The Challenges in Managing the Obese Patient in Gynecologic Surgery

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Global Obesity Patterns
• 58% of the world’s adult population will be overweight by 2030
• As of 2010, 28% of women obese globally
  – WHO identified obesity as 6th most significant cause of ill health

NIH and WHO Obesity Classifications

<table>
<thead>
<tr>
<th>Class</th>
<th>Body Mass Index (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>30.0-34.9</td>
</tr>
<tr>
<td>II</td>
<td>35.0-39.9</td>
</tr>
<tr>
<td>III</td>
<td>≥40 (severe or extreme)</td>
</tr>
</tbody>
</table>

Health Risks Associated with Obesity
• Coronary heart disease
• Hyperlipidemia
• Type II diabetes
• Asthma
• Obstructive sleep apnea
• GERD
• Fatty liver
• Cholelithiasis
• Stress urinary incontinence
• Cancer (colon, uterine, breast)
• Infection
• Degenerative joint disease
• Depression
• Venous stasis
• Hernia
• Irregular menstruation
• Hypertension
• Infertility
**Costs and Complications Related to Obesity**

- Treating obesity and its complications in U.S. approximates $100 billion/year
  - Overall mortality rises 30% for each 5 kg/m² increase in BMI
- Morbid obesity associated with major postoperative complications (OR 1.77) in cross sectional analysis of 22,214 women undergoing gynecologic procedures
  - Infection rates between 4-12% after abdominal hysterectomy (BMI>30) to as high as 30% in BMI>50
  - $3400 additional costs per person
  - Two fold increased risk of cesarean
  - Conversion rates of 8-36% from laparoscopy to laparotomy in uterine cancer staging

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**Physiologic Changes in the Obese Patient**

- Difficult to control airway
  - Reduced neck mobility
  - Distorted oropharyngeal anatomy
  - Improve laryngeal view with “ramped” position or fiberoptic intubation
- Respiratory compromise
  - Decreased chest wall compliance
  - Low vital capacity
  - Reduction in functional residual capacity
  - Decreased expiratory reserve volume
  - Increased work of breathing
- Altered drug distribution
  - Initial dosing based on lean body weight

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**Anesthesia in the Obese Patient**

- Positive airway pressure
  - 4-6 weeks preoperatively in those with OSA
  - Better delivery of anesthesia with reduced tongue volume, increased pharyngeal space, & improved ventilatory drive
  - PEEP 15 cm H₂O effective in maintaining intraoperative functional residual capacity
- Post-extubation treatment
  - CPAP immediately in postoperative period decreases hypoxemia
  - Non-Invasive positive pressure ventilation (NIPPV) improves lung spirometry values
  - Maintain upper body and head at 30°

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**Anesthesia in the Obese Patient**

- Inhalation agents
  - No difference in outcome or hospital course for bariatric patients
- Intravenous anesthesia
  - Preoperative and intraoperative alpha-2 agonists (clonidine, dexmedetomidine) can reduce opioid requirements
- Neuraxial anesthesia
  - Sympathetic blockade to higher levels due to smaller spinal component
  - More epidural adipose tissue results in greater technical difficulty
  - Less respiratory failure & faster return to baseline vital capacity and FEV₁
- Multimodal approach preferred

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1. Ludwig DS et al, JAMA 2009
2. Erekson EA et al, Obstet Gynecol 2011
3. Alennis MC et al, AJOG 2010
Obesity in Gynecologic Surgery

Feasibility of Laparoscopy in the Obese

• Prospective comparison of overweight (BMI 25-30), obese (BMI>30), and morbidly obese (BMI>36) undergoing laparoscopic hysterectomy for benign conditions
  - No differences in EBL, complications, length of stay, operative time
• Prospective study of laparoscopic hysterectomy in BMI>28 for endometrial cancer
  - Less IV pain medications
  - More nodes removed
  - Less total cost than laparotomy
• Largest series of 1460 undergoing laparoscopic hysterectomy for benign conditions
  - BMI>30 not associated with increased complications but longer operating time

1 Holub et al, Eur J Obstet 2001
2 Eltabbak GH et al, Gyn Oncol 2000
3 Chopin N et al, Hum Reprod 2009

Robotic Surgery in the Obese

• Feasibility and efficacy of robotic surgery in patients with high BMIs emerging
  - No randomized clinical trials for BMI>30 in gynecology
  - Multiple case series with robotic assisted myomectomy
  - Large comparative series of laparotomy (n=138), laparoscopy (n=81) & robotic surgery (n=103) in endometrial cancer
    - Robotic surgery resulted in highest node count, lowest blood loss, shortest hospital stay, fewer complications
  - Cohort of 181 obese patients undergoing robotic or laparoscopic surgery for endometrial cancer
    - Higher EBL and operative time but shorter LOS and conversion rate in robotic group

1 Boggess JF et al, AJOG 2008

Clinical Pearls in Minimally Invasive Surgery in the Obese

• Positioning
  - Higher risk of pressure sores and neural injuries
  - Yellowfin, PALPor, or Ultrafin stirrups
  - Protective padding
  - Beanbag
• Bariatric instruments
  - Long Veress (15 cm)
  - 45 cm bariatric vs standard 33 cm
• Pneumoperitoneum
  - Left upper quadrant entry (mean umbilical thickness 3.0 vs 4.4 cm)
  - Umbilicus pulled downward with pannus so consider supraumbilical incision for camera
  - Side docking to allow access to vagina
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**Increased Complications at Extremes of BMI**

- Abdominal wall distorted, displacing umbilicus and no longer approximates aortic bifurcation
- Avoid skin crease where increased infectious risk
  - Transverse incision pulling the pannus down without making skin defect
  - Supraumbilical incision or vertical midline extending around umbilicus

**Placement of Abdominal Incision**

- Transverse abdominal incisions less painful and allow for earlier mobilization
  - Vertical skin incisions in obese parturients associated with higher incidence of wound complications (OR 12.4)\(^1\)
- Pannus retraction
  - Montgomery straps or tape
- Avoid multiple tissue strokes
  - Electrocautery vs. scalpel for skin incision and subcutaneous tissue equivalent in wound strength and infection\(^2\)
  - Less analgesia required in electrocautery group

**Factors Predisposing Obese to Surgical Infections**

- Decreased wound oxygen levels
  - Decreased vascularity of subcutaneous tissue
  - Higher risk of hypoxemia
- Less dense tissue & greater tissue edema
- Increased intra-abdominal pressure
- Persistent skin moisture enabling microbial growth
- Difficult exposure
  - Longer operations
  - More trauma to retracted abdominal wall
- Higher prevalence of poor glycemic control
- Lower tissue concentrations of prophylactic antibiotics

\(^1\) Osler M et al, Hum Reprod 2011

\(^2\) Wall PD et al, Obstet Gynecol 2003

\(^3\) Chrysos E et al, Am Surg 2005

\(^4\) Walsh C et al, Obstet Gynecol 2009
Perioperative Prevention Strategies to Surgical Infections

- Double dose of prophylactic antibiotics in those \( \geq 100 \) kg or BMI>35
- Offer supplemental oxygen but not at high concentration
  - Randomized, double blind trial of women undergoing cesarean with regional anesthesia\(^1\)
    - 80% supplemental oxygen vs. 30% inspired oxygen
    - No lowered incidence of endometritis or wound infection
- Maintain normothermic body temperature
  - Vasoconstriction impairs tissue oxygen tension, collagen deposition, and cell mediated immunity
  - Use forced air and fluid warmers
  - Keep room temperature above 70\(^\circ\)F

\(^1\)Gardella C et al, Obstet Gynecol 2008

Prophylactic Drain Placement

- Drain placement to prevent wound complications controversial
- Theoretical benefit
  - Decreases potential dead space
  - Removes residual fluid and blood
- Possibly increased infectious risk
  - Route for bacteria to access devitalized tissue
  - Foreign body and bacterial reservoir
- Cochrane analysis including subfascial & subcutaneous drains after cesarean failed to decrease wound complications\(^1\)

\(^1\)Gates S et al, Cochrane Database Syst Rev 2005

Meta-Analysis of Subcutaneous Drains

- Six randomized controlled trials\(^1\)
- Required \( \geq 2 \) cm of subcutaneous tissue thickness
- Drains maintained for 6-72 hours until <30-50 mL over 24 hours
- No significant differences compared to controls
  - Wound disruption OR 0.74 (p= 0.36)
  - Hematoma OR 1.05 (p=0.94)
  - Infection OR 1.15 (p=0.58)
  - Seroma OR 0.44 (p=0.17)

\(^1\)Hellums EK et al, AJOG 2007

Subcutaneous Suture Closure

- Meta-analysis of 5 randomized trials
- Required \( \geq 2 \) cm of subcutaneous tissue
- Significant reduction in rate of wound disruption and seroma compared to no suture closure
- Subcuticular closure may worsen infectious risk
  - Possibly secondary to obscured wound drainage

\(^1\)Chelmow D et al, Obstet Gynecol 2004
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Subcutaneous Tissue Reapproximation

- Multicenter randomized trial of women undergoing cesarean
- Required ≥4 cm of subcutaneous tissue thickness
- Compared subcutaneous closure alone (n=149) or suture plus drain (n=131)
  - Running 3-0 Vicryl closure
  - 10 mm flat Jackson Pratt, below suture
- Suture group with lowered wound morbidity (17.4% vs 2.7%, RR 1.3)

\(^1\) Ramsey PS et al, Obstet Gynecol 2005

Individual Wound Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Suture</th>
<th>Suture + Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disruption</td>
<td>15.3%</td>
<td>21.6%</td>
</tr>
<tr>
<td>Seroma</td>
<td>9.0%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Hematoma</td>
<td>2.2%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Abscess</td>
<td>0.7%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Dehiscence</td>
<td>1.4%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Hospital Readmission</td>
<td>3.5%</td>
<td>6.6%</td>
</tr>
</tbody>
</table>

Addition of subcutaneous drain not effective for prevention of wound complications

Change in Practice Patterns & Wound Complications

<table>
<thead>
<tr>
<th>Variable</th>
<th>2005</th>
<th>2007</th>
<th>2009</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-incision antibiotics</td>
<td>3.9%</td>
<td>79.1%</td>
<td>89.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Subcutaneous drain</td>
<td>69.2%</td>
<td>30.2%</td>
<td>10.6%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Subcutaneous closure</td>
<td>30.8%</td>
<td>55.8%</td>
<td>63.8%</td>
<td>0.01</td>
</tr>
<tr>
<td>Anticoagulation</td>
<td>7.7%</td>
<td>9.3%</td>
<td>45.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wound complication</td>
<td>50.0%</td>
<td>20.9%</td>
<td>27.7%</td>
<td>0.07</td>
</tr>
<tr>
<td>Wound disruption</td>
<td>38.5%</td>
<td>20.9%</td>
<td>25.5%</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Retrospective study of 194 massively obese undergoing cesarean (BMI>50)

Role of Panniculectomy in the Morbidly Obese

- First described by Demars and Marx in 1890 and later refined by Kelly in 1910
- Increases accessibility and exposure to the pelvis
- Postoperative infections in 2.3%-33.3%
  - Undermining of adipocutaneous flap increases wound complications
  - Sacrifice umbilicus if large hernia or stalk>5 cm
  - Closure in 2-3 layers & use of closed subcutaneous drains decrease infection\(^1,2\)
  - Incorporate deep muscle fascia with Scarpa’s and close dermis and superficial fat separately

\(^1\) Hopkins MP et al, AJOG 2000
\(^2\) Stanhope C et al, J Pelvic Surg 2002
Benefits of Panniculectomy in Morbidly Obese

- Potential decreased intraoperative blood loss, length of stay, and wound dehiscence\(^1\)
  - Decrease of fat necrosis
  - Reduced skin fold for bacterial accumulation
- Allows for higher total lymph node counts, particularly para-aortic, in uterine cancer patients\(^2\)

\(^1\)Hardy JE et al, Ann Plast Surg 2008
\(^2\)Eisenhaer EL et al, Ann Surg Oncol 2007

Closure Following Panniculectomy

- Linea alba plicated
- Multiple sutures to anchor to fascia
- Suction drainage to prevent excess fluid accumulation
- Skin staples or interrupted 3-0 nylon
- Pressure dressing with elastic tape or plaster mold

Extended Antibiotic Usage with Panniculectomy

- Retrospective cohort study at Mayo Clinic of 145 obese women (BMI>30) undergoing combined hysterectomy and panniculectomy\(^1\)
  - Cefazolin 2g IV followed by fluoroquinolone until drain removal
  - Mean BMI 42.6 kg/m\(^2\)
  - Median time of 14 days (range 7-26)
- Antibiotic lowered infection incidence (5.9% vs 27.9%, p<0.001)
  - 78% superficial wound infections
- 5 patients need to treat to prevent 1 infection
  - Recommend ciprofloxacin, which achieves high tissue concentrations in gynecologic tissues

\(^1\)El-Nashar SA et al, AJOG 2010
Long-Term Outcomes of Panniculectomy

- Retrospective review of 42 patients undergoing panniculectomy at time of pelvic surgery
  - Mean BMI 50.9
  - 81% endometrial cancer
  - Wound complications 36%
- Mean postoperative weight loss of 20 lbs
- At 2 years follow-up
  - 62% below preoperative body weight
  - 91% satisfied with procedure
  - 45% responded exercising more
  - 64% reported healthier lifestyle
  - 36% happier with body image

Mean Weight Change After Panniculectomy

- Wright JD et al, Gynecol Oncol 2006

Complex Wound Management

- Delayed wound closure of contaminated wounds
  - Performed after granulation tissue forms and before contraction begins
  - Generally 4-5 days postoperatively
  - Closure >10 days heightens risk of infection
- Placement of retention sutures
  - At least 2 cm from incision
  - Remove after 21 days
- Debridement of devitalized tissue within wound
  - Calcium alginate with gauze or foam for moist or wet wounds
  - Hydrogel for dry wounds
- No data to support hyperbaric oxygen

Negative Pressure Wound Therapy

- Introduced by Argenta and Morykwas in 1993
- FDA approved in 2004
- Pump applies 50-175 mmHg of continuous or intermittent suction
  - Reduces polyurethane foam volume up to 80%
- Dressing and tubing typically changed Q24-36 hours
- Bacterial counts typically remain low
- Easier to maintain and contour
**Negative Pressure Wound Therapy**

- Small case series in general surgery & gynecology to suggest help in wound healing
  - Improved patient comfort
  - Reduced nursing needs
  - Diminished odor and drainage
- Mechanisms of action
  - Promotion of angiogenesis
  - Increased blood flow
  - Reduction in wound surface area
  - Induction of cell proliferation
  - Modulation of wound fluid


**Review of Topical Negative Pressure Therapy**

- 400 peer reviewed articles (18 randomized clinical trials)
  - Pressure possibly transduced differently in soft and dense tissue
    - Suggest lower pressures in subcutaneous (75 mm Hg) and muscle (100 mm Hg) to minimize ischemia
  - Stronger evidence that effective in diabetic and pressure ulcers
  - Comparative healing capacity in 2 trials with acute and chronic wounds
  - Time involvement and nursing staff costs significantly lower
  - Use with caution in bowel anastomoses or enterotomy repairs out of concern for fistula formation
  - Reduction in edema and bacterial clearance controversial


**Postoperative Care in Obese Patients**

- Analgesia with local anesthetics via epidural may be safest approach
  - More respiratory depression with intrathecal opioids
- Use acetaminophen and NSAIDS to reduce narcotic consumption
- Consider antacid, H2 antagonist, or prokinetic agent to decrease gastric acidity and facilitate emptying
- Start ACE inhibitor or calcium channel blocker for uncontrolled hypertension
- Initiate early physical therapy for those with mobility limitations

2. Elia N et al, Anesthesiology 2005

**Critical Care Management in the Obese Patient**

- Hemodynamic monitoring
  - Length of cuff should be 75-80% of upper arm circumference, with width ~40%
  - Total blood volume and cardiac output linearly related to excess body weight
  - Appropriate vascular access (PICC)
- Mechanical ventilation
  - Initial tidal volumes of 8 mL/kg of ideal body weight and 6 mL/kg if ARDS
  - Plateau airway pressures maintained below 35 cm H2O
  - Addition of 10 cm H2O PEEP may assist with lung compliance
Weight Based Dosing of Medications

<table>
<thead>
<tr>
<th>Appropriate Weight</th>
<th>Drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal Body Weight</td>
<td>Digoxin, Beta-blockers, Penicillins, Cephalosporins, Corticosteroids, H2 blockers, Propofol, Lorazepam, Fentanyl</td>
</tr>
<tr>
<td>Total Body weight</td>
<td>Heparin Succinylcholine</td>
</tr>
<tr>
<td>Dosing Weight</td>
<td>Aminoglycosides, Fluoroquinolones</td>
</tr>
</tbody>
</table>

Thromboembolic Prophylaxis

- Data sparse on whether weight based or fixed doses of LMW heparin should be given in extreme obesity 1,2
  - Enoxaparin, dalteparin, tinzaparin all equally efficacious if ≤165 kg
- Meta-analysis in patients undergoing cancer surgery concluded no difference between LMW heparin and UFH in terms of efficacy, DVT location, or bleeding complications 3
- Optimal interval 6-8 hours postoperatively
- Although early meta-analysis and literature review indicated that aspirin reduced VTE incidence by 20%, ACCP Guidelines as of 2008 recommend against aspirin alone 4

ACCP -- Surgical Risk Assessment

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Risk of Fatal Embolus</th>
<th>Medical Considerations</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;1%</td>
<td>Age &lt;40</td>
<td>Early, frequent ambulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anesthesia ≤30 minutes</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>2-4%</td>
<td>Age 40-60</td>
<td>LMW Heparin Low dose UFH Fondaparinux</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anesthesia ≤30 minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gynecologic, Urologic, Neurosurgical</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4-8%</td>
<td>Age &gt;60</td>
<td>LMW Heparin Low dose UFH TID Fondaparinux</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orthopedic/Trauma, Cancer, Spinal cord, History of stroke/heart disease</td>
<td></td>
</tr>
</tbody>
</table>

Prophylactic LMWH Anticoagulation

- Current fixed doses of LMWH may be inadequate
  - Rowan et al found that <50% of patients undergoing laparoscopic gastric bypass placed on enoxaparin 40 mg bid reached target levels 1
  - Borkgren-Okonek et al reported that 74% of patients undergoing gastric bypass achieved target anti-Xa levels with 60 mg bid continued for 10 days postoperatively 2
  - ACCP recommends higher doses of LMWH or UFH for obese patients, but fails to specify dose 3
  - Increasing LMWH by 30% for morbidly obese (BMI>40)
  - Dosing by total body weight

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1 Al Yaseen E et al, J Thromb Haemost 2005
2 Hainer JW et al, Thromb Haemost 2002
3 Aki EA et al, Arch Intern Med 2008
4 Geerts WH, Chest 2008
Therapeutic Anticoagulation of VTE

- Cook et al found that in 499 patients treated for VTE, 36% of patients weighing >100 kg underdosed\(^1\)
  - Increased absolute drug clearance and volume of distribution (especially fondaparinux)
  - Clearance linearly correlated with lean but not total body weight
- Review of published studies\(^2\)
  - Weight based UFH nomograms appear superior, favoring actual rather than ideal body weight
  - LMWH dosing should be based on actual body weight without dose capping
  - Twice daily enoxaparin dosing preferable
  - Monitoring of anti-Xa activity should be considered, particularly in those >150 kg

\(^1\) Cook LM et al, J Thromb and Haemostasis 2007
\(^2\) Patel JP et al, BJH 2011

Monitoring Anti-Xa Levels

- Peak concentrations drawn 4 hours post-injection
  - 0.2-0.4 IU/mL for VTE prophylaxis
  - 0.5-1.0 IU/mL for BID VTE treatment
  - 1.0-2.0 IU/mL for daily VTE treatment

\(^1\) Nutescu EA et al, Ann Pharm 2009

Sample LMWH Dosing Nomogram

<table>
<thead>
<tr>
<th>Anti-Xa Level</th>
<th>Hold Dose</th>
<th>Dose Change</th>
<th>Next Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.35</td>
<td>No</td>
<td>↑25%</td>
<td>4 hours</td>
</tr>
<tr>
<td>0.35-0.49</td>
<td>No</td>
<td>↑10%</td>
<td>4 hours</td>
</tr>
<tr>
<td>0.5-1.0</td>
<td>No</td>
<td>No</td>
<td>Next day</td>
</tr>
<tr>
<td>1.1-1.5</td>
<td>No</td>
<td>↓20%</td>
<td>Before next dose</td>
</tr>
<tr>
<td>1.6-2.0</td>
<td>3 hours</td>
<td>↓30%</td>
<td>Before &amp; 4 hours after next dose</td>
</tr>
<tr>
<td>&gt;2.0</td>
<td>Until &lt;0.5</td>
<td>↓40%</td>
<td>Before next dose &amp; then Q12h</td>
</tr>
</tbody>
</table>

\(^1\) Nutescu EA et al, Ann Pharm 2009

Conclusions

- Utilize multimodal approach to anesthesia & analgesia
- Offer minimally invasive surgery if feasible
- Employ preventative strategies to reduce surgical site infections and thromboembolism
- Consider joint panniculectomy and subcutaneous closure
- Remember dosing modifications of drugs in management of medical co-morbidities