Perioperative Care of the Patient Undergoing Colorectal Surgery

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• Nothing to Disclose
Colorectal Surgery
Case Presentation

- MS is a 30 yr old WM with an episode of diverticulitis 2 yrs ago who presents with severe lower abdominal pain that has persisted despite out patient treatment with oral flagyl and cipro therapy.

- PE : remarkable for T 38.6; P94; BP 124/70; Abdomen shows suprapublic and LLQ tenderness and guarding
Case Presentation

- WBC 17,800

- CT scan: Severe diverticulitis of sigmoid colon with suspected local perforation and large surrounding phlegmon without formal abscess.
Case Presentation

- Patient treated in hospital with 3 days of IV zosyn and bowel rest.
- Discharged on 1 week of continued cipro and flagyl therapy.
- Because of mild persistent LLQ pain elective interval surgery planned.
Case Presentation

- 6 weeks later patient undergoes “elective” laparoscopic assisted sigmoid colectomy using accelerated recovery clinical pathway.

- He has preop mechanical bowel prep using oral antibiotics.

- He mobilizes and begin a low residue diet on first postoperative day with limited postoperative fluids.
Case Presentation

- Foley catheter is removed and IV is saline locked on first postop day.
- Patient uses only oral narcotics, acetaminophen, and toradol for pain management.
- He has bowel movement and is discharged on 2\textsuperscript{nd} postop day with wound doing well.
Case Presentation 2

• JB is a 65 yr old WM with a biopsy documented asymptomatic rectal cancer at 8 cm from anal verge on routine colonoscopy.

• Preoperative staging shows no evidence of metastatic disease.
Case Presentation 2

- Patient receives a mechanical bowel prep with oral antibiotics.
- Epidural catheter is placed prior to surgery.
- He undergoes a low anterior resection with low double stapled primary anastamosis without complication.
Case Presentation 2

- Patient receives low volume fluid management postop.
- Epidural catheter, foley catheter, and pelvic drain are removed on postop day 2.
- Diet is advanced to low residue diet by postop day 3.
- Patient experience bowel function on postop day 3 and is discharged on postop day 4.
Indications for Major Colon and Bowel Resection

- Colorectal cancer
- Diverticular disease
- Inflammatory bowel disease
Variability in Length of Stay After Colorectal Surgery

- Mean LOS for colorectal surgeries was 7.4 days; 6.1 days in the absence of postoperative complications; 16.1 days when a complication occurred.

Cohen, M. et al

Ileus Reduction In Colorectal Surgery

- Retrospective review of more than 800,000 patients undergoing surgery in 2002 found postoperative ileus rate of 4.25%.

- Mean hospital LOS was 9.3 days in patients with postoperative ileus vs 5.3 days in those without it.

- The difference in mean hospital costs was $6300 per patient.
Colorectal Surgery

• Traditional major colon and rectal surgery is associated with major morbidity!

• Average LOS 5 - 10 days

• Post-operative complications of 15%-20%

• Enhanced Recovery After Surgery (ERAS) protocols may reduce the length of stay and complication rates after major elective colorectal surgery without compromising patient safety.
ERAS Protocols

- Evidence based accelerated recovery programs that aim to decrease stress responses, organ dysfunction and improve postoperative recovery by focusing on:
  1. Patient education
  2. Optimal pain control minimizing narcotics
  3. Control surgical stress hormone response
  4. Maintain euvoletic fluid balance
  5. Early mobilization and nutrition
ERAS Background

- First introduced 15 years ago
- Large body of evidence in multiple specialties supporting the application of this principle to surgical recovery.
- “The hypothesis that a combination of unimodal evidence based care interventions to enhance recovery will subsequently decrease need for hospitalization, convalescence, and morbidity.”

  Kehlet H. Langenbecks

## ERAS Broadly Applicable

**TABLE 1. Results From Selected Fast-Track Surgical Programs**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Postoperative LOS</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groin hernia repair</td>
<td>1.5–6 h</td>
<td>Large consecutive series ( n = 1000–3000 ) using local infiltration anesthesia(^{134,135})</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td>Same day discharge ( &gt;80% )</td>
<td>Large consecutive series and randomized trials. Further improvement with antiemetics/multimodal nonopioid analgesia(^{136–140})</td>
</tr>
<tr>
<td>Bariatric surgery</td>
<td>(~80%, &lt;23 h)</td>
<td>( n = 2000 ) consecutive laparoscopic Roux-Y gastric bypass(^{141}); gastric banding(^{142})</td>
</tr>
<tr>
<td>Colonic resection</td>
<td>2–4 d</td>
<td>Documentation of benefits on recovery of all organ functions and reduced morbidity from multi-center series and randomized trials. Only minor differences between open and laparoscopic fast-track surgery</td>
</tr>
<tr>
<td>Complex colorectal procedures</td>
<td>3–5 d</td>
<td>Single-institution series, laparoscopic and open approach(^{149–154})</td>
</tr>
<tr>
<td>Pulmonary resection</td>
<td>1–4 d</td>
<td>Single-institution series, open, and thoracoscopic(^{155–157})</td>
</tr>
<tr>
<td>Reflux surgery</td>
<td>98%, &lt;23 h</td>
<td>Large (( n = 557 )) consecutive, single-institution series, laparoscopy(^{158})</td>
</tr>
<tr>
<td>Esophageal resection</td>
<td>7–8 d</td>
<td>Small single-institution series(^{159–161})</td>
</tr>
<tr>
<td>Pancreatic resection</td>
<td>7 d</td>
<td>Consecutive series before vs. after pathway, cost reduction(^{162})</td>
</tr>
<tr>
<td>Radical prostatectomy</td>
<td>(~75%, 1 d)</td>
<td>Large consecutive series(^{163})</td>
</tr>
<tr>
<td>Nephrectomy (donor)</td>
<td>1–2 d</td>
<td>Shortest (23 h) with laparoscopic approach, 2 d with open surgery(^{164,165})</td>
</tr>
<tr>
<td>Nephrectomy (other)</td>
<td>2–4 d</td>
<td>Consecutive patient series, shortest with laparoscopic approach(^{166–168})</td>
</tr>
<tr>
<td>Adrenalectomy</td>
<td>(&lt;1 d) in 80%</td>
<td>Laparoscopic approach, small, single-institution series(^{169,170})</td>
</tr>
<tr>
<td>Abdominal aortic aneurysmectomy</td>
<td>(~3 d)</td>
<td>Consecutive series, revised criteria for intensive care stay, fluid-restriction(^{171–174})</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>(&lt;1 d) in 90%</td>
<td>Large consecutive series(^{175–177})</td>
</tr>
<tr>
<td>Parathyroid and thyroid surgery</td>
<td>80%–90% ambulatory</td>
<td>Single-institution consecutive series(^{178–180})</td>
</tr>
<tr>
<td>Hip, knee, and elbow arthroplasty</td>
<td>(~1 d)</td>
<td>Small, single-institution series with or without minimal access operation(^{181–184})</td>
</tr>
<tr>
<td>Ovarian cancer surgery</td>
<td>5 d</td>
<td>Well-designed pathways, cost-reduction(^{185,186})</td>
</tr>
</tbody>
</table>

ERAS Protocol
Summary of Elements in Colorectal Surgery

• Preoperative
  • Preoperative patient education with discharge planning
  • Normal diet prior to surgery
  • No oral bowel preparation
  • Pre-op analgesia
    • Gabepentin/COX-2
  • Post-op nausea and vomiting prophylaxis
  • Pre-op carbohydrate load

• Intraoperative
  • Minimize systemic opioids
  • Extensive use of regional anesthesia (primary or supplementary)
  • Minimize incision length or use laparoscopy
  • Maintain euvolesia
  • Active warming
  • No post-operative NG tube
  • Avoid drains

• Postoperative
  • Avoid IV opioids
  • Regular diet 4 hours post-op
  • Enforced ambulation 6 hours post-op
  • Scheduled acetaminophen and NSAIDs (if appropriate)
  • Removal of urinary drainage at 24 hours

ERAS Principles

- preop assessment and optimization
  - patient information
  - stress reduction
  - pain relief
  - fluid therapy
  - additional interventions (antibiotics, thromboprophylaxis, oxygen therapy, etc.)
  - revision of care principles (drains, tubes, catheters, bowel clearance, etc.)
  - oral nutrition
  - ambulation, exercise

enhanced recovery

ERAS Protocol  Preoperative Care

- Preoperative patient education with discharge planning
- Meet with Ostomy nurse if applicable
- Assessment for regional block
- Oral bowel prep with oral antibiotics
- Preoperative analgesia - Gabepentin/COX-2
- Postop nausea and vomiting prophylaxis
- Pre-op carbohydrate load
ERAS Protocol  Intraoperative Care

- Minimize systemic opioids
- Extensive use of regional anesthesia - epidural catheters
- Minimize incision length or use of laparoscopic techniques if appropriate
- Careful handling and dissection of tissues
- Meticulous hemostasis
- Maintain euvolemma
- Active warming
- No post-operative NG tubes
- Avoid drains
Peri/Intraoperative Care

- Mechanical bowel prep
- Pre-op pain and nausea/vomiting prophylaxis
- Regional anesthesia (epidural) if appropriate
- Fluid management: balance intravenous fluids given - keep euvolemic.
  1. 500 to 1000 cc baseline
  2. Additional fluids given on basis of hemodynamic status; use of transesophageal doppler.
Peri/Intraoperative Care

- Try to minimize intraoperative opioids
- Minimal maintenance fluids in post-op recovery area (50-60 cc/hr)
ERAS Protocol  Postoperative Care

- Avoid IV opioids
- Regular low residue diet 4 hours post-op
- Enforced ambulation 6 hours post-op
- Acetaminophen and NSAIDs if appropriate
- Removal of foley catheter at 24 hours
Postop Day of Surgery

- Continue euvolemic state from OR - low volume IV fluids 40ml/hr
- Proactive pain control
- Optimize Acetaminophen and Ketorolac; consider Tramadol
- Epidural catheter or low dose oral opioids for first 24 hours
- Early oral intake including consideration of general diet
- Minimal tubes
- Ambulation the evening of surgery
Postop Days After Surgery

- Saline lock IV when oral intake OK
- Remove foley catheter postop day 1
- Continue diet- encourage small frequent amounts
- Out of bed for at least 8 hours
- Oxycodone 5-10 mg prn pain every 4 hrs for pain control with scheduled acetaminophen and NSAIDs
- Discharge planning evaluated.
ERAS Supporting Data

- Mata-analysis of 6 RCT with 452 patients included.
- The number of individual ERAS elements used ranged from 4 to 12, with a mean of 9.
- The length of stay in the ERAS group was 2.55 days less and the relative risk complication rate was 53% reduced in the ERAS group compared to controls.
- There was no significant difference in readmission and mortality rates.
- ERAS pathways appear to reduce LOS and complication rates after major colorectal surgery without compromising patient.
ERAS Recommendations in Colorectal Surgery

Table 1 Grade A recommendations by Enhanced Recovery After Surgery (ERAS) Group. Recommendations were assigned grade A if they were based on at least two good quality randomised-controlled trials (in patients undergoing gastrointestinal surgery) or one meta-analysis of RCTs with homogeneity.

In elective colonic surgery:
- Patients undergoing elective colonic surgery above the peritoneal reflection should not receive routine oral bowel preparation.
- The duration of pre-operative fasting should be 2 h for liquids and 6 h for solids.
- Patients should receive carbohydrate loading preoperatively.
- The preferred method for thromboembolism prophylaxis is subcutaneous low-dose unfractionated heparin or subcutaneous low molecular weight heparin.
- Patients should receive single-dose antibiotic prophylaxis against both anaerobes and aerobes about 1 h before surgery.
- Patients should receive a mid thoracic epidural commenced preoperatively and containing local anaesthetic in combination with a low-dose opioid.
- Laparoscopic colonic resection is recommended if the surgeon is proficient with the technique and prospectively validated outcomes show at least equivalence with open surgery.
- Nasogastric tubes should not be used routinely in the post-operative period.
- Intra-operative maintenance of normothermia with an upper-body forced air heating cover should be used routinely.
- Intraoperative and post-operative fluid restriction in major colonic surgery with avoidance of hypovolaemia is safe.
- When compared with excessive fluid regimens, normovolaemic regimens lead to more favourable outcomes.
- Intra-operative goal directed therapy is superior to non-protocol based standard with respect to outcome.
- Drains are not indicated following routine colonic surgery above the peritoneal reflection.
- Suprapubic urinary drainage for pelvic surgery is recommended.
- Mid thoracic epidural analgesia and avoidance of fluid overload are recommended to prevent post-operative ileus.
- Patients should receive continuous epidural mid thoracic low-dose local anaesthetic and opioid combinations for post-operative analgesia.
- Patients should be encouraged to commence an oral diet at will after surgery.
- Oral nutritional supplements at home for several weeks is recommended for nutritionally depleted patients.

Alvimopan To Reduce Ileus

- Blocks the peripheral effects of opioids on GI mobility and secretions by competitively binding to the GI tract mu-opioid receptors

- FDA approved to accelerate GI recovery following partial large or small bowel resection with anastomosis

- 5 multicenter, randomized, double blind, placebo-controlled studies showed improved mean time to GI recovery
Major Complications in Colon Resection Surgery

- Anastomotic leak
- Infection
  - A. Superficial wound infection
  - B. Deep space infection
- Ileus
- Thromboembolic complications
- Pulmonary complications
Major Complications in Colon Resection Surgery

- Cardiovascular complication
- Renal Failure
- UTI’s
Anastomotic Complications

- Incidence of anastomotic leak varies depending on the level of the anastomosis.

- Small bowel and ileocolic anastomoses have the lowest reported leak rates 1-3%.

- The highest leak rates are after coloanal anastomoses; 10-20%.

- The risk of anastomotic leak after low anterior resection is inversely related to the distance of the anastomosis to the anal verge.
Risk Factors for Anastomotic Leaks

- Immunosuppression (prednisone use)
- Poor nutrition; hypoalbuminemia
- Radiation exposure
- Morbid obesity
- Smoking history
- Local sepsis
- History of neoadjuvant therapy
Technical Factors Contributing To Anastomotic Leak

- Ischemia
- Tension
- Poor technique
- Stapler malfunction
- Excessive blood loss
- Prolonged operative time
- Use of drains is controversial
Anastomotic Leaks

- “Sound technique in the construction of anastomoses can minimize risk, as can the correction of malnutrition and the use of proximal fecal diversion in patients with risk factors.”

Dietz, D. Am Society of Colon and Rectal Surgeons
Anastomotic Leak
Anastomotic Leak
Anastomotic Leak
Anastomotic Leak
Surgical Site Infection In Colorectal Surgery

- SSIs are a major cause of postoperative morbidity.
- Risk assessment, adherence to key preventive strategies, and active surveillance may reduce SSI rates.
Surgical Site Infections

- 2\textsuperscript{nd} leading cause of nosocomial infections
- 290,000 SSIs were diagnosed in U.S. in 2002; resulting in 8207 deaths.
- SSIs mortality rate 2-12 times that of patients who do not have a SSI.
- Significant financial burden - SSIs accounted for $3.45 - $10.07 billion in direct costs in 2007.
- ACS NSQIP Best Practice Guidelines
Risk Factors for SSIs

- Advanced age
- Obesity
- Hyperglycemia/diabetes
- Dyspnea
- Hypoxia
- ASA class > 2
- Smoking
- Alcoholism
Risk Factors for SSIs

- Steroid use
- Recent radiation therapy
- Preoperative albumin < 3.5mg/dl
- Total bilirubin > 1.0mg/dl
- Trauma/shock
- Transfusion
- Hypothermia
Surgery Related Risk Factors For SSI

- Inadequate surgical scrub or skin preparation
- Abdominal surgery
- Surgery requiring bowel anastomosis
- Contaminated or dirty/infected procedure
- Surgery for cancer
- Emergency surgery
- Complex surgery (WVUs > 10)
- Prolonged procedure
- More than 3 diagnoses at time of discharge
Introduction

• Direct Costs:
  • Minor Superficial Infections - $400
  • Complex Infections after joint surgery - $63,135
  • Mediastinitis after Cardiac Surgery - $299,237

• Home Health Care Costs:
  • Wound Infections after Colon Resection - $6,200


Introduction

- Median Direct Costs in the 1990s:
  - Hospitalization in infected patients - $7,531
  - Noninfected patients - $3,844

- Increase in costs:
  - $2,671 - for colon surgery
  - $11,001 - for spinal surgery

Introduction

- 288,906 patients:
  - 11.9% had an SSI
  - In hospital mortality in infected patients was 14.5% vs. 1.8% in noninfected patients

Introduction

- Hospital-associated infections in Massachusetts - the cost of such infections in 2006 was estimated at $223,000,000 to $275,000,000.

- A 1% incidence of SSI was projected to generate national costs of over $900,000,000 per year for in-hospital costs alone and a total of $1.6 billion in excess costs overall.

- Such figures may account for only 10% of overall costs when including indirect social costs such as time off work and loss of job.

Checklist/Recommendations

1. CDC and JHACO guidelines
2. Double gloving and using drapes that prevent liquid penetration
3. Preoperative showering with chlorhexidine and preoperative cleansing of the operative site with a chlorhexidine-impregnated cloth just before entering the operating room.
4. Clippers when needed
5. Alcohol and chlorhexidine prep
6. Antimicrobial incise drapes
7. Suture material has been selected which resists infection.
8. Dead spaces have been obliterated, where possible.
9. Minimal trauma to the wound itself by gentle handling of tissues and limited use of electrocautery
10. Conduit drains and drainage through a working incision have not been used.
11. Prophylactic topical antibiotics
12. Prophylactic systemic antibiotics have been used according to guidelines in all surgical cases where the incidence of infections exceeds approximately 0.5% or when any foreign body is implanted.
13. Core temperature has been maintained at 36°C or higher throughout the perioperative period.
14. Inspired oxygen has been given at a sufficient concentration to maintain subcutaneous oxygen concentrations of approximately 100 mm Hg and pulse oxygen readings above 96.
15. All diabetic and hyperglycemic patients have received tight glucose control (blood glucose <180 mg/dL) during the perioperative period and for 2 to 3 days afterward in high-risk patients.
16. Transfusion of blood products has been limited.
17. Stopped smoking for at least 4 weeks before operation for highly elective procedures, such as abdominoplasty.
Critical to Quality Tree: SSI for Colorectal Surgery

Pre-operative Processes
- Chlorhexidine cloths @ AM admission

Patient Cleansing
- Hibiclens® shower night before and end day of surgery
- Ensure understanding by reading pamphlet “Preventing SSI”

Antibiotic administration
- Ensure SCIP compliance
  1. Right antibiotics
  2. Administer 50 min prior to incision
  3. Discontinued within 24 hours
- Ensure re-dose of cefazolin within 3-4 hours after incision
- Chloraprep applied – use appropriate amount to ensure complete coverage of incisional area

Intra-operative Processes
- Use closing tray for closure of fascia and skin
- Glove change by staff before closure of fascia
- Practice good hand hygiene
- Patient shower with Hibiclens® following dressing removal
- Hand cleansing agent readily available
- Signage encouraging hand hygiene
- Purell® hand wipes made available to patients
- Ensure dressing removal within 48 hours
- Dismiss patient with 4 oz. bottle of Hibiclens®
- Patient education on wound care and recognizing infection symptoms
- Follow-up phone call from nurses

Reduce SSI by 50% (10 → 5%)

Closing protocol @ time of fascia closure
- Glove change by staff before closure of fascia

Post-operative Processes
- Ensure understanding by reading pamphlet “Preventing SSI”
- Chloraprep applied – use appropriate amount to ensure complete coverage of incisional area

Patient and Hand hygiene
- Practice good hand hygiene
- Patient shower with Hibiclens® following dressing removal
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Post-hospitalization Processes
Colorectal Surgery
30-Day Morbidity

Observed Rate: 21.32%
Expected Rate: 27.78%
O/E Ratio: 0.77
Status: As Expected
Colorectal Surgery
Surgical Site Infection

Observed Rate: 4.41%
Expected Rate: 13.32%
O/E Ratio: 0.33
Status: Exemplary
SSI Prevention for Colorectal Surgery

- Bowel Prep or Not?
- What about Oral Antibiotics?
Bowel Prep for Colorectal Surgery

• If you are not going to use oral antibiotics along with a mechanical bowel prep (MBP) then the MBP is not necessary and there is a suggestion of harm along with more GI symptoms and C. difficile infection.

• Oral antibiotics along with a MBP in advance of colorectal surgery is associated with a lower incidence of SSI and should be reconsidered.

Dellinger, P.; NSQIP conference presentation; 2011.
U.S. Colon Cancer Surgeries - 2008

98,923 Patients

Open Colectomy 97%

Laparoscopic 3%

RiverBend Colorectal Surgeries in 2010

543 Total Colorectal Surgeries

46% MIS

250 Surgeries Using Minimally Invasive Techniques
Case Example:
Laparoscopic Colectomy - 1991

- Too Expensive (Equipment)
- More complications
- No recovery benefit
- Oncologically dangerous?
- Steep learning curve
- Absence of formal training

Case Example:

Laparoscopic Colectomy - Today

- Smaller incisions
- Less blood loss
- Faster GI recovery
- Shorter length of stay
- Less post op narcotics
- Less pulmonary infections
- Less wound infections
- Equal oncologic outcomes
Case Example:
Laparoscopic Colectomy - Today