

Cesarean Section

Background

1. Definition

- Uterus exposed via entrance through abdominal cavity
- Peritoneum opened
- Uterus incised
- Delivery of baby and placenta
- Hemostasis achieved via closure of the uterus and abdominal wall

Indications

1. Maternal

- Cervical cerclage in place
 - Definition
 - Stitch placed high up around the cervix to help keep it closed
 - Lower genital tract obstruction
 - Malignancies
 - Vulvovaginal condylomas
 - Inflammatory bowel disease
 - Prior vaginal colporrhaphy
 - Definition
 - Surgical repair of a defect in the vaginal wall
 - Anal anatomy affected by disease
 - Genital herpes infection
 - Especially in females with active infection
 - HIV infections
 - Especially in females with high viral titers and low CD4 counts

2. Fetal

- Malpresentation
 - Abnormal positioning
 - Breech
 - Persistent posterior presentation
 - Congenital anomalies
 - Hydrocephalus
 - Skeletal dysplasias
 - Fetal neural tube defects
 - Nonreassuring fetal heart rate
 - Definition
 - Severe variable decelerations
 - Late decelerations
 - Sinusoidal wave patterning or lack of variability

3. Maternal and fetal indications

- Abnormal labor due to cephalopelvic disproportion
 - Definition
 - Fetus cannot negotiate the pelvic inlet
 - Suspect with macrosomia or slowly progressing labor
- Abnormal placentation
 - Placenta previa

- Uterine scar
 - Occurs with prior cesarean deliveries or prior myomectomies

Contraindications

1. Compromised maternal status
 - Severe pulmonary disease preventing use of anesthesia
2. Fetal karyotypic abnormalities
 - Trisomy 13
3. Congenital abnormalities
 - Anencephaly

Preoperative Details

1. Reason for cesarean section
 - Physician and pt must discuss why procedure is performed
2. Clinical assessment
 - Fasting for 8 hrs (elective procedures)
 - Intravenous fluids
 - Lactated Ringer's solution
 - Avoid excessive dextrose
 - Due to risk of cord hyperglycemia
 - Blood tests
 - Hemoglobin
 - Rhesus group and antibody screen
 - HIV, syphilis testing if high-risk patient
 - Antibiotic prophylaxis
 - Beneficial in both elective and non-elective procedures
 - Decrease in incidence of endometritis
 - Decrease in incidence of wound infections
 - Decrease in incidence of urinary tract infections
 - Antibiotic choice
 - Ampicillin and Cefazolin equally efficacious
 - Use of broad spectrum agents do not improve efficacy
 - Timing of administration
 - Given at cord clamp vs. preoperatively
 - No difference in infectious morbidity rates
 - Place on external fetal monitor, BP cuff, pulse oximetry
 - Place foley catheter
3. Anesthesia
 - Regional types
 - Subarachnoid block (spinal)
 - Most commonly used in women undergoing repeat cesarean delivery
 - Epidural
 - Most commonly used in women undergoing primary cesarean delivery
 - Generalized type
 - Utilized if airway establishment necessary
 - Most commonly used in urgent deliveries

- Risk of failed endotracheal intubation greater in pregnant versus non-gravid females
 - Regional vs. generalized
 - Regional anesthetics utilized more than generalized
 - Low procedure failure rate
 - Maternal mortality and serious morbidity rare
 - Procedure-related complications rare overall
4. Surgical prep
- Shave just prior to incision
 - Prep with alcohol or iodine scrub
 - Test level of anesthesia by grabbing skin bilaterally with Allis clamp

Intraoperative Details

1. Position

- Supine
 - Woman is positioned on her back without any tilt
- Lateral tilt
 - Tilting the woman towards her left side 10-15°
 - Avoids venal caval compression by uterus
- Lateral versus supine
 - Insufficient evidence to recommend for or against either position

2. Abdominal skin incision

- Vertical type
 - Midline
 - Incise skin between umbilicus and pubic symphysis
 - Advantages
 - Lack of vasculature
 - Disadvantages
 - Increased dehiscence
 - Development of incisional hernia
 - Increased scarring
 - Paramedian
 - Incise skin to the right of midline
 - Advantages
 - Stronger scar formation
- Transverse types
 - Pfannenstiel
 - Traditional incision utilized
 - Located two fingers-breadth above pubic symphysis
 - Curves upward within the folds of the skin ("smile" incision)
 - Maylard
 - Utilized if exposure is limited
 - Rectus abdominus muscles divided sharply
 - Incision length longer than Pfannenstiel
 - Cherney
 - Utilized if exposure is limited
 - Expose tendinous attachment of rectus abdominus muscle bodies to fascia of the pubis
 - Muscle is severed as low as possible

- Divide one or both muscle attachments as required
 - Vertical vs. transverse skin incision
 - Transverse type of incision recommended over vertical
 - Adequate for majority of cesarean deliveries
 - Less postoperative pain
 - Improved cosmetic effect
 - Decreased risk of incisional hernias
3. Uterine incision
- Transverse
 - In >90% of c-sections
 - Definition
 - 1-2 cm incision above the upper original margin of bladder
 - Extend bilaterally and cephalad
 - Identify presenting part of fetus and deliver
 - Vertical
 - Indications for use
 - Lower segment of uterus is narrow
 - Anterior placenta previa present
 - Fetus in transverse lie presentation
 - Definition
 - Start incision in inferior portion of lower uterine segment
 - Enter cavity and extend incision with sharp dissection
 - Identify presenting part of fetus and deliver
 - Transverse vs. vertical uterine incision
 - Transverse type recommended
 - Associated with less blood loss
 - Lower risk of uterine rupture in future pregnancies
4. Delivery
- Delivery of baby
 - Umbilical cord is double clamped
 - Obtain fetal blood sample
 - Addition of oxytocin
 - Add 20 units to IV fluids to stimulate contractions
 - Removal of placenta
 - Manually
 - Physically remove placenta with hands
 - Most common method utilized
 - Increased blood loss
 - Due to open dilated sinuses in uterine wall
 - Decreased operation time
 - Spontaneously
 - Cord traction utilized to facilitate removal
 - Time-consuming
 - Decreased blood loss
 - Dilated sinuses in uterine wall close with time
 - Lower risk of endometritis
 - Lower maternal exposure to fetal red blood cells
 - Uterus
 - Externalization of uterus

- Deliver uterine fundus through abdominal incision
 - Facilitates uterine massage
 - Facilitates determination of uterine atony
 - Facilitates examination of adnexa
- Closure of uterine incision
 - Transverse type
 - Continuous locking stitch most commonly utilized
 - Use double-layer closure if planning for future pregnancies
 - Less risk for uterine rupture in future deliveries
 - May use single-layer closure if there is no plan for future pregnancy
 - Vertical type
 - Several layers of closure required since thicker portion of uterus incised
- Complete closure
 - Peritoneal tissue
 - Non-closure of visceral and parietal layers
 - Decreased operative time
 - Decreased incidence of postoperative fever
 - Subfascial tissue
 - Close with running stitch with synthetic braided material
 - Subcutaneous tissue
 - Irrigation dependent on physician choice
 - No need for reapproximation of tissue
 - Place drains in obese patients
 - Skin edges
 - Close with subcuticular stitch or staples

Postoperative Details

1. Recovery room

- Vital signs q15min
- Urine output
- Palpation of fundus
 - Level of firmness and contraction

2. Pain control

- Regional anesthesia
 - Patients also receive long-acting analgesic
- Generalized anesthesia
 - Administer narcotics IM or IV on schedule
 - Switch to oral narcotics once patient tolerates liquids

3. Hydration

- Total amount of intravenous fluids
 - Three to four liters typically utilized since placement of IV line for the first 24 hours post-procedure
- Begin clear liquid diet 4-8 hours post-procedure

4. Ambulation

- Encourage on the first postoperative day
- Advance ambulation as tolerated

5. Removal of staples and bandages

- Removal of staples dependent on patient status
 - Healthy patients
 - Usually prior to discharge at 3-4 days postoperatively
 - Patients at risk for poor wound healing
 - Remove after discharge at 5-8 days postoperatively
 - Remove dressings 12-24 hours postoperatively
6. Contraception
- Discuss contraception prior to discharge
 - Encourage patient to refrain from intercourse 4-6 weeks postpartum

Pearls

1. US Preventive Services Task Force recommendations
- Blunt uterine incision expansion
 - Prophylactic antibiotics
 - Either ampicillin or first-generation cephalosporin for just one dose
 - Spontaneous placenta removal
 - Non-closure of both visceral and parietal peritoneum
 - Drain of subcutaneous tissue in obese patients
 - When tissue thickness is >2 cm

Complications

1. Intraoperative complications
- Uterine lacerations
 - More common with transverse uterine incisions
 - May extend laterally or inferiorly
 - Simple to repair
 - Watch out for uterine vessels and ureters during repair
 - Ureteral injuries
 - Most likely to occur when repairing major lacerations of the uterus
 - Injury is often identified after the operation is complete
 - Injuries include occlusion or transection
 - Bladder injuries
 - More common with transverse abdominal incisions
 - Occurs when separating the bladder from the lower uterine segment
 - Repair dome injury with 2-layer closure
 - Trigone injury requires urology consult
 - Bowel injuries
 - Most common risk factor is adhesions from prior surgeries
 - Serosal injuries occur when bowel is adherent to uterus
 - Repair with interrupted silk sutures
 - Lumen injuries
 - Repair with 2-layer closure
 - Uterine atony
 - Risk factors
 - Multiple gestations
 - Polyhydramnios
 - Patients previously on prolonged oxytocin augmentation
 - Testing for atony

- Palpate for firmness and contraction after uterine massage and administration of intravenous oxytocin
 - Treatment
 - IM injections of prostaglandins or methylergonovine
 - Repeat if necessary
- 2. Postoperative complications
 - Endomyometritis
 - Risk factors
 - Prior cesarean delivery
 - Lower socioeconomic status of patient
 - Unplanned cesarean delivery
 - Decrease rate of incidence with use of prophylactic antibiotics
 - Bowel function
 - Slow return of bowel function
 - Assess fluid and electrolyte status
 - Consider postoperative narcotics as etiology
 - Conservative treatment
 - Urinary tract infections
 - Risk factors
 - Diabetic patients
 - Patients with comorbidities
 - Long duration of use of an indwelling catheter
 - Wound infections
 - Risk factors
 - Prior cesarean delivery
 - Unplanned cesarean delivery
 - Low socioeconomic status of patient
 - Open, irrigate, and debride incision for treatment
 - Pack and clean open wound multiple times in a day
 - Thromboembolism
 - Risk factors
 - Obesity
 - Advanced maternal age
 - Poor postoperative ambulation
 - Prevention
 - Use intermittent compression devices/compression stockings
 - Early ambulation postoperatively
 - Anticoagulation of high-risk patients
 - Monitor for pulmonary emboli
 - Thrombophlebitis
 - Risk factors
 - Endomyometritis
 - Wound infections
 - Suspect when patient fails to respond to broad-spectrum antibiotics
 - Physical exam positive for tender cord-like mass in pelvis
 - Treatment is heparin with broad-spectrum antibiotics

Follow Up

1. Follow-up appointment
 - Observed the same as patient who delivers vaginally
 - Schedule follow-up in 4-6 weeks post delivery
 - Discuss the procedure, complications, future use of contraception, and plan for future pregnancies
2. General recovery
 - Recovery is generally slightly longer versus vaginal delivery
 - Overall long-term condition of patient is the same versus vaginal delivery
 - Pt must know why c-section was done and what kind of incision was used
3. **Vaginal birth after cesarean section (VBAC)**
 - Overall 70% successful
 - Must discuss risks
 - Risk of uterine rupture is 0.7%
 - Absolute risk of hypoxic encephalopathy is 0.46/1000
 - No incr risk of maternal death
 - Must discuss facility and availability of resources to perform vaginal delivery
 - Increased success
 - Cesarean due to abnormal fetal heart pattern
 - Cesarean due to malpresentation
 - Decreased success
 - Cesarean due to cephalopelvic disproportion
4. Repeat cesarean delivery
 - Recommended for vertical uterine incisions
 - Decreased risk for uterine rupture

References

1. Berghella V, Baxter JK, Chauhan SP. Evidence-based surgery for cesarean delivery. *Am J Obstet Gynecol.* 2005 Nov;193(5):1607-17. Review.
2. Bloom, SL et al. Complications of anesthesia for cesarean delivery. *Obstet Gynecol.* 2005 Aug;106(2):281-7.
3. Hofmeyr, GJ and M Mathai. Techniques for caesarean section. *The Cochrane Library, Cochrane Collaboration Vol (4), 2006.*
4. Hofmeyr, GJ and M Mathai. Abdominal surgical incisions for caesarean section. *The Cochrane Library, Cochrane Collaboration Vol (4), 2006.*
5. Landon, MB et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. *N Engl J Med* 2004; 351: 2581-2589, Dec. 16, 2004.
6. Online resource: Sehdev, HM. Cesarean Delivery. eMedicine update 2005.

Authors: Monica Bhagat, MD, & Juan Jan Qiu, MD, *Penn State Hershey Medical Center, PA*

Editor: David Wakulchik, MD, *Aultman FMRP, OH*