Abdominal Wall Muscles

Transverse Section of the Rectus Abdominis

The aponeurosis of the external and internal oblique and the transversus abdominis from the rectus abdominis

A. above the arcuate line

B. below the arcuate line

Incisions: Open to Close

- Antibiotics
- Skin Preparation
- Incision Types
- Incision Technique
- Peritoneal Closure
- Abdominal Closure
- Fascial Closure
- Suture Choice
- Suture Technique

- Irrigation
- Drains
- Subcutaneous Closure
- Skin Closure
- Skin Dressing
Antibiotics

• A single dose of intravenous antibiotics 1 hour before incision reduces the incidence of surgical site infections
  – 2 grams of cefazolin
• Penicillin allergy
  – Metronidazole and aminoglycoside
  – Vancomycin
Skin Preparation

• Hair
  – Avoid removal if possible
  – Use of clippers rather than straight razor decreases wound infection
• Preparation solution
  – Iodine versus chlorhexidine ± alcohol equivalent
  – Alcohol preparations must be allowed to dry before surgery because of an increased risk of fire
Incision Types: Transverse and Vertical

Transverse
- Pfannenstiel
- Cherney
- Maylard
- Küstner

Vertical
- Midline
- Paramedian
Transverse Incisions

- Pfannenstiel
- Cherney
- Maylard
- Küstner
Pfannenstiel Incision: The Frying Pan Handle

Advantages
• More cosmetic
  o Scar is almost imperceptible
  o Hidden in the pubic hairline
  o Obscured by a skin crease
• Less painful
• Less pulmonary depression
• Excellent postoperative strength

Disadvantages
• No upper abdominal exposure
• Possible increased hematoma rate
Pfannenstiel Incision: Opening

The fascia is separated from rectus muscle superiorly and inferiorly.
The rectus muscle is separated in the midline and the peritoneum is incised longitudinally.
Pfannenstiel Incision: Closing

Sutures may be placed in the rectus muscle to close a rectus diastasis.

The sheath is closed with continuous suture, and the skin is approximated with a subcuticular suture.

Cherney Incision

Advantages

• Excellent pelvic exposure
• Dehiscence or hernia is rare
• Incision of choice to “extend” Pfannenstiel

Disadvantages

• Limited upper abdominal exposure
Cherney Incision: Opening

Transverse incision of rectus sheath.

• The lower sheath is separated from rectus muscles.
• The tendons are exposed and incised 1.5 cm above periosteum of symphysis.

Cherney Incision: Closing

The tendons are sutured to lower rectus sheath above symphysis.

Maylard Incision

Advantages
• Excellent exposure, including upper abdomen
• Dehiscence or hernia is rare

Disadvantages
• Risk of femoral nerve injury from retractor
• Risk of subfascial hematoma
• Poor choice for patients with extensive vascular disease
Maylard Incision: Opening

- The incision of rectus sheath is extended laterally to iliac spine to expose rectus muscle.
- The rectus muscles are cut transversely.

• Cut edges of muscles are sutured to the rectus sheath.
• Ligated epigastric vessels and exposed transversalis fascia.
• Transversalis fascia and peritoneum are incised transversely.
• Urachus is ligated.

Küstner Incision

Advantages
• More cosmetic
• Increased exposure versus Pfannenstiel

Disadvantages
• Visible erythema in area of fat dissection postoperatively
• Unable to extend around the umbilicus
• More painful than transverse fascial incision
Küstner Incision: Opening

- Transverse incisions to sheath.
- Subcutaneous tissue separated from linea alba.

Vertical Incisions

- Midline
- Paramedian

Vertical Midline Incision

Advantages
- Versatile, rapid, low blood loss
- Excellent exposure

Disadvantages
- More painful
- Increased pulmonary depression
- Less cosmetic

• The line alba is incised and muscles are separated in the midline.
• The peritoneum is opened at cephalic pole of incision.
• The peritoneal incision is expanded longitudinally, slightly off midline to avoid urachus.

Vertical Paramedian Incision

Advantages
• Theoretical decreased risk of herniation
• Improved lateral exposure

Disadvantages
• More likely to encounter the inferior epigastric vessels compared with midline incision
• Less cosmetic
• The anterior rectus sheath is opened for the full length of the incision 2-3 cm from the midline.

• The rectus muscle is retracted laterally and the posterior sheath is incised longitudinally under the muscle bed.

The lateral paramedian incision is placed near the lateral border of the rectus muscle.

When the muscle is retracted laterally, the inferior deep epigastric artery is seen.

Finally, the posterior sheath is closed.

Transverse Versus Vertical Incision

• Multiple prospective randomized trials
  o No difference between vertical and transverse incisions in fascial disruption
Scalpel: One is Enough

- No difference in wound infection rate
- Skin knife usually is sterile
- Knife blade is not a vehicle for bacterial contamination
- No bacteriological evidence to justify the use of different blades
Electrocautery Versus Scalpel

- Equal inflammation and infection rates
- No differences in pain or wound healing
- Less blood loss with electrocautery
- More rapid incision with scalpel
Peritoneal Closure: To Do or Not To Do?

- Peritoneal reformation results from transformation of subperitoneal fibroblasts
- Surgical closure prevents autolysis of early fibrinous attachments
- Even minimally reactive sutures increase tissue necrosis and foreign body reaction
Peritoneal Closure: Do NOT Do!

Edges do not need to be closed to enhance healing

- No increase in infectious complications
- No influence on wound integrity
- Avoiding closure decreases adhesion formation, including bowel adhesions
- Not closing decreases surgical time and may shorten hospital stay
Abdominal Closure: Variables

- Active infection
- Cancer
- Diabetes
- Ileus
- Immunosuppression (steroids)

- Malnutrition
- Obesity
- Postoperative wound infection
- Pulmonary disease
- Radiation therapy
Abdominal Closure Risks

• Hernia
  o 2-5% of benign surgeries
  o 10-20% of malignant surgeries

• Evisceration
  o Less than 1%
Fascial Closure

- Continuous sutures versus interrupted sutures
- Absorbable sutures versus permanent sutures
- Suture placement
- Significant decrease in incisional hernia with continuous sutures odds ratio (OR), 0.73. 95% confidence interval (CI), 0.55-0.99
- No difference in wound infection or dehiscence rate
- Continuous suture more rapid, less risk to staff, and less expensive
- Suture to wound length ratio should be $\geq 4$
Absorbable suture associated with higher incidence of incisional hernia (OR, 0.68, 95% CI, 0.52-0.87)

No difference in wound infection or dehiscence rate

Permanent suture associated with higher incidence of wound pain and suture sinuses
Suture Choice: Size Matters

• Suture diameter and cross-sectional area differ markedly despite same gauge
• Permanent sutures have greater tensile strength but higher incidence of stitch sinus and incision pain
• Monofilament sutures have lower incidence of infection
Suture Technique: Look Good to Be Good

- Large bites, loosely tied is stronger
- Square knot is strongest
- Surgeon’s knot decreases breaking strength
- Surgeons use too many throws
  - Four or fewer is sufficient for silk or braided
  - Six or fewer is sufficient for monofilament
Irrigation:
The Solution to Pollution is Dilution

• Antibiotic solutions have no effect on non contaminated wounds
• Volume, volume, volume
Drains

• Controversial with conflicting data
• If drain is included, the following should be used:
  o Closed-suction system
  o Separate exit wound
Subcutaneous Closure

• In obese patients (more than 2 cm of subcutaneous fat), closure of subcutaneous fat at cesarean delivery decreased superficial wound disruption by 35%

• If performed, use fine absorbable suture in continuous fashion

Drains and Subcutaneous Closure

- Multicenter randomized trial of women undergoing cesarean delivery
  - Greater than 4 cm of subcutaneous fat
    - Suture closure: 17% wound morbidity
    - Suture closure plus drain: 22% wound morbidity
- Addition of a drain to subcutaneous closure does not prevent wound complications
Staples May Be Worse Than Subcuticular Sutures

In a prospective randomized study of 416 women who underwent cesarean delivery, the wound separation rate was significantly higher at 17% in the staple group, compared with 5% in the suture group.

Staple closure was an independent risk factor for wound separation after controlling for:
- gestational age
- repeat cesarean delivery
- obstetric complications
- maternal comorbidities
- body mass index (BMI) greater than 30
- incision type
- operating room time
- insurance

Facts

- Staple closure required more scheduled and unscheduled office visits for wound care
- Mean gestational age of 38 weeks
- Mean age of 29 years
- 70% white
- 60% BMI greater than 30

Skin Closure

• Stainless steel staples in 197 women versus 4-0 absorbable monofilament on a PS2 needle in 219 women
• Adhesive closure strips placed after removing staples and at subcutaneous closure
• Subcutaneous closure in both if greater than 2 cm
• Composite wound complication rate was 22% in stapled closure compared with 9% in suture closure
• Composite rate included:
  o wound separation
  o wound infection or need for antibiotics
  o follow-up visits for wound
  o hospital admission for wound

Skin Dressing

- Dry, adherent dressing traditional
- Wound healing facilitated by moist environment (semiocclusive dressing)
  - Faster healing, less pain, and less scarring
  - No increase in infection rate
  - Leave on for 24-48 hours
Recommendations

- Choose appropriate incision
- Clip hair just before surgery
- One knife or knife and electrocautery
- Meticulous surgical technique
- Do not close peritoneum
- Close fascia with running, nonlocked, mass closure using monofilament, delayed-absorbable suture
- Use smallest suture gauge appropriate
Recommendations

- Wide bites, loosely tied in a square knot with appropriate number of throws
- Irrigate subcutaneous tissue copiously with saline
- Drain deep wounds with closed-suction system via separate exit wound
- Avoid staples
- Semiocclusive dressing for 24 hours to 28 hours
Bibliography


