Operative Vaginal Deliveries

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History

- Chamberlen Family
  - Developed first forceps which were maintained as a family secret
  - Peter the Elder 1628 – surgeon to Queen Henrietta Maria, wife of Charles I
  - Peter the Younger
    - Member of Royal College of Physicians 1628
    - 3 sons became Obstetricians & continued the practice of forceps - Paul, John, Hugh Sr.
History

- Hugh Chamberlen Sr.
  - 1670 - Tried to sell family secret to Francois Mauriceau w/ Parisian govt.
  - 1673 - May have sold instruments to Dutch Ob that then instituted use in Medical-Pharmacological College of Amsterdam

- Hugh Jr.
  - Prominent English Ob
  - Released family secret in 1720

- 1733 forceps noted to be in common use
History

- Jean Palfyn (1650-1730)
  - Parallel branch forceps
- Vectis blade
  - Could be used as a lever at shoulder dystocia
  - Tractor with fenestration hooked over fetal head or chin
- William Smellie (1697-1763)
  - One of first Obs to study and teach forceps
  - Credited w/ “English lock” & addition of the pelvic curve
History

- By mid-18th century faulty use of forceps lead to more cautionary practice
- William Hunter – proponent of conservative mgmt & “leaving to nature”
  - Approach lead to death of 21yo Princess Charlotte and her baby in 1817, destroying two generations of heirs to British thrown
- Antoine Dubois applied forceps for the entrapped after-coming head of Napolean Bonaparte’s son
History Vacuum

- Sir James Young Simpson 1849
  - “suction traction”
  - First described for use for depressed skull fractures in 1632
  - 1694 vacuum device described in assisted birth at Plymouth

- Malström 1953
  - Steel cup, chain for traction, suction hose attached to pump, and pressure gauge
Incidence of Operative Vag Deliveries

- 3.5% of all deliveries are operative vaginal
  - Lowest rates in the Northeast
  - Highest rates in the South
- Overall rate is decreasing
  - Residency graduates average 5-9 procedures
- Proportion of vaginal deliveries performed by vacuum is increasing
  - In 1992, the number of vacuum deliveries surpassed forceps
  - Today, vacuums (4%) performed at 4x the rate of forceps (1%)
Forceps – Basic Design

Diagram showing the basic design of forceps, including parts such as Toe, Blade, Fenestration, Pelvic Curve, Heel, Shank, Lock, and Handle.
Outlet Forceps

- **Simpson**
  - Have both pelvic and cephalic curve
  - Elongated and flattened cephalic curve
  - Parallel shanks – better for multips
  - Well-molded heads of term infants

- **Elliott (eg, Tucker-McLane)**
  - Pelvic and cephalic curve
  - Overlapping shanks – better for nullip
  - More rounded cephalic curve – less ideal for very molded head
  - Original Elliotts have a tensioning screw on handle
Modifications

- **Tucker-McLane**
  - Elliot forceps with no screw

- **Kielland**
  - No pelvic curve
  - For rotational maneuvers

- **Luikart Modification**
  - Pseudo-fenestration
    - Less likely to slip during traction then solid blade
    - Inserts easier like a solid blade
Commonly Used Forceps

**Simpson forceps**
- The most commonly used types of forceps in outlet delivery.
- Has elongated cephalic curve.
- These are used when there is substantial molding of the fetal head.

**Elliot forceps**
- Has adjustable pin for regulating the lateral pressure on the handles.
- They are used most often when there is minimal molding.
- More suitable for outlet delivery.

**Kielland forceps**
- Has small pelvic curve and a sliding lock.
- Suitable for head with little molding.
- The most common forceps used for rotational delivery.
- Helps correct asynclitism.

**Piper's forceps**
- Distinct perineal curve.
- Allows for application to the after-coming head in breech delivery.

**Tucker-McLane Forceps**
- Suitable for fetal head with little molding.
- Used in rotational delivery.

**Braton Forceps and Traction Handle**
- Rotational delivery.
- Most importantly used for delivery of OT positions in a platypelloid pelvis.
Commonly Used Forceps

- Tucker-McLane
- Simpson
- Elliot
- Kielland
- Barton
- Piper
- Bailey-Williamson
Application of Forceps

Application of Obstetric Forceps

The left handle of the forceps is held in the left hand. The blade is introduced into the left side of the pelvis between the fetal head and fingers of the operator’s right hand.

Continued insertion of the left blade. Note the arc of the handles as they rotate to be applied to the mother’s left.

Application Cont’d

First blade in situ.

Blades symmetrically placed and articulated along occipitomental diameter.
Application of Forceps

**Gentle Traction**

With intermittent traction, as the vulva is distended by the occiput, an episiotomy may be performed if indicated.

Additional horizontal traction is applied, and the handles are gradually elevated, as the handles are raised, the head is extended.

**Delivery of the Head**

Upward traction is continued as the head is delivered.

Forceps may be disarticulated as the head is delivered. Modified Ritgen maneuver may be used to complete delivery of the head.
Vacuum Options
## Choice of Vacuum Cup – no “Ideal”

### Soft
- Plastic, silicone, rubber, polyethylene
- Usually bell shaped
- Appropriate for uncomplicated OA deliveries
- Less traction
  - Possibly less risk of scalp injury

### Rigid
- Plastic, polyurethane, polyethylene
- Often mushroom shaped
- More suitable for OP, OT, and difficult OA deliveries
- Increased traction
Indications for Operative Vaginal Delivery

- Prolonged Second Stage (4hr / 3 / 3 / 2)
  - Per ACOG, w/ improved fetal surveillance, length of labor alone is not a strong indication
- Suspicion of immediate or potential fetal compromise
- Maternal Indications
  - Cardiac
  - Neurologic
  - Contraindications to Valsalva
Contraindications to Operative Vag Delivery

- Vacuum contraindicated before 34 weeks
  - Due to risk of IVH
- Fetal demineralizing disease (e.g., osteogenesis imperfecta)
- Fetal bleeding diatheses (e.g., hemophilia, alloimmune thrombocytopenia, or vWD)
- Fetal head is unengaged
- Malpresentation (e.g., brow, face)
- Unknown fetal position
Pre-Delivery Considerations

- Position – location of presenting occiput relative to maternal pelvis
- Presentation – cephalic
- Lie – longitudinal, oblique, or transverse
- Engagement – relationship when BPD has passed beyond the plane of the pelvic brim. Leading point of skull at or below ischial spines
- Asynclitism – relationship between the anterior & posterior parietal bones and the sagittal suture within the maternal pelvis.
- Clinical pelvimetry
Patient Preparation

- Empty bladder (void or catheterization)
- Confirm fetal position
- Dorsal lithotomy
- Adequate anesthesia (neuraxial / local / none [for vacuum])
Forceps Application

- Ghost or phantom application
- Confirm correct positioning of blades
  - Sagittal suture lies in midline
  - No more than a finger tip fits between fenestration and fetal head on either side
  - Posterior fontanelle no more than one finger breadth above plane of shanks
Criteria for Types of Forceps Deliveries

- **Outlet**
  - Scalp visible at introitus
  - Fetal skull has reached pelvic floor
  - Sagittal suture is in anteroposterior diameter or ROA/LOA, ROP/LOP <45°

- **Low Forceps**
  - Leading point of fetal skull at station ≥ +2 cm
  - Rotation is ≤ 45°
Criteria for Types of Forceps Deliveries

- **Mid-Forceps**
  - Engaged in the pelvic, but station is above +2 cm

- **High forceps**
  - Not classified
Choice of Instrument

**Forceps**
- Probably safer for fetus
- Unlikely to detach
- Can be used for prematurity
- Active rotation of fetal head

**Vacuum**
- Probably safer for mother
- Traction may be up to 50 lbs
- Torsion or rotation should not be applied
- Less need for regional anesthesia
Vacuum Application

- Flexion point
  - Outward traction flexes the neck, keeping the mentovertical diameter in the direction of the birth canal
- Midline, over sagittal suture
- Middle of cup is 6cm from ant. fontanelle, 3cm from posterior
Vacuum Application

- Place over the flexion point, symmetrically over the sagittal suture
- Sweep 360° to ensure no vaginal, cervical, or vulvar tissues are trapped btw cup & fetal surface
- Similarly, ensure cup isn’t placed over fontanelle
- May raise suction to 100-150 mmHg to maintain cup’s position
Vacuum Application

- Rapid application leads to reduced time to delivery
  - No differences in maternal or neonatal morbidity
- Increased risk of cephalohematoma with application-to-delivery times >5 min
- Reduce suction between contractions?
  - Time-to-delivery, failure, maternal lacerations, incidence of cephalohematoma, & neonatal outcomes are ALL SIMILAR
Vacuum Traction

- Pressures of 500-600 mmHg; but pressures in excess of 450 mmHg rarely necessary
Vacuum Traction

- Steady (no jerking or rocking)
- With contractions, along with maternal expulsive efforts
- Stem should be perpendicular to cup to maintain the seal
- Initial angle of traction is downward toward the floor
- Extend upward 45° above the floor as head emerges & crowns
- Allow handle to passively turn as head auto-rotates with descent
When to Abandon Further Attempts

- Progress should be noted within the first couple pulls
- Abandon procedure if...
  - Difficulty applying instrument
  - If descent does not easily proceed with traction
  - No delivery in reasonable time frame
Complications of Forceps

- Maternal – lacerations / hemorrhage
- Fetal
  - Cephalohematoma
  - Subgaleal Hematoma
  - Shoulder dystocia – brachial plexus
  - Retinal hemorrhage
  - Skull and facial fractures
  - Lacerations and ecchymoses
  - Intracranial hemorrhage
  - Spinal cord injury
  - Facial nerve palsy
  - Mortality
Complications of Vacuum

- Scalp lacerations if torsion is excessive
- Cephelohematoma (~14-16%)
  - Btw skull & periosteum. Does not cross suture lines.
- Subgaleal hematoma (~26-45 /1000 vacuum del)
  - Btw aponeurosis & periosteum. Potential for massive blood loss.
- Intracranial hemorrhage
  - Sub-dural/arachnoid, intraventricular, intraparenchymal
- Hyperbilirubinemia
- Retinal Hemorrhage (38%)
- Rate of serious complication ~5%
Complications of Vacuum
Documentation of Vacuum Delivery

- **Indication**
- **Fetal status (station, position, EFW, interpretation of FHR tracing)**
- **A record of discussion with patient**
  - Verbal / written consent
- **Pre-requisites were met**
  - Full cervical dilation
  - Empty bladder
  - No fetal contraindications
Documentation of Vacuum Delivery (cont)

- **Description of the procedure itself**
  - Anesthesia
  - Type of vacuum cup
  - Total time of vacuum application
    - Was suction reduced btw contractions
  - Maximum suction pressure
  - Number of pulls / contractions; Progress w/ each pull
  - Number of “Pop-offs”
  - Episiotomy / lacerations
Reasons for Failed Vacuum Deliveries

- Feto-pelvic disproportion
- Incorrect technique
  - Pulling too quickly
  - Poorly timed with maternal expulsive efforts
  - Upward traction prior to crowning
- Paramedian or Deflexing applications
- Large Caput Seccedaneum
  - Lessens total traction
Trial of Operative vaginal delivery??

- California study of 83,340 singleton infants born to nulliparous women
  - Higher incidence of intracranial hemorrhage and other birth trauma following failed operative vaginal deliveries
  - Unless preoperative assessment is highly suggestive of success, a trial is best avoided
Alternative Instruments after Failed Attempt?

- “Although studies are limited, the weight of available evidence appears to be against attempting multiple efforts at operative vaginal delivery with different instruments, unless there is a compelling and justifiable reason.”

- California study - intracranial hemorrhage rate highest in combined group
References