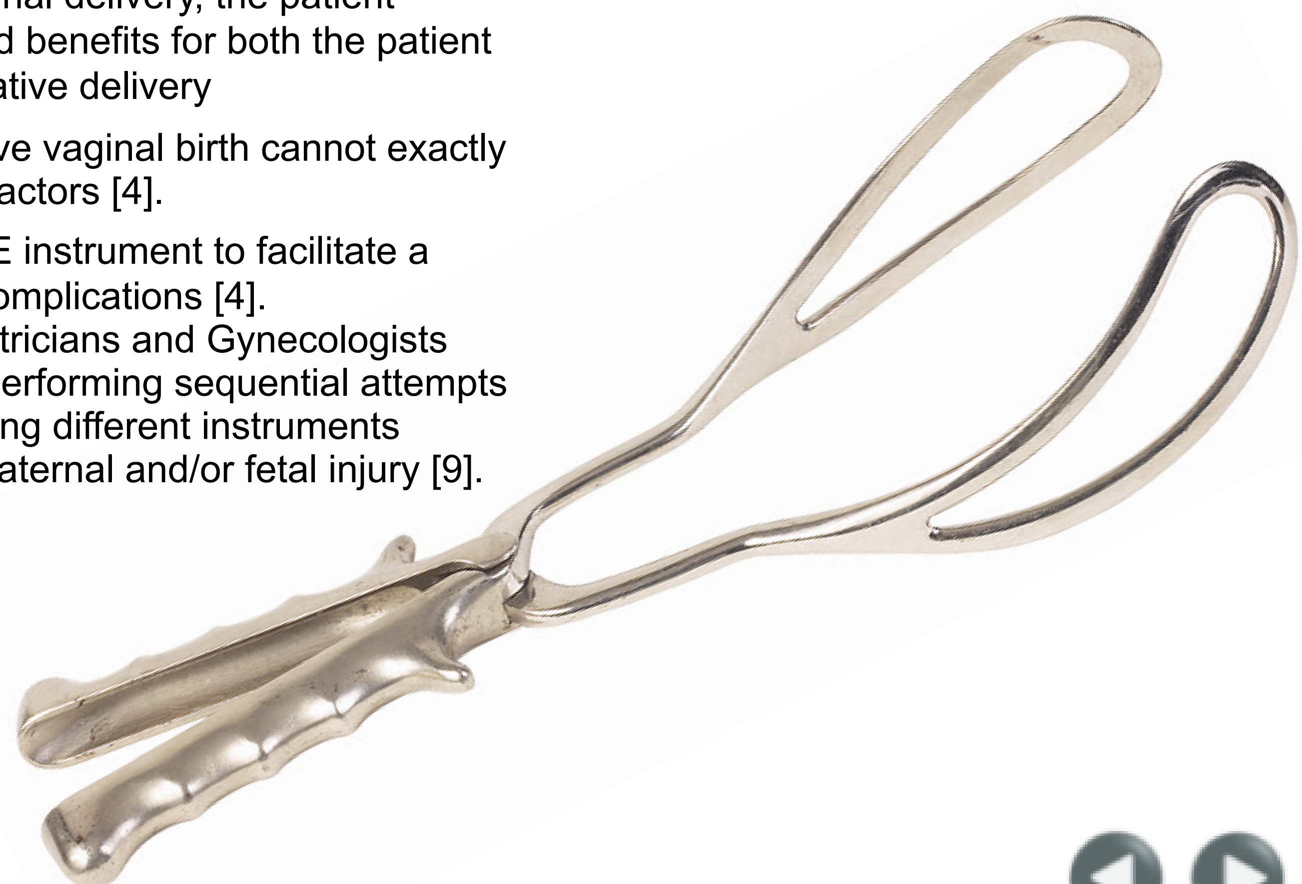
Benefits of Operative Delivery

- Avoids cesarean section
- Can potentially be accomplished more quickly than a cesarean section

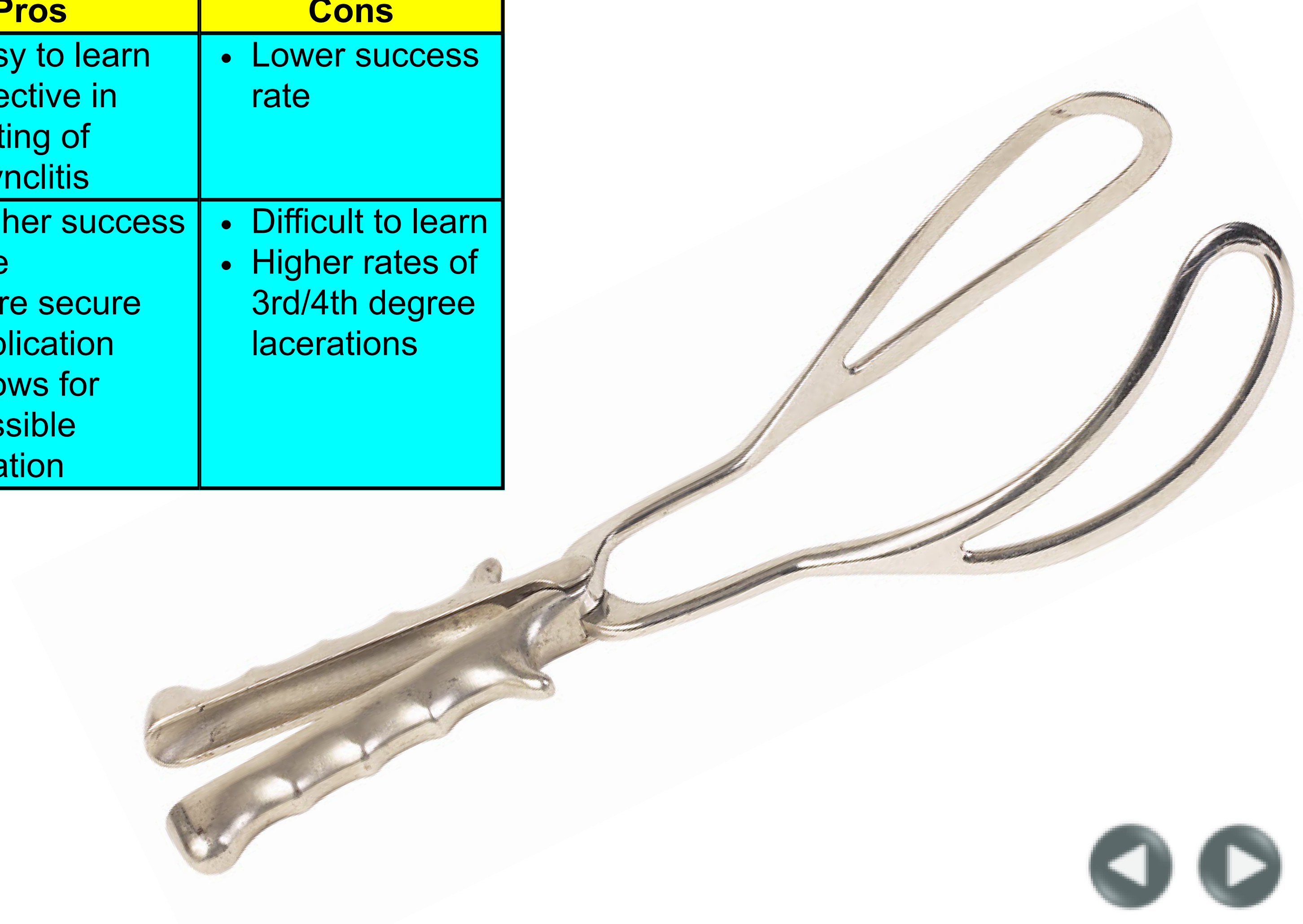
- Before an operative vaginal delivery occurs, an assessment should be performed to ascertain the chance of success.
  - Estimated fetal weight
  - Adequacy of maternal pelvis
  - Fetal station and position
  - Adequacy of anesthesia
- Variables associated with failure rates include occiput posterior (OP) presentation and macrosomia [3, 34-40].
- Other risk factors for failed operative delivery include:
  - Nulliparity
  - Higher station
  - Extreme molding of the fetal head
  - Maternal obesity
  - Abnormal labor progress



- The choice between forceps and vacuum typically depends on the clinical circumstance and operative preference based on experience and training.
- Prior to performing an operative vaginal delivery, the patient should be counseled on the risks and benefits for both the patient and the fetus of both modes of operative delivery
- The success or failure of the operative vaginal birth cannot exactly be predicted by pre-procedural risk factors [4].
- The skilled provider must select ONE instrument to facilitate a successful vaginal birth to prevent complications [4].
    - The American College of Obstetricians and Gynecologists (ACOG) recommends against performing sequential attempts at operative vaginal delivery using different instruments because of increased risk for maternal and/or fetal injury [9].

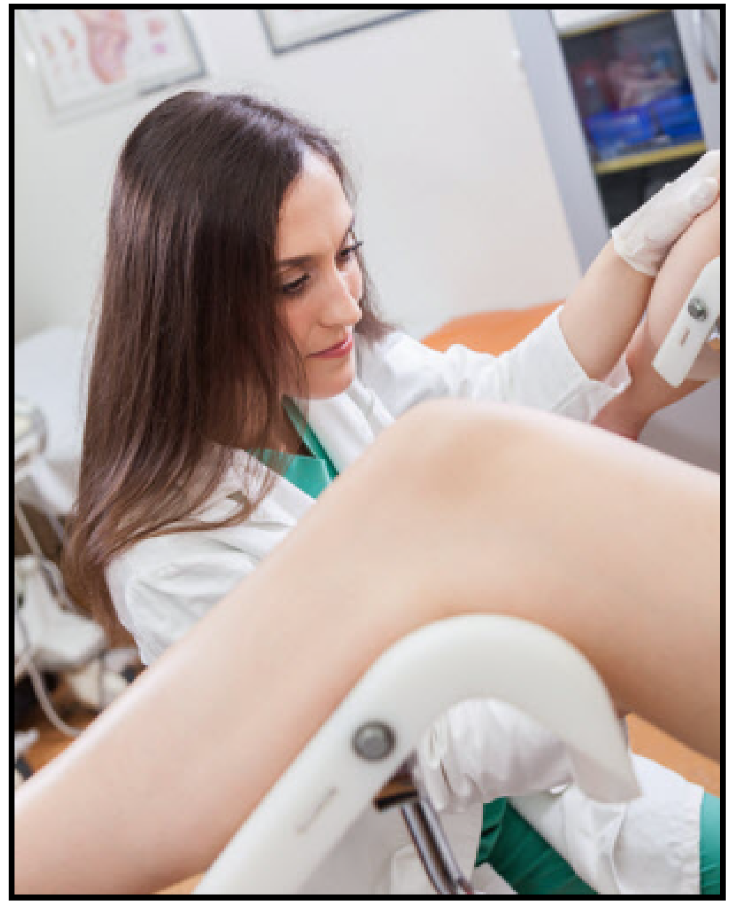


	Pros	Cons
Vacuum	• Easy to learn • Effective in setting of asynclitis	• Lower success rate
Forceps	• Higher success rate • More secure application • Allows for possible rotation	• Difficult to learn • Higher rates of 3rd/4th degree lacerations



Maternal Complications of Operative Vaginal Delivery

- Increased risk of 3rd/4th degree laceration [42, 45].
    - 6x increased risk with forceps
    - 2x increased risk with vacuum
- No difference in rates of bowel or urinary dysfunction at 5 years postpartum [14-19, 41-44, 46-48].



Fetal Complications of Operative Vaginal Delivery

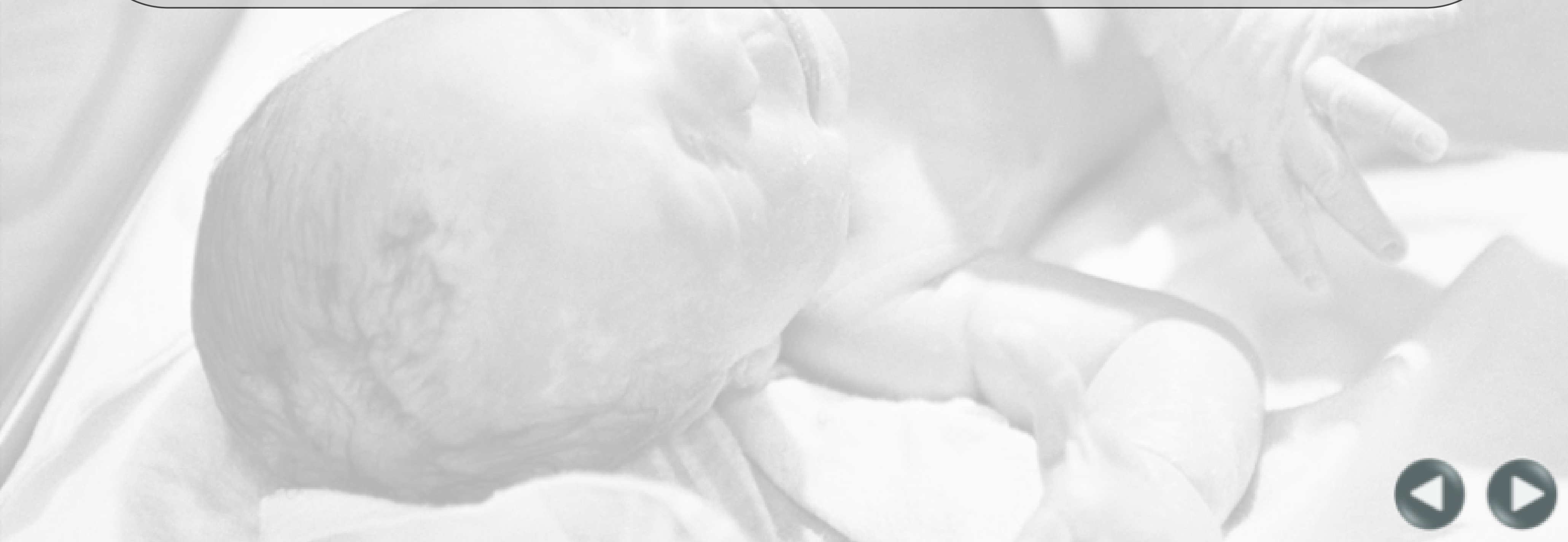
- Overall risk of neonatal complications is <1%
- The rate of major morbidity and mortality of either modality is not substantially greater than C/S performed following labor
- Compared to C/S, vacuum delivery is associated with slightly increased rates of:
  - Cephalohematoma
  - Subgaleal hemorrhage
  - Scalp laceration
  - Skull fracture
  - Brachial plexus injury

- Compared to C/S, forceps delivery is associated with slightly increased rates of:
  - Facial lacerations
  - Facial nerve palsy
  - Corneal abrasions
  - External ocular trauma
  - Skull fracture
  - Intracranial hemorrhage [5-7].

- No difference in rates of:
  - Central neurologic complications
  - Neonatal encephalopathy
  - Neonatal death

Contraindications to Operative Vaginal Delivery

- Unengaged fetal head
- Unknown position of fetal head
- Fetus with suspected or known skeletal dysplasia
- Fetus with suspected or known blood dyscrasia [7, 8, 23, 32].



- An operative vaginal birth may be considered when the likelihood of success is present. If safety is a concern, cesarean delivery is the better option.
- The health care provider must have the appropriate training, experience, and ability to use the selected instrument.
- Appropriately skilled personnel should be in attendance to provide ongoing care to the mother during the procedure and to the neonate following delivery.

Indications for Operative Vaginal Delivery

- Nonreassuring fetal status that is suspicious for fetal compromise.
  - Operative vaginal delivery may expedite the delivery if criteria are appropriate for vacuum or forceps use; otherwise, a c/s delivery may be more effective and safer.
- Maternal cerebral vascular disease (CVD), cardiac or neurological, or cystic lung disease where Valsalva maneuver is contraindicated.
- Inadequate progress of labor or lack of effective pushing technique by the mother.
- Prolonged second stage of labor with no descent over a period of:
  - 2 hours for multiparous patient without epidural
  - 3 hours for multiparous patient with epidural or nulliparous patient without epidural
  - 4 hours for nulliparous patient with epidural

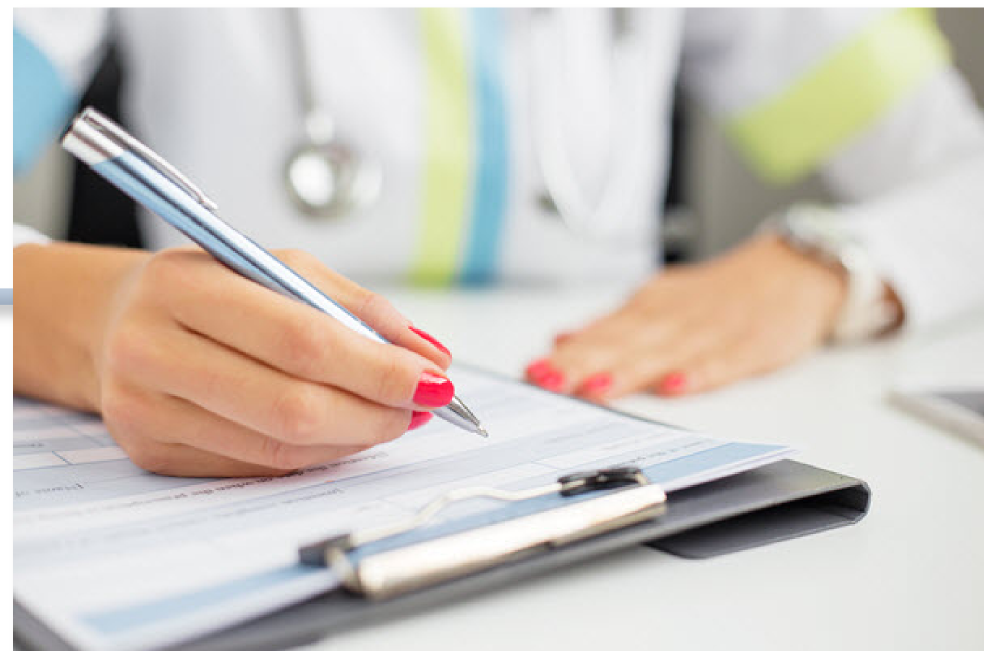
- It is very important to have informed consent prior to using an instrument to facilitate a vaginal birth.
- This must include the risks and benefits of the instruments use and the understanding that an immediate c/s may be necessary if complications to mother and/or fetus arise.
- Prior to performing an operative vaginal delivery, informed consent must be obtained.

Requirements for Operative Vaginal Delivery

- The woman's bladder should be emptied to prevent injury during instrumentation use. If she cannot empty the bladder on her own, a straight catheter should be used.
  - If a catheter is used, it should be promptly removed to prevent maternal urinary tract injury.
- A digital pelvic exam should be performed to ensure complete dilation of the cervix.
- Evaluate that the fetus is engaged in the vertex presentation and is at an appropriate station for operative delivery.
  - Criteria to be considered should include fetal size, extreme molding or caput, extension of the fetal head, asynclitic fetal presentation, and maternal pelvic deformities or CPD.
  - Ultrasound evaluation may help with this assessment [10].
- The labor pattern should demonstrate an adequate contraction pattern and the membranes should be ruptured.
  - Prophylactic antibiotics are not indicated [49].
  - Routine episiotomy should not performed.
- Appropriate anesthesia
- Ensure that the patient is willing and arrangements are in place to perform a C/S if operative delivery is not successful or if complications occur.

Requirements for Operative Vaginal Delivery

- Fully dilated cervix
- Ruptured membranes
- Engaged fetal head
- Known position of fetal head
- Known estimated fetal weight
- Adequate maternal pelvis
- Empty maternal bladder
- Informed consent obtained
- Willingness and ability to proceed with C/S if operative delivery unsuccessful

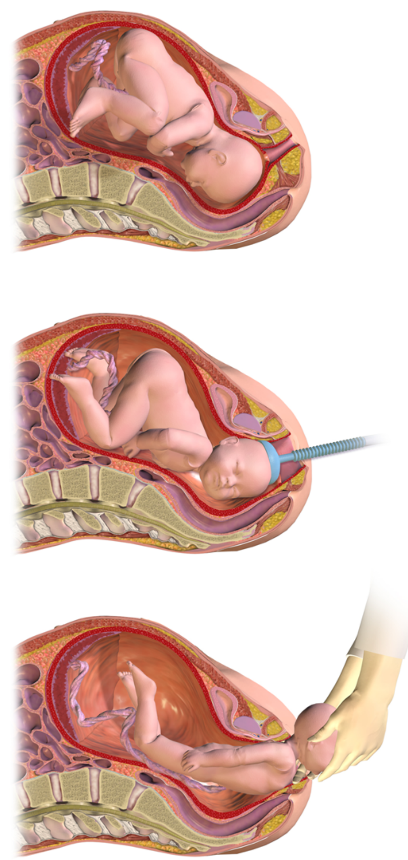


Vacuum-assisted Vaginal Delivery

Vacuum Cups

- May be soft or rigid
- May be bell or mushroom or "M" shaped
- Sizes vary by manufacturer
- Any size may be used for late preterm or term fetus that meets criteria for vacuum assisted delivery
- Numerous trials have compared the soft versus rigid cups. A Cochran analysis of data included nine trials of 1375 women and noted the soft cups more frequently failed to achieve vaginal delivery, but caused less scalp injury than rigid cups, but no difference in terms of maternal injury [29].
- When applying to the fetal head, the cup should be placed 2 cm anterior to the posterior fontanelle and centered over the sagittal suture, ensuring that no maternal tissue is included

Vacuum-assisted Delivery



Soft Vacuum Cups

- The soft cup is more appropriate for an uncomplicated delivery.

Click here to view images and more information on soft cup vacuums.

Rigid Vacuum Cups

- Rigid vacuums are made of metal or a firm plastic, are mushroom-shaped, and vary from 40 to 60 mm in diameter.
- A suction device is attached to the cup via a peripherally located vacuum port.
- This type of cup is to be considered for a more difficult delivery such as OP, a transverse lie, and the more difficult occiput anterior (OA) deliveries [11].
- Vacuum cups can be disposable or reusable.
- This rigid device is less likely to become detached.

Click here to view images comparing soft and rigid vacuum cup.

Soft Vacuum Cups

- The soft cup is more appropriate for an uncomplicated delivery.

Rigid Vacuum Cups

- Rigid vacuums are ma
and vary from 40 to 60
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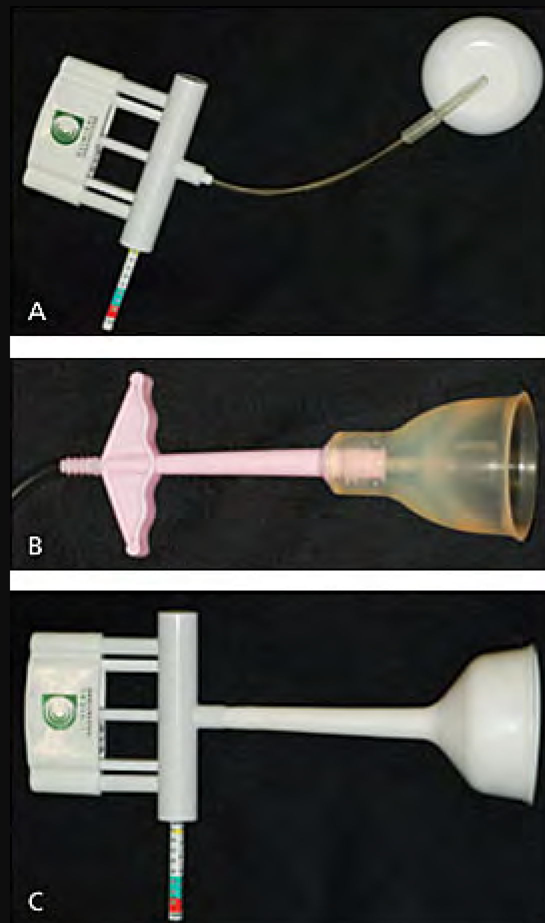
*images comparing
um cup.*

Soft Cup Vacuums:

- Soft cups are more appropriate for an uncomplicated occiput anterior (OA) presentation because less traction is needed.
- Failures with the soft cup are most likely related to detachment [29].
- Features of the soft cup include:
  - A handle for traction.
  - A combined vacuum pump and handle device or a vacuum port for a vacuum hose attachment.
    - Suction can be generated with an electrical suction device or manually with a hand held device which can be activated by either the provider or an assistant.
  - A fixed guard inside of the vacuum cup for safety.
  - The soft vacuum cups are made of silicone, plastic, polyethylene, or rubber.
  - The shape may be bell or mushroom "M" shaped but are generally bell shaped.
  - Devices come with a traction force indicator to compare personal impression with an objective measurement of the force being used.

Click here to see images of soft cup devices.


A
B
C

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PMC full text: Rev Obstet Gynecol. 2009 Winter; 2(1): 5–17.

<< Prev   Figure 2   Next >>

Figure 2

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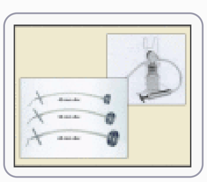
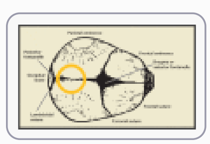
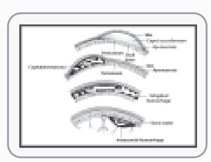
Types of vacuum cups. The 2 main types of hand-held disposable vacuum devices are shown: (A) The soft cup, which is pliable and funnel- or bell-shaped. (B) The rigid cup, which is firm and mushroom-shaped (M cup). They can be made of plastic, polyethylene, or silicone. The freely rotating stem of the hand-held device (shown as an arrow) prevents torque (rotation) of the cup and resultant cookie-cutter injuries to the fetal scalp.

Images in this article



Click on the image to see a larger version.

Typical steps for vacuum extraction

- After the vacuum is applied to the fetal head, with the onset of a contraction, the provider or assistant should apply suction.
- Traction should be maintained throughout the contraction.
- The nurse will indicate when the suction gauge has reached the appropriate level to assist with the delivery.
- The nurse or provider should apply suction to the recommended level.
- The procedure should be abandoned if delivery does not occur within 3 pulls or 15 to 20 minutes [10].

Forceps-assisted Vaginal Delivery

- Forceps may be considered for rotation of the fetal head when in a cephalic presentation or used to assist in the delivery of the after coming head during a breech delivery.
- Forceps are not to be applied if the cervix is not completely dilated or the fetal presenting part is not engaged [9, 30].
- When applying to the fetal head, the forceps should be evaluated to ensure that the sagittal suture is aligned with the shanks, the posterior fontanelle is one finger breadth above the shanks and the lambdoid sutures are equidistant from the forceps blades.

Outlet Forceps	• Used when the fetal head is visible at the vaginal introitus without separating the labia majora, or the fetal head is on or at the perineum, and the fetal presentation is right or left occiput anterior or posterior position. • Rotation does not exceed 45 degrees [9, 30].
Low Forceps	• Used when the fetal skull is +2 cm station or 2 cm or more beyond the ischial spines. • Rotation is required if the fetal head requires >45 degrees of rotation [9, 30].
Midforceps	• Used when the fetal head is engaged but is higher than +2 cm station relative to the ischial spines [9, 30]. • Use of midforcep delivery is only appropriate in selected clinical scenarios.

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The type and placement of forceps will be determined based on maternal and fetal factors.

Correct placement is important to prevent both maternal and fetal injury.

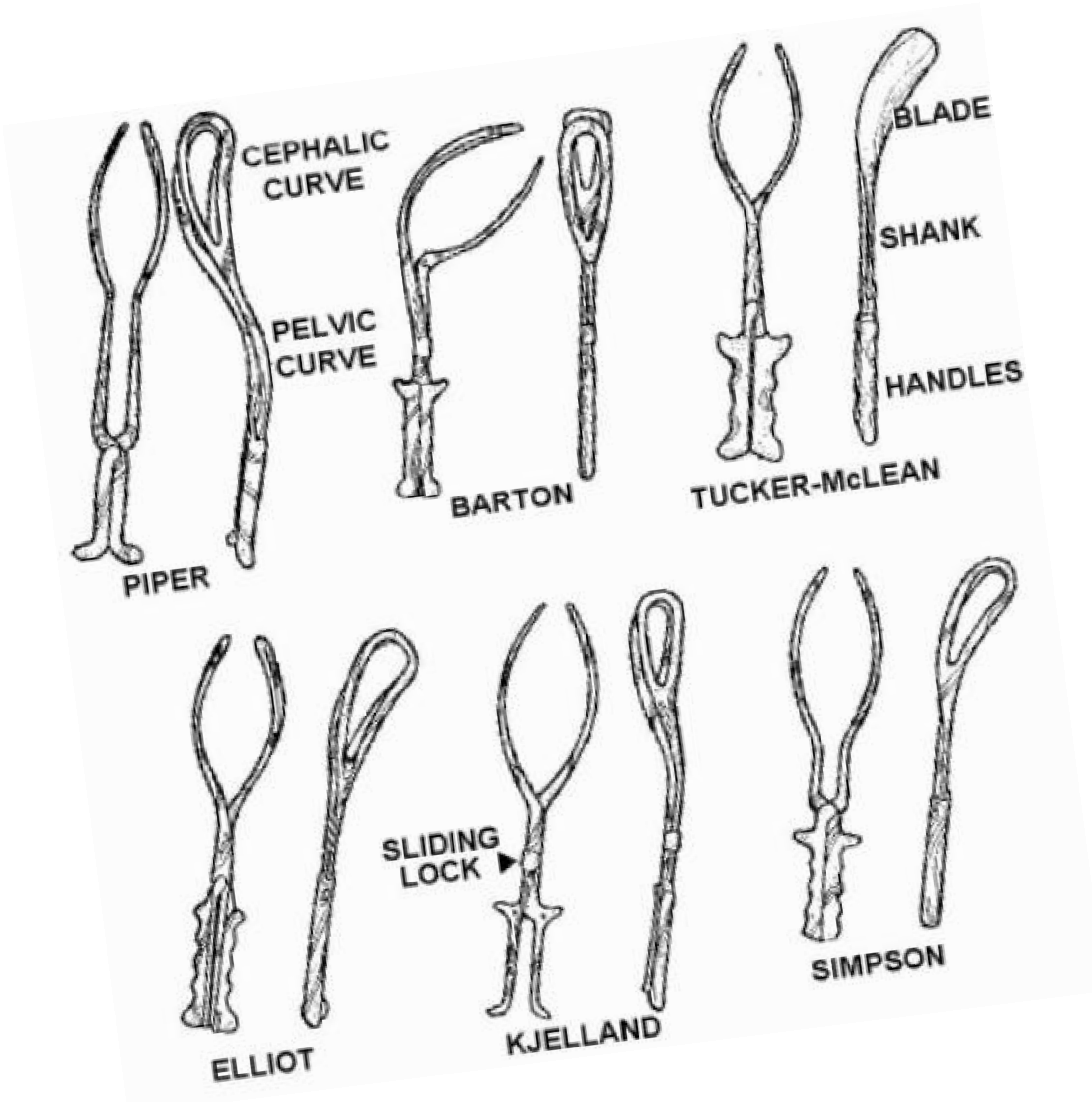
Click the titles on the right to view additional images.

Types of Forceps

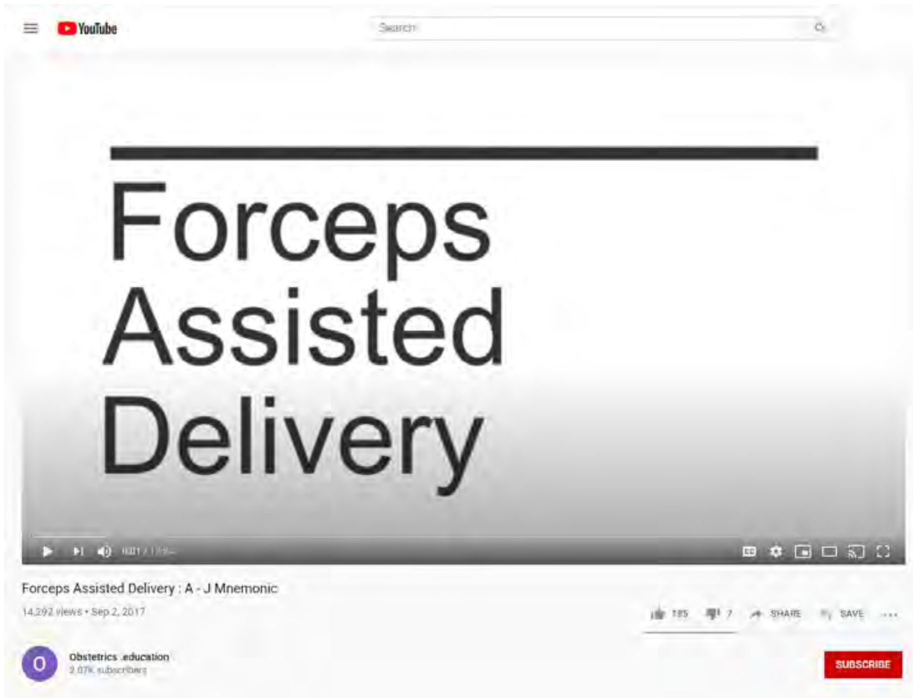
Placement of Forceps 1

Placement of Forceps 2

Types of Forceps



Forceps Assisted Delivery



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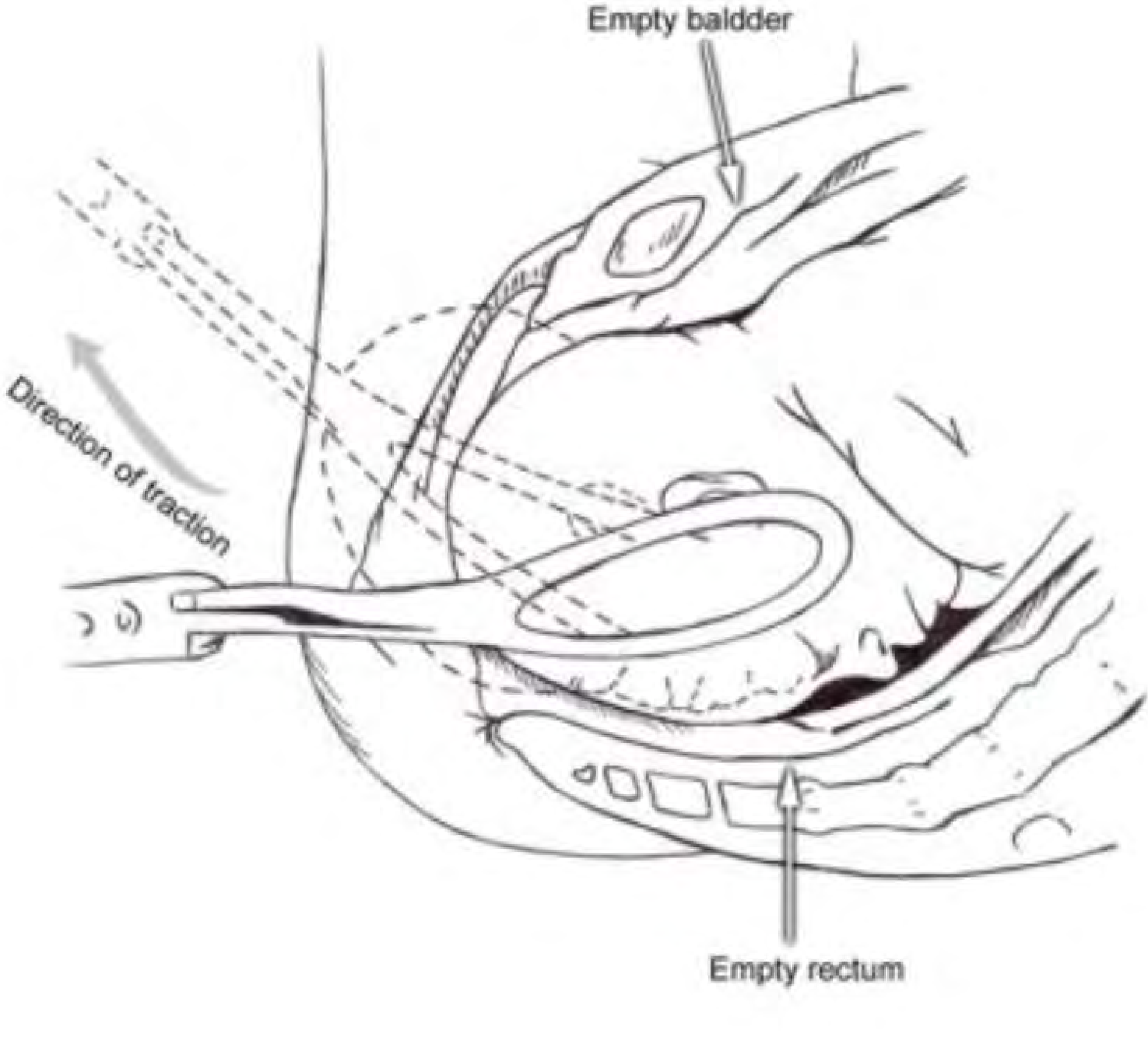

Empty baldder
Direction of traction
Empty rectum

- The type of forceps selected is based upon:
  - Size and shape of the fetal head
  - Size and shape of the maternal pelvis
  - The indication for forceps to facilitate delivery
  - Provider preference and experience
- To reduce the risk of lacerations to the fetus, confirmation of appropriate application is necessary prior to applying traction.
- To reduce risk of maternal lacerations, the forceps should be removed when expulsion of the fetal head is assured but before the widest diameter of the fetal head passes the vaginal introitus.

- Forceps requires the provider to use steady movement following the birth canal, and limiting any rocking motion [10].
- Traction should occur with maternal pushing efforts and be released in between contractions [13].
- Rotation of the fetus is associated with higher risk of complications for the fetus and woman when compared to use for traction.
- Progress should be noticed with the first two pulls [12].
  - Forceps should be abandoned if descent does not occur in this time frame.
  - Some experts suggest abandoning the procedure if delivery has not occurred within 15 to 20 minutes or after three pulls [10].

What if operative delivery is unsuccessful?

- There is increased risk of intracranial injury when vacuum, forceps, and c/s occur in combination [9].
- When operative delivery fails to achieve a vaginal delivery, ACOG recommends against repeat operative delivery with a different modality due to increased maternal and fetal risks of complications.
    - Fetal risks include increased intracranial injury
    - Maternal risks include increased rates of 3rd and 4th degree lacerations and postpartum hemorrhage [9, 13].
    - If attempted operative delivery fails, C/S is recommended

Complications of Operative Delivery

Complications are dependent on:

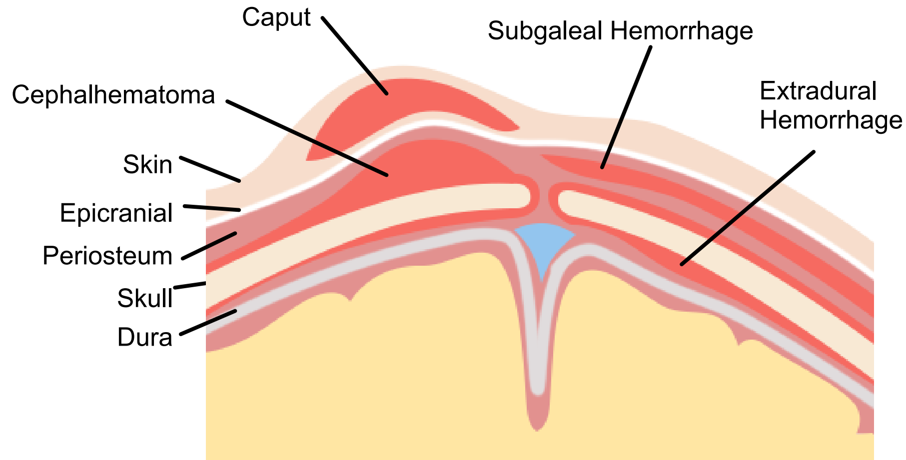
- Maternal parity
- Position/placement of the forceps or vacuum
- Fetal station
- Head position at the time of application
- Provider experience

Complications of Operative Delivery

- Maternal complications:
  - Increased pain during delivery and postpartum
  - Vaginal lacerations including third and fourth degree lacerations
  - Cervical lacerations
  - Vulvar and/or vaginal hematomas
  - Urinary incontinence or retention
  - Anal incontinence
  - Anemia related to blood loss [14-20]
- Rectal injury is greater for operative delivery when the fetus is in the OP position compared to OA [20].
- Readmission to the hospital is greater due to complications following operative delivery [14-20].

Complications of Operative Delivery

Fetal Complications associated with Vacuum Delivery

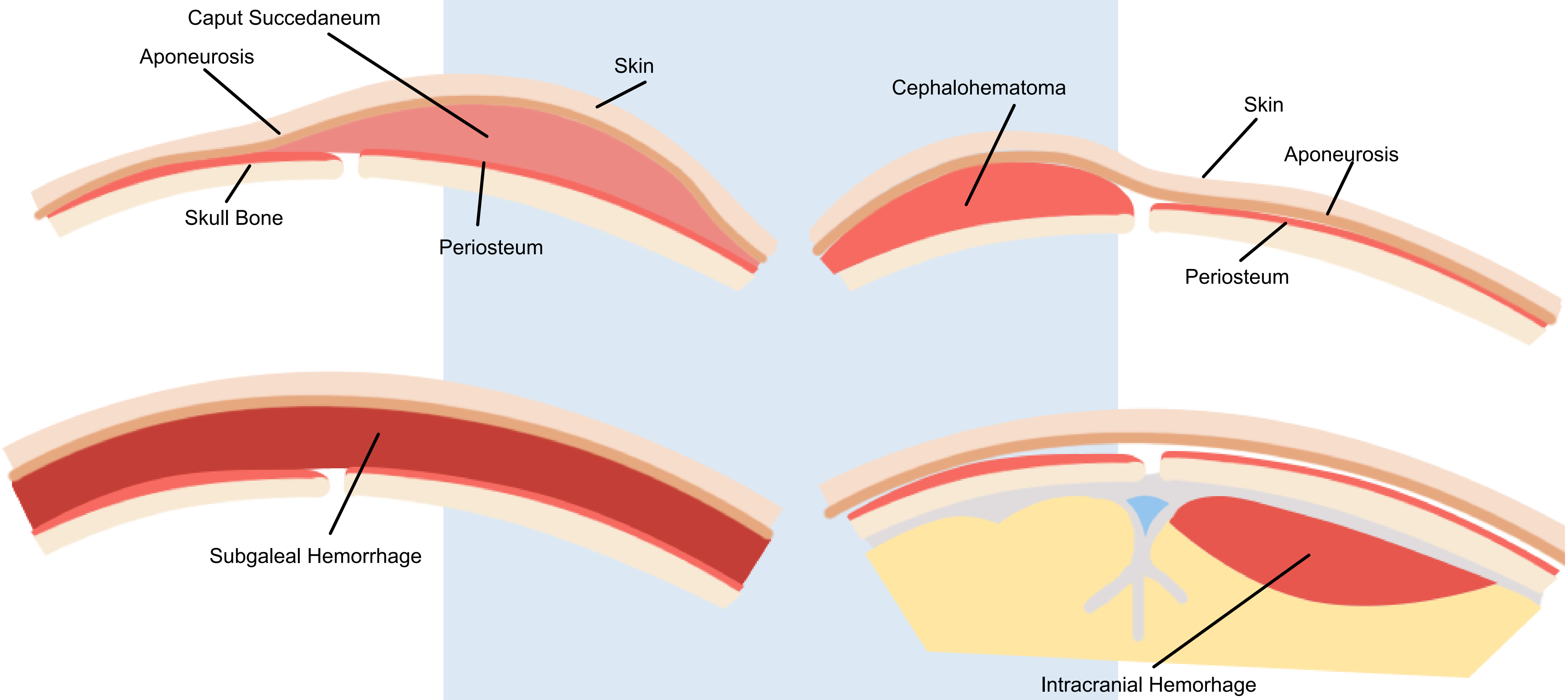


- Intracranial hemorrhage [22]
- Scalp abrasions
- Lacerations
- Cephalohematoma
- Subgaleal hematoma
- Retinal hemorrhage
- Hyperbilirubinemia
- Skull fracture [23-25]
- Shoulder dystocia is more common with vacuum assisted deliveries [22, 26, 31].

Complications of Operative Delivery

- Fetal Complications associated with Forceps Delivery
  - Skin lacerations
  - Bruising
  - External ocular injury/trauma
  - Intracranial hemorrhage
  - Subgaleal hematomas
  - Hyperbilirubinemia
  - Retinal hemorrhage
  - Nerve injury
  - Skull fracture
  - Death [8, 27, 28, 32]
- Long term effects of vacuum or forceps use on the fetus does not demonstrate a difference in child development [24].

Complications of Operative Delivery
Fetal Complications associated with Operative Delivery



The provider must be trained and skilled in the use of the vacuum or forceps prior to use.

Risks and benefits of operative delivery need to be evaluated against c/s delivery.

Click each box for more information.

Prior to attempted operative delivery, evaluate for:

- Complete cervical dilation
- Ruptured membranes
- Fetal presentation, engagement, station and position
- Maternal anesthesia adequacy
- Empty maternal bladder
- Ensure gestational age is appropriate for instrumentation
- Fetal bleeding diathesis or demineralization disorder

Click each box for more information.

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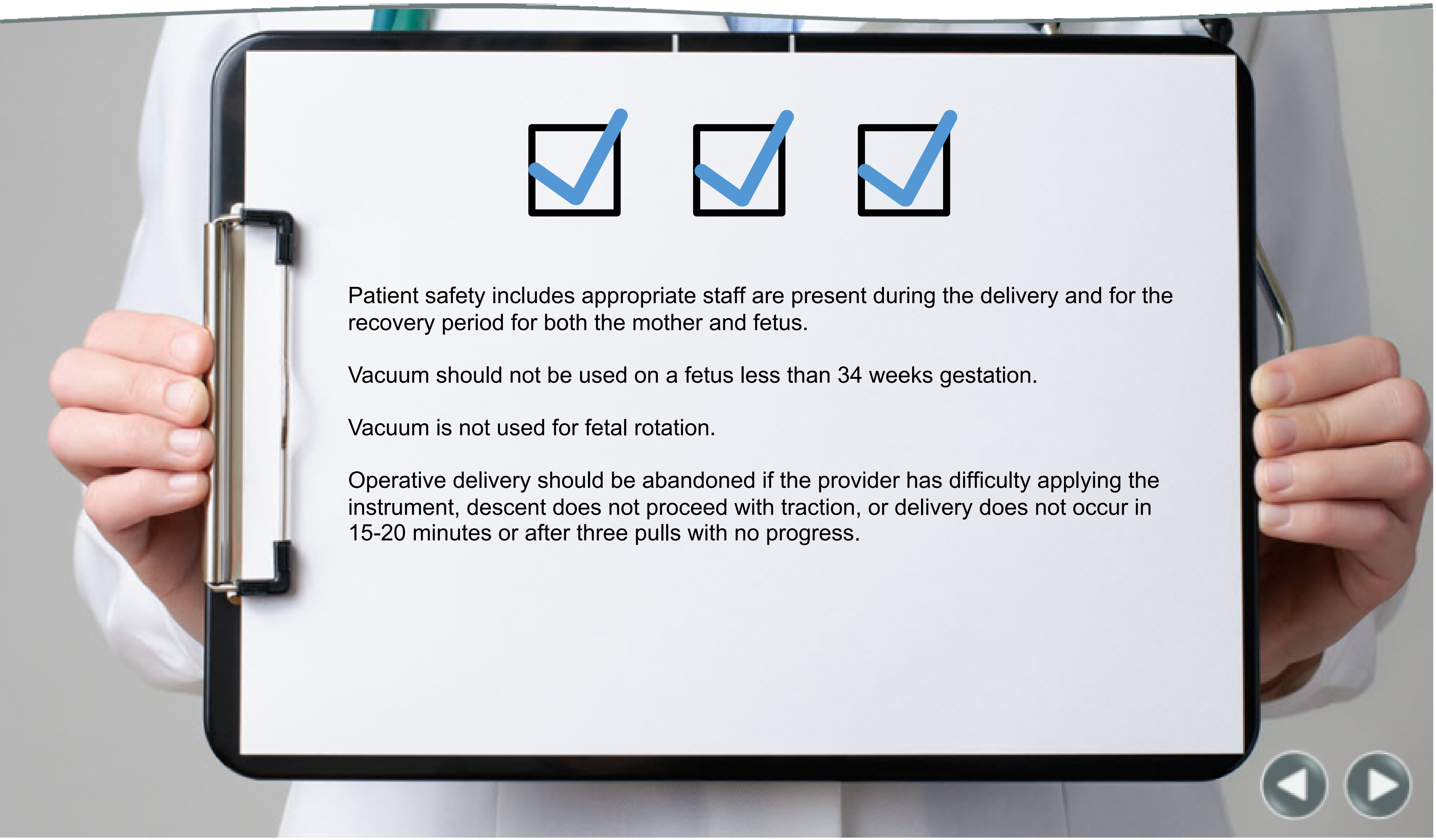

Congratulations!

You have successfully completed this module.

Click on the above 'X' to take the post-test for this course. If you do not attain a passing score after two attempts at the post-test the entire program must be repurchased.

1. Martin JA, Hamilton BE, Osterman MJK, Driscoll AK, Drake P. Births: Final Data for 2017. Natl Vital Stat Rep. 2018;67(8):1.

2. Clark SL, Belfort MA, Hankins GD, Meyers JA, Houser FM; Variation in the rates of operative delivery in the United States. Am J Obstet Gynecol. 2007;196(6):526.e1.

3. Murphy DJ, Liebling RE, Verity L, Swingler R, Patel R, Early maternal and neonatal morbidity associated with operative delivery in second stage of labour: a cohort study. Lancet. 2001;358(9289):1203.

4. Palatnik A, Grobman WA, Hellendag MG, et al. Predictors of Failed Operative Vaginal Delivery in a Contemporary Obstetric Cohort. Obstet Gynecol 2016; 127:501.

5. Vacca A. Vacuum-assisted delivery. OBG Manag 2004; Suppl:S1.

6. Watts P, Maguire S, Kwok T, Talabani B, Mann M, Wiener J, et al. Newborn retinal hemorrhages: a systematic review. J AAPOS 2013.

7. Gei AF, Belfort MA. Forceps-assisted vaginal delivery. Obstet Gynecol Clin North Am 1999; 26:345.

8. Dupuis O, Silveira R, Dupont C, Mottolese C, Kahn P, Dittmar A, et al. Comparison of "instrument-associated" and "spontaneous" obstetric depressed skull fractures in a cohort of 68 neonates. Am J Obstet Gynecol 2005;192(1):165-70.

9. Committee on Practice Bulletins Obstetrics. ACOG Practice Bulletin No. 154 Summary: Operative Vaginal Delivery. Obstet Gynecol 2015; 126:1118. Reaffirmed 2018.

10. Edozien, L.C. Towards safe practice in instrumental vaginal delivery. Best Pract Res Clin Obstet Gynaecol, 2007; 21:639.

11. O'Mahony, F., Hofmeyr, G.J., Menon, V. Choice of instruments for assisted vaginal delivery. Cochran Database. Syst Rev 2010; CD005455.

12. Sjostedt, JE. The vacuum extractor and forceps in obstetrics. Acta Obstet Gynecol Scand. 1967; 46 Suppl 10:Suppl.

13. Fong, A., Wu, E., Pan, D. et al. Temporal trends and morbidities of vacuum, forceps, and combined use of both. J Maternal Fetal Neonatal Med, 2014; 27:1886.

14. Liu S, Heaman M, Joseph KS, et al. Risk of maternal postpartum readmission associated with mode of delivery. Obstet Gynecol 2005; 105:836.

15. Meyer S, Schreyer A, De Grandi P, Hohlfeld P. The effects of birth on urinary continence mechanisms and other pelvic-floor characteristics. Obstet Gynecol 1998; 92:613.

16. Meyer S, Hohlfeld P, Achtari C, et al. Birth trauma: short and long term effects of forceps delivery compared with spontaneous delivery on various pelvic floor parameters. BJOG 2000; 107:1360.

17. Fitzpatrick M, Behan M, O'Connell PR, O'Herlihy C. Randomised clinical trial to assess anal sphincter function following forceps or vacuum assisted vaginal delivery. BJOG 2003; 110:424.

18. Pretlove SJ, Thompson PJ, Toozs-Hobson PM, et al. Does the mode of delivery predispose women to anal incontinence in the first year postpartum? A comparative systematic review. BJOG 2008; 115:421.

19. Friedman AM, Ananth CV, Prendergast E, et al. Evaluation of third-degree and fourth-degree laceration rates as quality indicators. Obstet Gynecol 2015; 125:927.

20. Damron DP, Capeless EL. Operative vaginal delivery: a comparison of forceps and vacuum for success rate and risk of rectal sphincter injury. Am J Obstet Gynecol 2004; 191:907.

21. Johanson, R.B., Heycock, E., Carter, J., et al. Maternal and child health after assisted vaginal delivery; five-year follow up of a randomised controlled study comparing forceps and ventouse. Br J Obstet Gynaecol 1999; 106:544.

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

23. Towner, D., Castro, M. A., Eby-Wilkens, E., Gilbert, W. M. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. N Engl J Med 1999; 341: 1709.

24. Baskett, T. F., Fanning, C. A., Young, D. C. A prospective observational study of 1000 vacuum assisted deliveries with the Omni Cup device. J Obstet Gynaecol Can 2008; 30:573.

25. Wen, S. W., Liu, S., Kramer, M. S, et al. Comparison of maternal and infant outcomes between vacuum extraction and forceps deliveries. Am J Epidemiol 2001; 153:103.

26. Werner, E. F., Janevic, T. M., Illuzzi, J, et al. Mode of delivery in nulliparous women and neonatal intracranial injury. Obstet Gynecol 2011; 118:1239.

27. Gei, A. F., Belfort, M. A. Forceps-assisted vaginal delivery. Obstet Gynecol Clin North Am 1999; 26: 345.

28. Towner, D., Castro, M. A., Eby-Wilkens, E., Gilbert, W. M. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. N Engl J Med 1999; 341:1709.

29. Johanson R, Menon V. Soft versus rigid vacuum extractor cups for assisted vaginal delivery. Cochran Database Syst Rev 2000; :CD000446.

30. Hagadom-Freathy AS. Yeomans ER, Hankins GD. Validation of the 1988 ACOG forceps classification system. Obstet Gynecol 1991; 77:356.

31. Caughey AB, Sandberg PL, Zlatnik MG, et al. Forceps compared with vacuum: rates of neonatal and maternal morbidity. Obstet Gynecol 2005; 106:908.

32. Robertson PA, Laros RK Jr, Zhao RL. Neonatal and maternal outcome in low-pelvic and midpelvic operative deliveries. Am J Obstet Gynecol 1990; 162:1436.

33. Harrison MS, Saleem S, Ali S, et al. A Prospective, Population-Based Study of Trends in Operative Vaginal Delivery Compared to Cesarean Delivery Rates in Low- and Middle-Income Countries, 2010-2016. Am J Perinatol 2019; 36:730.

34. Gopalani S, Bennett K, Critchlow C. Factors predictive of failed operative vaginal delivery. Am J Obstet Gynecol. 2004;191(3):896

35. Al-Kadri H, Sabr Y, Al-Saif S, Abulaimoun B, Ba'Aqeel H, Saleh A. Failed individual and sequential instrumental vaginal delivery: contributing risk factors and maternal-neonatal complications. Acta Obstet Gynecol Scand. 2003;82(7):642.

36. Saropala N, Chaturachinda K. Failed instrumental delivery: Ramathibodi Hospital, 1980-1988. Int J Gynaecol Obstet. 1991;36(3):203.

37. Ben-Haroush A, Melamed N, Kaplan B, Yogev Y. Predictors of failed operative vaginal delivery: a single-center experience. Am J Obstet Gynecol. 2007;197(3):308.e1.

38. Olagundoye V, MacKenzie IZ. The impact of a trial of instrumental delivery in theatre on neonatal outcome. BJOG. 2007;114(5):603.

39. Bhide A, Guven M, Prefumo F, Vankalayapati P, Thilaganathan B. Maternal and neonatal outcome after failed ventouse delivery: comparison of forceps versus cesarean section. J Matern Fetal Neonatal Med. 2007;20(7):541

40. Aiken CE, Aiken AR, Brockelsby JC, Scott JG. Factors influencing the likelihood of instrumental delivery success. Obstet Gynecol. 2014;123(4):796

41. Dell DL, Sightler SE, Plauché WC. Soft cup vacuum extraction: a comparison of outlet delivery. Obstet Gynecol 1985; 66:624.

42. Landy HJ, Laughon SK, Bailit JL, et al. Characteristics associated with severe perineal and cervical lacerations during vaginal delivery. Obstet Gynecol 2011; 117:627.

43. Macleod M, Strachan B, Bahl R, et al. A prospective cohort study of maternal and neonatal morbidity in relation to use of episiotomy at operative vaginal delivery. BJOG 2008; 115:1688.

44. Gurol-Urganci I, Cromwell DA, Edozien LC, et al. Third- and fourth-degree perineal tears among primiparous women in England between 2000 and 2012: time trends and risk factors. BJOG 2013; 120:1516.

45. Angioli R, Gómez-Marín O, Cantuaria G, O'sullivan MJ. Severe perineal lacerations during vaginal delivery: the University of Miami experience. Am J Obstet Gynecol 2000; 182:1083.

46. Damron DP, Capeless EL. Operative vaginal delivery: a comparison of forceps and vacuum for success rate and risk of rectal sphincter injury. Am J Obstet Gynecol 2004; 191:907.

47. Wu JM, Williams KS, Hundley AF, et al. Occiput posterior fetal head position increases the risk of anal sphincter injury in vacuum-assisted deliveries. Am J Obstet Gynecol 2005; 193:525.

48. Benavides L, Wu JM, Hundley AF, et al. The impact of occiput posterior fetal head position on the risk of anal sphincter injury in forceps-assisted vaginal deliveries. Am J Obstet Gynecol 2005; 192:1702.

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49. Liabsuetrakul T, Choobun T, Peeyananjarassri K, Islam QM. Antibiotic prophylaxis for operative vaginal delivery. Cochrane Database Syst Rev. 2017;8:CD004455. Epub 2017 Aug 5.