Gastrointestinal Complications of Cardiovascular Surgery

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Disclosures

- Advisory Board – Mallinckrodt Pharmaceuticals
- Device Consultant – Medtronic (Covidien)
- Charter member of the American Society of Enhanced Recovery After Surgery (ERAS)
- I’ve been doing this long enough to remember when these complications were much more common
CTV Surgery – then
Objectives

- Describe the common gastrointestinal complications of CTV Surgery
- Define risk factors for the occurrence of GI complications in CTV Surgery
- Chronicle changes in the incidence of GI complications in CTV Surgery
- Describe possible care pathways to reduce the incidence of these complications and improve patient outcomes
What you will not hear

- You will not hear an effective scoring system to predict patients at high risk for GI complications after cardiothoracic surgery.
- You will not hear an effective scoring system to predict death from GIC after CTV surgery.
- You will not hear the answers to the quiz.
GIC after CTV Surgery

GIC in CTV Patients
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Post-op GIC in CTV Patients

- Reported incidence ranges from <1% to 5.3%
- Reported mortality in these patients ranges from 21% to 53%
- Heterogeneous group of complications
- Often difficult to identify clinically
- Differ in their presentation than in non-CTV patients
- Associated with prolonged hospital stay and increased cost of hospitalization
Post-op GIC in CTV Patients

- Overall incidence is probably decreasing
- Complex cardiac procedures (bypass, valve replacement, aortic reconstruction) and Heart Failure Assistive Devices (Ventricular Assist Device, Total Artificial Heart and Cardiac Transplant) are now associated with GI complications
Pre-Operative Risk Factors for GIC in CTV

- Decreased left ventricular ejection fraction
- Advanced patient age (>70)
- Diabetes
- Prior cerebrovascular accident
- COPD
- Chronic Renal Insufficiency (Creatinine > 1.4)
- History of atrial fibrillation
- Peripheral Vascular Disease
- History of Gastric or Peptic Ulcer Disease
- Low Cardiac Output
  ◦ Pre-operative need for intra-aortic balloon pump
- Urgent/Emergent Surgery
Intra-Operative Risk Factors for GIC in CTV

- Valvular Surgery or Combined bypass/valve operations
- Prolonged pump time (greater than 100 minutes)
- Intra-operative use of vasoactive agents
Post–Operative Risk Factors for GIC in CTV

- Admission to the Intensive Care Unit
- Prolonged mechanical ventilation
- Need for Intra-aortic balloon pump
- Post-op need for vasoactive agents
- Need for dialysis
- Need for re-exploration after surgery
- Post–operative sepsis/infectious complications
  - Sternal wound infection
Predictors of Death after Intra-abdominal Event

- New York Heart Association class III and IV
- Smoking
- Direct bilirubin > 2.4 mg/dl
- Syncope at time of presentation
- Chronic obstructive pulmonary disease
- AST > 600 mg/dl
- Need for 2 or more pressors
GIC after CTV Surgery
Post-operative ileus
Bowel motility changes

- Despite the significant hemodynamic effects on the GI tract by CTV surgery are fairly well tolerated
- Impairs small intestinal transport
- Increases gut permeability (especially with prolonged pump times)
- Decreases intestinal absorption
Post-operative Ileus

- Occurs in somewhere between 1 – 10% of patients
- Can present in different ways
  - Isolated gastric distension
  - Prolonged bowel dysfunction
  - Colonic dysfunction
- It is important to distinguish ileus from a more serious underlying problem
  - Ileus is usually not accompanied by severe pain
Dysphagia
Dysphagia

- Common complaint after CTV surgery
- Associated factors
  - History of gastro-esophageal reflux
  - Endotracheal intubation
  - TEE – increases odds of developing dysphagia eight fold
Esophageal and Gastric Perforations
Esophageal and Gastric Perforations

- Can occur after trans-esophageal echo
- Probably underdiagnosed or underreported and may occur in more than 1.2% of CTV patients
- May present 4–11 days after TEE
- Treatment requires repair and/or drainage
Among the most common GI complications

- Often associated with history of gastro-esophageal reflux
  - Risk for pulmonary aspiration
- Multi-factorial etiology
  - Mucosal hypoperfusion
  - Previous history of gastric mucosal disorder
  - Use of non-steroidal anti-inflammatory drugs
Gastritis and Esophagitis

- Avoid hypotension and hypoperfusion
- Aggressive treatment with H2-receptor blockers or proton pump inhibitors

- For patients with reflux
  - Maintain head of bed at 45%
Among the most common GI complications
- 15 – 29% of all GIC of CTV Surgery
- High levels of anti-coagulation required for operations requiring Cardiopulmonary Bypass
- Associated with previous history of peptic ulcer disease
- Significantly elevated risk with prolonged mechanical ventilation
- Upper GI bleeding is more common than lower GI bleeding
- Greater than 90% of upper GI bleeding is proximal to the ligament of Treitz
Gastrointestinal Hemorrhage

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Upper Gastrointestinal Hemorrhage

Treatment

Medical

- H2-Receptor blockers or proton pump inhibitors
- Red blood cell transfusion (trigger to move to surgical management > 4 – 6 units)
- Correction of coagulopathy
- If medical management fails move to Interventional or Surgical Options
Upper Gastrointestinal Hemorrhage

Treatment

Surgical

- Upper endoscopy or clipping
- Endovascular embolization
- Surgical Intervention
Lower Gastrointestinal Bleeding
Lower Gastrointestinal Bleeding

Treatment

Medical (15% mortality)
- Hemodynamic stabilization
- Correction of coagulopathy

Surgical (49% mortality)
Reserved for refractory cases, hemodynamic instability or transfusion trigger (> 4– 6 units)
- Endovascular embolization
- Surgery
Mesenteric Ischemia

- Occurs within hours to days after surgery
- GI tract is vulnerable to ischemia because it is often unable to compensate for systemic hypotension
- May also result from persistent vasoconstriction following the initial “low flow” state despite the return of hemodynamic stability (non-occlusive mesenteric ischemia or NOMI)
Mesenteric Ischemia

- Flow to the jejunal mucosa decreases by 40% and to the serosa by almost 50% upon the institution of hypothermic cardiopulmonary bypass
- Similar decreases in oxygen delivery and consumption increase dramatically with the resultant decreases in intestinal mucosal pH.
Mesenteric Ischemia

- Mortality may exceed 65%
- Pathognomonic sign: *Pain out of proportion to the physical exam* (may be masked by *pot–op state as many of these patients are ventilated/sedated*)
- Persistent lactic acidosis
- Results in mucosal sloughing
- Gangrenous changes in the bowel wall
- Perforation
Mesenteric Ischemia

- Heparin–Induced Thrombocytopenia is a rare but important cause of intestinal ischemia
- Must have a high index of suspicion and replace heparin with ergatroban until ruled out
- Decrease in platelet count of 50% from admission
Ischemia secondary to low flow state

- Splanchnic hypo-perfusion
  - Pre-operative
    - Low left ventricular ejection fraction
    - Peripheral vascular disease
    - Hypovolemia
    - Increased pulse pressure
    - Prior myocardial infarction
    - Renal Failure (Creatinine >1.4)
Ischemia secondary to low flow state

- Splanchnic hypo-perfusion
  - Intra-operative
    - Hypotension
    - Hypovolemia
    - Use of vasoconstrictive drugs
    - Longer pump times (>100 minutes)
      - Non-pulsatile flow
      - Hemodilution
      - Hemolysis
      - Inflammatory cascade activation
      - Hypothermia
Off–Pump CABG

- One study (Rodriguez et al) showed a significant difference in the incidence of GIC for Off–Pump CABG than for On–pump CABG.
- These results have not been duplicated in other studies.
Ischemia secondary to low flow state

- Splanchnic hypo-perfusion
  - Post-operative
    - Hypotension
    - Cardiogenic shock
    - Intra-aortic balloon pump
    - Prolonged mechanical ventilation
      - High PEEP
        - Impaired cardiac output
        - Activation of the renin-angiotensin-aldosterone system results in increases in catecholamine levels
          Shunts blood away from the gut
Ischemia secondary to low flow state

- Splanchnic hypo-perfusion
  - Diagnosis
    - Visceral angiography is the gold standard
      - May require significant dye load
      - Can be difficult to do in unstable patient
    - CT Angiography
      - Valid diagnostic alternative
      - Can demonstrate the anatomy and diameter of the SMA
      - Can reveal narrowing of branches of SMA
      - Can demonstrate spasm of intestinal marginal artery
      - Can show poor venous return as a sign of vasospasm
  - Important to let the radiologist know what you are looking for, as timing of injection is critical
Ischemia secondary to low flow state

- **Splanchnic hypo–perfusion**
  - **Medical Treatment**
    - Restoration of adequate intra–vascular volume
    - Maintenance of adequate cardiac output
    - Selective arterial cannulation, dilatation and installation of vasodilating agents
  - **Surgery**
    - Reserved for need for vascular bypass or
    - Resection of necrotic bowel
      - Intraoperative use of ICG Immunofluorescence
      - Second Look Laparotomy
Intraoperative Immunofluorescence
Ischemia secondary to embolic phenomena

- Macrovascular embolism or thrombosis
  - SMA embolus
  - If treated early have better outcomes
    - Can be treated with endovascular or open approaches

- Microvascular emboli
  - Cholesterol showering
  - Most commonly due to aortic manipulation

- Intra–aortic balloon pump
  - Hypo–perfusion
  - Thrombus and embolization

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Ischemia secondary to embolic phenomena
Acute cholecystitis

- Incidence is about 8% of postoperative GIC in CTV patients

- Symptoms
  - Right upper quadrant pain
  - Tenderness in right upper quadrant (Murphy’s sign)
  - May be masked by sedation and mechanical ventilation
  - Consider as a source of post-operative fever
Acalculous cholecystitis is common

- Multiple factors
  - Lack of enteral eating
  - Gallbladder wall ischemia secondary to “low-flow “ state
- Mortality rates are high (>50%)
- Usually reflect overall poor status of patients
Acute Cholecystitis
Acute cholecystitis

**Treatment**

- Often poor candidates for surgery
- Laparoscopy requires increased intraabdominal pressure which decreases venous return
- Open procedures are poorly tolerated
- Percutaneous cholecystostomy tube can often allow patient to get over acute episode until better able to tolerate surgery
  - Can often be performed at the bedside under ultrasound
Pancreatitis

- Relatively uncommon
  - 1–3% of GIC of CVT Surgery
- Etiology unknown
  - Theorized to result from low flow state
  - Tissue ischemia
  - Gallstone disease
  - Microembolization
  - History of pancreatic disease
Pancreatitis

 Symptoms
  ◦ Upper abdominal pain (can be severe)
  ◦ Nausea
  ◦ Vomiting
  ◦ Ileus
  ◦ Abdominal Distension

 Elevated lipase
  ◦ Greater than 5,000 (Elevated amylase/lipase occurs in approximately 1/3 of CTV patients
Pancreatitis
Pancreatitis

- Treatment largely supportive
- Necrotic and/or hemorrhagic pancreatitis is extremely rare in CTV patients
- Surgery postponed for 30 days or longer if possible
Ogilvie's syndrome
  - Multifactorial origins including narcotics and anticolinergic agents

Marked colonic distension in the absence of distal obstruction

Results from ineffectual colonic motility caused by excessive sympathetic stimulation, parasympathetic dysfunction, or both

Untreated, leads to cecal over-distension and resultant perforation (critical diameter 9 – 12cm)

Mortality ranges from 15% – 50%
Colonic Pseudo-obstruction
Colonic Pseudo-obstruction

Treatment

- Medical
  - Endoscopic decompression
  - Neostigmine administration
    - 2.0 mg over 3 – 5 minutes.
      - (Side effect – Symptomatic bradycardia)

- Surgical
  - Cecal decompression
    - Cecostomy
    - Colonic resection and entero-enterostomy
    - Colostomy creation
Can see all the complications of CTV surgery

Immunosuppression results in increased susceptibility to bacterial, fungal, parasitic and viral infections
- Cytomegalovirus enteritis
- Candida esophagitis
- C. diff. enterocolitis
- Yersinia entercolitis

Gastrointestinal malignancy
- Post-transplant lymphoproliferative disorders
Enhanced Recovery after Surgery

Putting Evidence into Practice
Running a Marathon
Preparing Patients for Surgery

No Food or Drink

NPO
What Really is ERAS

- **ERAS** stands for Enhanced Recovery After Surgery.
- ERAS is a multimodal peri-operative care pathway designed to achieve early recovery for patients undergoing major surgery.
- ERAS represents a paradigm shift in peri-operative care in two ways.
  - First, it re-examines traditional practices, replacing them with evidence-based best practices when necessary.
  - Second, it is comprehensive in its scope, covering all areas of the patient's journey through the surgical process.
History

Enhanced Recovery after Surgery

Henrik Kehlet
Colorectal Surgeon, Denmark

Why is the patient still in hospital?
• Poor analgesia
• Poor mobility
• GUT dysfunction

Developed a pathway to accelerate the rapid return of body homeostasis

History of ERAS

Original Consensus Article 2005

Enhanced recovery after surgery: A consensus review of clinical care for patients undergoing colonic resection


• Evidence base for 17 manoeuvres that individually may have only a small impact but together have a great impact on outcome in colorectal surgery
Enhanced Recovery Pathway

**Preoperative**
- Preadmission counseling
- Fluid and carbohydrate loading
- No prolonged fasting
- No/selective bowel preparation
- Antibiotic prophylaxis
- Thromboprophylaxis
- No premedication

**Intraoperative**
- Short-acting anesthetic agents
- Mid-thoracic epidural anesthesia/analgesia
- No drains
- Avoidance of salt and water overload
- Maintenance of normothermia (body warmer/warm intravenous fluids)

**Postoperative**
- Mid-thoracic epidural anesthesia/analgesia
- No nasogastric tubes
- Prevention of nausea and vomiting
- Avoidance of salt and water overload
- Early removal of catheter
- Early oral nutrition
- Non-opioid oral analgesia/NSAIDs
- Early mobilization
- Stimulation of gut motility
- Audit of compliance and outcomes
1. Pre-operative assessment, optimization and counseling
2. Standards of Care
3. Elements to reduce pathophysiological insult
4. Elements to avoid post-op gut dysfunction or ileus
5. Elements to improve metabolic response to surgery
6. Audit – compliance and outcome

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ERAS Elements – Grouping

1. Pre-operative assessment, optimization and counseling
2. Standards of Care
3. Elements to reduce pathophysiological insult
4. Elements to avoid post-op gut dysfunction or ileus
5. Elements to improve metabolic response to surgery
6. Audit – compliance and outcome
Preoperative Fasting – Change from “nothing by mouth after midnight” to No **solid** foods after midnight, oral intake of water or other clear fluids (tea, coffee, apple juice) up to 3 hours prior to surgery
Preoperative Oral Carbohydrate

- Evening before surgery drink 2 cartons and morning of surgery drink 1 carton of high carbohydrate beverage.

- Improves feelings of thirst, hunger and anxiety, accelerates the return of bowel function and reduces postoperative insulin resistance.
Enhanced Recovery after Surgery

- Learn about ERAS
- Many elements are common to all surgeries
- Decreases LOS
- Decreases Complications
- Improves patient satisfaction
Questions

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References

References


References