

# Colorectal ERAS

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# ERAS

- Enhanced Recovery after Surgery (ERAS)
- First colorectal guidelines published in 2005

# Why implement ERAS

- Reduction in the rates of morbidity
- Improve speed of recovery
- Shorten length of stay (LOS)

# More than one society for ERAS?

- ERAS Society ([www.erassociety.org](http://www.erassociety.org))
- ASER American society for enhanced recovery
  - ([www.aserhq.org](http://www.aserhq.org))

# Colorectal ERAS

- Recommendations divided into
  - Preadmission
  - Pre-operative
  - Intraoperative
  - Postoperative

# Pre-admission Items

- 1. Preadmission information, education and counseling
- 2. Preoperative optimization
  - Smoking cessation-patients who smoke have in increased risk of intra- and postoperative complications.
    - 4-8 weeks of abstinence appears necessary to reduce respiratory and wound-healing complications.
  - Avoiding alcohol abuse-alcohol abuse increases postoperative morbidity. (pre-operative abstinence of 4 weeks is recommended)

**NO SMOKING,  
EATING OR DRINKING  
BEYOND THIS POINT**



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# Pre-admission Items

- 3. Prehabilitation-a process in the continuum of care that occurs between the time of diagnosis and beginning of acute treatment.
  - Prehabilitation shows promising results in recovery of functional capacity and may reduce complications after colorectal surgery. (further evidence/research is required before considering this item mandatory part of ERAS



# Putting the pieces together



# Pre-admission items

- 4. Preoperative nutritional care
  - Preoperative malnutrition has been associated with increased postoperative morbidity and mortality as well as poor oncologic outcomes in surgery for gastrointestinal cancer.
  - For malnourished patients, oral nutritional supplementation has the best effect if started 7-10 days pre-operatively and is associated with a reduction in infectious complications and anastomotic leaks.

# Taste Great & Less Filling?



# Preadmission items

- 5. Management of Anemia
  - Most patients presenting for colorectal surgery will have iron deficiency because of blood loss or chronic inflammation.
  - Anemia may be a risk factor for all complications and mortality. (However, administration of blood products peri-operatively may also increase complications and have long term impact on survival in patients with colorectal cancer)
  - As a result, it is important/essential to optimize the patient's Hb concentration preoperatively. (I.E. oral iron therapy or IV iron infusions.

## Iron therapy



Oral iron

VS



Iron sucrose  
(venofer)

IV iron

# Preoperative Items

- 6. Prevention of PONV

# PONV

- PONV- can result
  - dehydration
  - Delayed nutrition intake
  - Placement of an NG tube
  - Increase IV fluid administration
  - Prolonged hospital stay
  - Increased healthcare costs
  - Patient dissatisfaction

# PONV

- Etiology
  - Multifactorial
  - Divided into 3 categories
    - 1. patient-related
      - Female gender, history of PONV/motion sickness, nonsmokers etc.
    - 2. anesthesia related (TIVA can mitigate in part)
      - Volatile anesthetics
      - Nitrous oxide
      - Liberal use of narcotics
    - 3. surgery related
      - Type and duration of the surgery and the gastrointestinal pathology.



# PONV Prevention

- Opioid sparing multimodal techniques.
- Carbohydrate loading
- Antiemetic drugs

# PONV

- 1<sup>st</sup> line drugs

- Dopamine antagonists (droperidol)
- Serotonin antagonist (ondansetron)
- Corticosteroids (dexamethasone) (4-5 mg dose had clinical effects similar to 8-10mg doses)

- 2<sup>nd</sup> line

- antihistamines (promethazine)

- anticholinergics (scopolamine)

- D2 antagonists (metoclopramide)

# PONV

- More recently preoperative use of gabapentin (Neurontin) or pregabalin (Lyrica) has been shown to reduce nausea and vomiting.
- Aprepitant (Emend)- is a neurokinin 1 receptor antagonist which may be used in high risk patients.
- IV Tylenol before the onset of pain has been shown to reduce PONV

# NG decompression?



# Preoperative

- 7. Pre-anesthetic medicines
  - Preoperative anxiety may increase perioperative analgesic requirements and postoperative complication rates.
  - The American Geriatrics Society-benzodiazepines should be avoided in older patients where possible to offset the risk of cognitive impairment, delirium and falls. (Hold the Versed)

# Responsibility to limit delirium



# Preoperative

- 8. antimicrobial prophylaxis and skin preparation.
  - Intravenous antibiotic prophylaxis should be given 60 min prior to incision as a single dose. In patients who had also had an oral bowel prep, oral antibiotics should also be given.
  - Skin disinfection should be performed using chlorhexidine-alcohol based preparations.



# Preoperative

- 9. Bowel Preparation-







*"Friend or enema?"*

# Preoperative

- 10. Preoperative fluid and electrolyte therapy
  - Patients should reach operating room as close to a state of euvolemia as possible.
  - Avoid mechanical bowel prep when possible. (MBP may cause patients to lose up to 2 L of total body water)
  - Avoid prolonged preoperative fasting
  - Allow clear liquids (including carbohydrate drinks) up to 2 hours prior to the induction of anesthesia
  - Correct any fluid and or electrolyte excesses or deficits.

# Preoperative

- 11. Preoperative fasting and carbohydrate loading
  - Preoperative administration of oral carbohydrates (CHO) in the evening before and 2-3 hours prior to induction has been shown to attenuate the catabolic response induced by overnight fasting and surgery

# Benefits of CHO

- Benefits of CHO
  - Improve preoperative well-being
  - Reduce postoperative insulin resistance
  - Decrease protein breakdown
  - Maintain lean body mass and muscle strength
  - Reduced myocardial injury
  - Small reduction in hospital stay
  - Reduced time to flatus

# Restrictions for CHO?

- Patients with delayed gastric emptying or gastrointestinal motility disorders may not be given CHO due to risk of aspiration.
- Obese, elderly, diabetics?



# Intraoperative Items

- 12. Anesthesia protocol
  - Avoid benzodiazepines
  - Use short-acting agents
  - Opioid sparing, multi-modal

# Intraoperative

- Anesthesia protocol
  - Induction-propofol
  - Maintenance-no evidence to support volatile vs TIVA
    - Sevo or Des
    - Avoid Nitrous Oxide
- Cerebral function monitoring (BIS) to target a goal between 40-60 may help to avoid reducing risk of post-op delirium and postoperative cognitive dysfunction
- Maintain deep muscular block with Rocuronium
- Routine use of sugammadex to reverse rocuronium



# Intaoperative

- 13. Intraoperative fluid and electrolyte therapy
  - Goal of fluid therapy is to maintain intravascular volume, cardiac output and tissue perfusion while avoiding salt and water overload
  - Most patients will require crystalloids at a rate of 1-4 ml/kg/hr to maintain homeostasis
  - Goal directed fluid therapy is associated with
    - Reduction in morbidity
    - Reduction in LOS
    - ICU LOS
    - Time to passage of feces

# Intraoperative

- 14. Prevention of intraoperative hypothermia
  - Important to maintain patients at 36 degrees C or over.
  - Esophageal temperature probe
  - Bair hugger and hotline
  - Pre-operative warming

# Intraoperative

- 15. Surgical access
  - Minimally invasive approach to colon and rectal cancer has clear advantages for improved and more rapid recovery and reduced complications

# Intraoperative

- 16. Drainage of peritoneal cavity and Pelvis
  - Pelvic and peritoneal drains show no effect on clinical outcome and should not be routinely used.

# Postoperative

- 17. Nasogastric Intubation
  - Have been used historically to reduce postoperative discomfort from gastric distention and vomiting.
  - All recent data show that the routine use of a NG has no positive, but rather a series of negative effects
  - Negative effects of NG tube
    - Pharyngolaryngitis
    - Respiratory infections
    - Nausea and vomiting
    - Prolonged return of bowel function

# Postoperative

- 17. NG tube
  - Routine insertion of a nasogastric tube during elective colorectal surgery should be avoided except for evacuating air that may have entered the stomach during ventilation by the facial mask prior to the endotracheal intubation
  - If placed during surgery, ng tubes should be removed before reversal of muscle relaxant.
  - Still a role for NG tube in some patients with post-op ileus refractory to conservative management to decompress the stomach and reduce the risk of aspiration

# Postoperative

- 18. Postoperative analgesia-
  - Mainstay strategy is to avoid opioids and to apply multimodal analgesia.
  - Benefit of using a multimodal approach is based on concept that several multiple pain reducing mechanisms will improve pain control while avoiding the side effects of each drug

# Postoperative

- Multimodal
  - 1. Tylenol
  - 2. NSAIDS-still debate whether NSAIDS are associated with increased incidence of anastomotic leak.
  - 3. Lidocaine infusions
  - 4. dexmedetomidine
  - 5. ketamine
  - 6. magnesium sulphate
  - 7. high dose steroids
  - 8. gabapentinoids



# Regional

- Epidural (TEA)
- Spinal-duramorph
- Tap block

# Epidural (TEA)

- Thoracic epidural analgesia (Tea)
  - T7-T10 remains the gold standard in patients undergoing open colorectal surgery.
    - Superior analgesia compared to systemic opioids
  - Should be initiated before surgery and continued for 48-72 hours after surgery
  - Primary epidural failure rate ranges between 22% and 32%
  - APR will require supplemental analgesia for dermatomes (S1-S3)
- Lumbar epidural-discouraged due to
  - insufficient upper sensory block covering the surgical incision
  - lack of blockade of sympathetic fibers
  - Risk of lower limb motor block
  - Urinary retention

# Epidural (TEA)

- Advantages of TEA
  - Accelerates the recovery of bowel function after colorectal surgery
  - Reduces risk of respiratory and cardiovascular complications
- Large study combining GA & TEA did not show any impact on 30 day morbidity or mortality

# TEA (open vs laparoscopic)

- TEA may increase LOS in patients undergoing Laparoscopic colon surgery
- IV lidocaine, spinal analgesia, abdominal trunk blocks, intraperitoneal local anesthetic have all shown to provide adequate analgesia similar to those provided by TEA

# Spinal

- High efficacy and low complication profile
- In comparison to TEA, patient can be mobilized sooner and is at less risk of hypotension and fluid overload.
- Typical doses .1-.15 mcg duramorph
  - OSU-0.2 mcg
  - University of Virginia 0.15
  - LMH 0.15mcg

# Intrathecal Morphine

- Onset
  - 30-60 minutes
- Peak
  - 60-90 minutes
- Duration
  - 12-28 hours
- \*\*\*Potential for Delayed respiratory depression

## INTRATHECAL ANALGESIA

Drug	Dose	Onset (min)	Peak effect (min)	Duration (hrs)	Advantages	Disadvantages
Morphine	0.1-0.25 mg	30	60	12-24	Long duration	Significant side effects; delayed respiratory depression; biphasic modality
Fentanyl	10-25 mcg	5	10	2-3	Rapid onset	Short duration
Sufentanil	5-10 mcg	5	10	2-4	Rapid onset; few side effects	Short duration; can see sinusoidal fetal HR; respiratory depression > fentanyl
Meperidine	10 mg	10	15	4-5	Rapid onset; potentiation of spinal anesthesia	Nausea and vomiting; pruritis significant

# Intrathecal Morphine

- Respiratory Depression
  - 1. Rate less than 10 breaths/min
  - 2. Reduced oxygen saturation <90%
  - 3. hypercapnia/hypercarbia
    - Arterial CO<sub>2</sub> more than 50mmhg
- Who is at risk?
  - Obese patients?
  - OSA patients?
  - Coexisting Disease



# Techniques to Detect Respiratory Depression

- Oxygen saturation
- End-tidal CO<sub>2</sub>
- Level of Sedation

# ASA guidelines

- Monitoring should be performed for a minimum of 24 hours after administration of intrathecal morphine
  - At least once an hour for the first 12 hours followed by every 2 hours for the next 12 hours

# Lidocaine infusion

- Reduces opioid use and nausea in colorectal surgery
- Infusion ranges 1.5-3 mg/kg/hr with a bolus of 0 to 1.5 mg/kg.
  - Plasma lidocaine concentrations are similar to those when running an epidural infusion.

# What is the correct dose?

- Perioperative lidocaine infusions at rates greater than or equal to 2mg/kg/hr were associated with decreased pain scores and opioid consumption in the first 24 hours.
  - There was no evidence of effect for rates less than 2 mg/kg/hr

# How long should we continue the infusion?

- Administration of lidocaine intraoperatively and continuing up to 8 hours after surgery was associated with reduced cumulative morphine consumption.
- There was no evidence of effect of infusions beyond 24 hours.
  - Total analgesic consumption was reduced up to 35% when lidocaine was continued 0 to 1 Hr post-op and up to 83% when continued for 24 hrs.
  - Ideally around 24 hours would be good starting part
    - Requires monitored bed, etc.

# Magnesium?

- Plays a critical role in a variety of physiologic process
- 4 most common cation in the body
- Magnesium blocks NMDA receptor and calcium channels
- High therapeutic index, Cost-effectiveness
- Hypomagnesium occurs frequently after several surgeries. Abdominal, orthopedic, and cardiac operations

# Magnesium

- Hypermagnesium
  - Rare in clinical medicine unless renal function of the patient is compromised.
    - Normal plasma conc is 0.7-1.1mmol/L
    - If plasma conc reaches 4/5 mmol/L toxic symptoms such as deep tendon reflex and dizziness can occur
    - Respiratory arrest occurs at >6mmol/L
    - Cardiac arrest occurs at >8mmol/L

# Mechanism of Magnesium?

- Not primary analgesic by itself
- Enhances analgesic actions of more established analgesics as an adjuvant agent
- Usual doses
  - Loading dose 30-50 mg/kg followed by a maintenance of 6-20 mg/kg/h
    - 70 kg person x 30mg = 2100 mg or 2.1 gm
    - 70 kg person x 50 mg = 3500 mg or 3.5 gm



# Abdominal wall blocks

- TAP-transversus abdominis plane
  - Small RCT in laparoscopic colorectal and other surgeries show that TAP blocks reduce opioid consumption and improve recovery.

# Postoperative

- 19. Thromboprophylaxis
  - What is incidence of DVT in patients undergoing Colorectal surgery without thromboprophylaxis?
  - What are risks for DVT
    - Ulcerative colitis
    - Advanced malignancy (stage 3 or 4)
    - Hypercoaguable state
    - Steroid use
    - Advanced age
    - obesity

# Thromboprophylaxis

- All patients benefit from mechanical thromboprophylaxis achieved with compression stockings and or intermittent pneumatic compression (ICP) during hospitalization or until mobilized
- Pharmacological thromboprophylaxis with LMWH or unfractionated heparin has been shown to reduce the incidence of symptomatic venous thromboembolism as well as overall mortality.
- Single administration of LMWH is as effective as twice daily administration.
- Combination of ICP together with pharmacological prophylaxis decreased the incidence of PE and DVT when compared to a single modality.
- ERAS recommends extended thromboprophylaxis (ETP) for 28 days after colorectal surgery in the abdomen or pelvis

# Postoperative fluid and electrolyte therapy

- 20. Postoperative fluid and electrolyte therapy
- IV fluids are generally not necessary after the day of the operation
- Patients are encouraged to drink when they are awake and free of nausea.
- An oral diet can be started as soon as 4 hours after surgery
- If oral intake is tolerated, IV fluids should be discontinued, at least by POD #1

# Urinary Drainage

- 21. Urinary drainage
- Routine transurethral catheterization is recommended for 1-2 days after colorectal surgery
- Low risks patients should have catheter removed on POD 1

# Prevention of Postoperative Ileus

- Major contributor of
  - Patient discomfort
  - Delayed discharge
  - Increased cost
- Prevention
  - Limiting opioid administration via multimodal analgesia
  - Minimally invasive surgery
  - Eliminating NG tubes
  - Maintaining fluid balance
  - Peripherally acting u-opioid receptor antagonists
  - Chewing gum

# Entereg (Alvimopan)

- Indicated to accelerate the time to upper and lower gastrointestinal recovery following surgeries that include partial bowel resection with primary anastomosis
- Mechanism-opioid antagonist which acts on U-receptors in the gut. Can potentially block narcotic effects on GI tract without blocking systemic narcotic targets.

# Contraindications

- Contraindicated in patients who have taken therapeutic doses of opioids for more than > 7 consecutive days prior to taking Entereg
- Use with caution in patients who took more than 3 doses of an opioid within the week before surgery.
- Not recommended in patients with severe hepatic impairment, end-stage renal disease, or in patients with complete bowel obstruction



# Entereg (Alvimopan)

- For hospital use only
- First dose (12 mg po) given 30 minutes to 5 hours prior to surgery
- Continue (12mg po) orally twice daily until discharge or criteria met (max 7 days)
  - First sign of flatus
  - First bowel movement

# Why can you take it for only 15 doses?

- Potential risk of myocardial infarction with long term use!!
  - Clinical trials showed increase in MI during long term use
  - No increased risk observed during short term use
- E.A.S.E. Program
  - Entereg access support and education program
  - Due to potential risk of MI, Entereg is available only through
    - EASE program which limits patient to max of 15 doses

- 23. Postoperative glycemic control
  - Hyperglycemia is a risk factor for complications and should therefore be avoided.
  - Fortunately several interventions in the ERAS protocol prevent insulin resistance thereby improving glycemic control with no risk of causing hypoglycemia.

# Postoperative Nutritional Care

- 24. Postoperative nutritional care
  - Well established that any delay in the resumption of normal oral diet after major surgery is associated with increased rates of infectious complications and delayed recovery.
  - Early diet has shown to be safe 4 hours after surgery (in patients with a colorectal anastomosis)

# LMH ERAS for Colorectal Surgery

- Patients are identified by surgeon and central scheduling.
- All patients are required to go through PAT
- PAT valuable in patient explanation, education, and preoperative clearance.
- Smoking/alcohol cessation ideally greater than 4 weeks prior to surgery
- Patients will be given carbohydrate drink (CHO) to ingest the night before as well as 2-3 hours prior to surgery. Allow clear liquids up to 2 hrs prior to surgery

# Preoperative (Avoid Benzodiazepines for >65)

- Gabapentin 600 mg po x one dose
  - May give 300 mg po x one dose for patients
    - Greater than age 70 or GFR < 60
  - Hold if patient has pre-existing confusion
- Tylenol 1000 mg po x one dose
  - Hold in patients with active liver disease
- Celebrex 400 mg po x one dose (not given to patients with CAD)
  - May also give 200 mg in patients with GFR < 60
    - Consider Toradol IV in patients unable to take celebrex (15mg-30mg)

# Preoperative (Anti-emetics)

- Scopolamine patch (1 behind the ear for 24 hours)
  - Contraindicated in patients with history of narrow-angle
    - Glaucoma
- Pepcid 20 mg IV x one dose
- Alvimopan (Entereg) should be given 30 min to 5 hrs prior to surgery then twice daily until first bowel movement or up to POD 7 (max of 15 doses)

# Intraoperative

- Pre-induction spinal with 0.15 duramorph with 0.85 ml sterile saline/.85ml LA
- Tap block can be substituted instead of IT morphine in patients where long acting opioids are contraindicated



# Intraoperative

- Induction with Propofol
- Maintenance with propofol or Sevo/Des
- Consider TIVA for patients with high risk of PONV
- Avoid use of Nitrous oxide
- Ketamine 0.25-0.5 mg/kg (IBW) bolus prior to incision followed by 0.25-0.5 mg/kg IV bolus every hour (use vial)
  - Try to stop ketamine 1 hour prior to emergence
- Magnesium 2gm IV (If ESRD or CR>2 consider 1gm)
  - 30mg/kg over 10 minutes (Univ. of VA)
- Lidocaine infusion 1.5 mg/kg with induction followed by 2 mg/kg/hr IV (This will run through PACU discharge)

# Intraoperative

- Try to avoid narcotic as much as the case allows
- If using BIS, maintain BIS between 40-60
- Deep block with rocuronium and full reversal with sugammadex
- Maintain normothermia utilizing bair hugger, fluid hotline, low flow gases etc.
  - Maintain esophageal temperature 36 degrees or greater
- May need to place an OG or NG tube. Please leave tube off suction for at least 1 hour following administration of PO Meds
- Please remove NG/OG at the end of case if surgeon allows. This should be done prior to reversing muscle relaxant

# Intraoperative

- Decadron 4-8 mg IV (at the start of case)
- Zofran 4 mg IV (30 min prior to emergence)
- Maintain Euvolemia
  - 1-4 ml/kg/hr (Suggest 3 ml/kg/hr on pump)
  - Limit to less than 4 liters for first 24 hrs (includes intra-op)

# Postoperative

- Scheduled meds
  - Tylenol 1000 mg q 6 hrs
  - Gabapentin 100 mg po q8 hrs may increase to
    - 200 mg q 8 hrs
    - 300 mg q 8 hrs
  - Celebrex 200 mg q 12 hrs (May substitute toradol 15-30mg)
  - Zofran 4 mg IV q 8hrs

## Prn meds

- Tramadol 50 mg po q 6 hrs (hold for history of dementia or seizures)
- Oxycodone 5 mg po q 4 hrs prn moderate pain
- Oxycodone 10 mg po q 4 hrs prn severe pain

# Celebrex

- Adult dose for pain
  - Initial dose
    - 400 mg po x 1 dose
  - Maintenance dose
    - 200 mg BID
- Renal dose adjustments
  - Mild to mod impairment-no dose adjustment is needed
  - Severe renal impairment (CrCl less than 30ml/min)
    - Not recommended
- Liver dose adjustment
  - Mild hepatic impairment-no dose adjustment
  - Moderate (C-P class B) reduce by 50%
  - Severe hepatic impairment-not recommended

# Celebrex (We will hold in patients with CAD)

- US Boxed warning
  - Risk of serious cardiovascular and gastrointestinal events
  - NSAIDS may cause an increased risk of serious cardiovascular thrombotic events, including myocardial infarction and stroke.
  - Celebrex is contraindicated in the setting of CABG surgery
  - Gastrointestinal bleeding, ulceration and perforation
- Contraindications
  - Known allergy to celebrex, reaction to ASA or other NSAID,
    - Allergy type reaction to sulfonamides

# The End

