MASSACHUSETTS GENERAL HOSPITAL

MGH Liver ERAS Pathway
Updated 07.29.2021

ANESTHESIA BUNDLE

Element	Definition
Preoperative Management of Blood Pressure Medications Surgeons, residents, fellows PPE/PATA Anesthesia	• Hold diuretics and Angiotensin Converting Enzyme (ACE) inhibitors on the day of the procedure • Instructions given to hold Diuretics/ACE Inhibitors day of procedure • Pre-op assessment confirms Diuretics/ACE inhibitors held day of procedure
Preemptive Analgesia Surgeons, residents, fellows CPC / pre-op Nursing Anesthesia	• Patients should NOT receive gabapentin or celecoxib prior to surgery
Intraoperative Antiemetic Prophylaxis Anesthesia	• Unless contraindicated, patients should receive intraoperative antiemetic prophylaxis with at least two of the following medications: 1. Zofran 4mg IV–30 min before the end of the case 2. Decadron 4-6mg IV –use early in the case ALTERNATIVES 1. Scopolamine patch – applied pre-op 2. Haldol 1mg IV – some use this early and some late in the case
PACU & Inpatient Antiemetic Prophylaxis Anesthesia	• The following agents/doses are preferred: 1. Zofran 4mg IV–30 min before the end of the case 2. Decadron 4-6mg IV –use early in the case ALTERNATIVES 1. Haldol 1mg IV – some use this early and some late in the case 2. Phenergan 6.25-12.5 mg IV may be used as a last resort If a drug was given already (pre or intra-op) it should not be the initial agent given in the PACU.
Measurement of Intra-op Temperature Anesthesia PACU Nursing	Temperature will be recorded the following way: 1. By esophageal temperature probe 2. Every 5 minutes during the case • PACU temperatures should be taken within 5 minutes of patient arrival using a forehead probe
Intra-op Oxygen Administration Anesthesia	• 80% FiO2 provided throughout case is an option but is not a metric
Use of Paralytics and Narcotic Agents During the Anesthetic Anesthesia	The following agents should be **AVOIDED**: 1. Pancuronium 2. Isofluorane The following agents are **PREFERRED**: 1. Propofol 2. Rocuronium 3. Cisatracurium 4. Vecuronium 5. Fentanyl (if a narcotic must be used at induction) The following agents are **ACCEPTABLE**: 1. Ketamine 2. Dexmedetomidine 3. Lidocaine (judicious) 4. Total IV Anesthetic (TIVA) 5. Morphine (judicious) 6. Hydromorphone (judicious)

Intraoperative Fluid and Ventilation Management
 	
Anesthesia
	Patient type:
	• Low Risk i.e. ASA I & II patients undergoing laparoscopic or straightforward open surgery
	Best practice Defined by:
	• No fluid in holding area
	  ○ PRE LIVER TRANSECTION – no fluid. Use IV pushes for medications.
	  ○ POST LIVER TRANSECTION – aim to re-establish zero fluid balance. Consider goal directed fluid therapy if available.
	Monitoring required:
	• Bladder Catheter
	• BP cuff
	• Pulse Oximetry
	
	<u>Intraoperative non-invasive monitoring</u>
	Approach to Hypotension:
	• Utilize pressors
	• May bolus 250cc of colloid for significant refractory hypotension
	Approach to low urine output:
	• Accept 0.2 ml/kg/hr
	• Do not treat low UO if other data imply euvolemia

Post-Op Analgesia (1)
 	
Surgeons, residents, fellows
PACU Nursing
Floor Nursing
	• If possible, non-narcotics should be used on a scheduled basis for analgesia with narcotics reserved for breakthrough pain
	• POD #1
	  1. IV Ketorolac 15mg q 6 hours for 48 hours (15mg q 6 hours if patient is over 65) unless the patient has renal impairment and PACU creatinine is acceptable (may use POD 0 if OK with surgeon)
	  2. Acetaminophen 500mg po q6hrs.
	• Narcotics may be given via PCA pump, IV or SC:
	  1. Dilaudid and Morphine are preferred agents, but minimal amounts should be used.
	  2. For epidurals, please use minimal narcotics in epidural mix

Post-Op Analgesia (2)
 	
Anesthesia
	Patients undergoing open surgery should get either an epidural, regional block, or wound catheter placed in the TAP plane by surgeon (ON-Q). Patients should be prepared in the pre-op clinic that they will receive regional anesthesia before or during their operations.
	
	TAP Block On-Q Best Practice
	1. TAP could be placed pre-op, but post-op is preferred to avoid case delay
	2. Ultrasound guided TAP is preferred
	3. Consider On-Q catheter placement intra-op
	
	Epidural Best Practice
	1. Epidural is placed pre-op
	2. Ideally epidural placed at T7-T8 T9-T10 for combined colorectal resections
	3. Epidural medication per hospital best practice with an emphasis on minimizing narcotic.
	  ○ Infusion rate per hospital best practice
	4. Epidural is removed on POD #3 – or on POD #2 if patient is tolerating POs.
	  ○ Avoid removing at night if possible
	  ○ If patient receiving SC Heparin wait at least 6 hours after last dose to remove
	  ○ Ideally epidural should be removed >3 hours prior to discharge
	  ○ If there is Epidural-related hypotension, Patient remains in PACU overnight.

SURGICAL BUNDLE

Element	Definition
Demarcation and Verification as ERAS/SSI Patient Surgeons, residents, fellows Surgical clinic nursing	• All patients undergoing hepatectomy are considered ERAS patients
Patient Education Surgeons, residents, fellows Surgical clinic nursing PPE/PATA	Educational material will be provided by the surgeon's office at the time of booking covering: 1. Preoperative discharge preparation including dietary recommendations, home preparation, physical activity, and alcohol/tobacco abstinence 2. Day of surgery workflow / expectations 3. ERAS pain control methodology, including regional anesthesia 4. Routine postoperative care and expectations
Bowel Preparation Surgeons, residents, fellows Surgical clinic nursing	• Mechanical bowel prep per surgeon preference. Acceptable alternatives include but are not limited to: 1. 2-4 Dulcolax pills at 2PM followed by 1 bottle of Miralax in 64oz clear liquid taken from 3-5PM 2. 2-4 Dulcolax pills at 2 PM followed by 1 bottle of Mg Citrate at 3PM
Oral Antibiotic Prep	• NONE FOR LIVER AND BILIARY OPERATIONS
Preoperative Nutritional Supplement Surgeons, residents, fellows Surgical clinic nursing	• Acceptable pre-op nutritional supplement drinks: • THE HEPATOBILIARY SURGEONS AND ANESTHESIOLOGISTS ARE OK WITH GATORADE, ENSURE Clear OR CLEARFAST until midnight 1. A carbohydrate drink containing at least 45gm of complex carbohydrates in at least 400cc of fluid Is strongly recommended (e.g. 24oz of Clearfast, Ensure Clear pre-surgery clear or an equivalent preparation) 2. If above option is unavailable, up to 20oz of Gatorade is an acceptable alternative • Timing for drinking of the supplement: 1. Patients given instructions for one of the accepted carbohydrate drinks to be started 3 hours before induction and fully administered no later than 2 hours prior. 2. Drink is started 3 hours before induction and fully administered no later than 2 hours before induction • BMI > 30 calorie restricted diet for one week.
Preoperative antibacterial shower Surgeons, residents, fellows Surgical clinic nursing	• Shower/bathe with liquid chlorhexidine soap for 2 days prior and on the morning of surgery per institutional best practice.
Prophylactic Antibiotics Surgeons, Anesthesia	ANTIBIOTICS WITH INDUCTION OF ANESTHESIA One of the following CMS approved antibiotic regimens must be used: i. Cefoxitin ii. Cefotetan iii. Unasyn/Zosyn iv. Ertapenim v. Cefazolin + Metronidazole + Levofloxacin vi. Cefuroxime + Metronidazole vii. Ceftriaxone + Metronidazole viii. Aminoglycoside + Clindamycin ix. Aztreonam + Clindamycin x. Quinolone + Clindamycin xi. Aminoglycoside + Metronidazole

	Timing and Dosage: 1. Infusion started within 60 minutes of incision and completed before incision 2. Dose should be weight based Intra-op re-dosing should be performed based on pharmacokinetics of antibiotics chosen Discontinue Perioperative antibiotics within 24 hours
Use of Liver OR team Anesthesia, Circulating RN and Scrub Nurse/Tech	• Anesthesia team, Circulating RN and Scrub Nurse/Tech are familiar with liver surgery.
Maintenance of Normothermia Surgeons, residents, fellows Anesthesia OR Nursing	Actively warm before and throughout surgery to achieve target temperature of 36° C using one or more of the following: 1. Room temperature at >68° F until patient prepped and draped 2. Fluid warming device 3. OR table warming pad 4. Forced warm air under-body or over-body device
Intraoperative Skin Prep Surgeons, residents, fellows OR Nursing	• Acceptable skin preps: 1. Chloroprep is the preferred skin prep 2. Duraprep is an acceptable substitute 3. Prep must be allowed to air-dry (minimum 3 minutes) before draping and incision 4. Exclusive iodine-only solutions are <u>not</u> acceptable except in emergent cases • Method to ensure adequate drying time: Hospitals may use whatever system they prefer to ensure compliance
Instrument Segregation Best practice (Dirty Tray Best practice) Surgeons, residents, fellows OR Nursing	• Instruments utilized to remove biliary stents should be removed from instrument table • Gloves are changed if contaminated bile is touched.
Use of Wound Protectors During Bowel Resection Surgeons, residents, fellows OR Nursing	• Wound proctor per surgeon preference • Acceptable types of wound protectors per surgeon preference 1. Single ring wound protectors 2. Alexis XL
Peri-Operative Glucose Monitoring and Management Surgeons, residents, fellows PPE/PATA	**Pre-operative Testing of Diabetes** • A HbA1c should have been drawn within 3 months and, if not, one should be ordered • In the event of an abnormal elevated result the primary care MD or endocrinologist should be contacted to request their assistance in optimizing glucose control before surgery **Pre-operative management of diabetes medications** Instructions given for Insulin and Oral hypoglycemics given to patients with DM 1. Surgeons or their staff will reach out to endocrinologists (or PCPs when there is no endocrinologist involved) and ask them to provide the patient with guidance on medication management on the prep day prior to surgery and the morning of the operation Monitoring: 1. All diabetic patients should have a FS or other blood glucose determination in pre-op holding 2. All diabetics and patients treated with insulin should have hourly intra-op glucose monitoring

	3. Glucose levels > 200mg/dl should be treated with insulin per hospital best practice Timing of glucose monitoring: 1. In Pre-Op holding 2. Q1hr Intra-Op 3. Post-Op in PACU (unless patient has 2 normal values in row): i. Q6hr for diabetics ii. In the morning on Post-Op day #1 for non-diabetics. Discontinue after this unless hyperglycemic
Optimized Postoperative Fluid Management Surgeons, residents, fellows Anesthesia PACU Nursing Floor Nursing	<u>Initial postoperative fluid orders:</u> • Crystalloid @ 1cc/kg(ideal weight)/hr X 12hrs then 0.5cc/kg x 24 hours • Allow clears PRN • Allow up to 3 boluses of 250cc crystalloid or colloid for hypotension • Call if >2 250cc boluses required • Initially audit: • BP • Number and type of fluid boluses • Epidural order changes in orders and narcotic requirements (may be affected if fluid is not an option for low BP) <u>Postoperative Hypotension and Fluid Responsiveness:</u> • Do not intervene unless: ○ SBP is 15% below baseline SBP <u>or</u> ○ MAP < 65 <u>or</u> ○ UOP < 0.25 mL/kg/hr <u>and</u> patient has other signs of hypovolemia • If any of the above occur, the patient should be examined and causes of hypotension other than inadequate fluid administration excluded (e.g. bleeding, myocardial ischemia etc.) • If the patient meets above criteria, initial response may be: ○ Crystalloid or colloid 250mL bolus up to 3 times within 24 hours <u>and/or</u> ○ Vasopressors if patient is in a step-down or ICU setting (consider placing patients in such a setting if you anticipate fluid management challenges) • Failure to respond appropriately should result in: 1. A call to the senior resident or attending before administering additional fluid 2. A more objective measure of fluid status. Inferring fluid status is difficult and frequently inaccurate. Ideally, non-invasive monitoring should be made available (e.g. ultrasound machines that allow simple echocardiography). 3. Surgical residents should be taught to perform simple bedside echocardiography when they are taught to perform FAST examinations.
Early Postoperative Diet Advancement Surgeons, residents, fellows PACU Nursing Floor Nursing	1. IV fluid discontinued the morning of POD#1 or once patient tolerates 300cc PO, based on physician preference. 2. Post Op Day #1: then advance diet as tolerated (or based on assessment of patient) 3. If nausea or vomiting, delay advance until symptoms have abated 4. Do not order “sips” except immediately post op
Early Postoperative Mobilization Surgeons, residents, fellows PACU Nursing Floor Nursing	• The following activity orders should be placed for all ERAS patients: 1. Patients should be out of bed as soon as tolerated with goal by POD#1 to be OOB for all meals and at least 8h per day. 2. Patients should be OOB to chair at the latest 3-6 hours postoperatively (goal would be OOB to chair in the PACU, if tolerated). Patients may ambulate as tolerated starting immediately postoperatively. 3. On POD #1 and thereafter: Ambulate in hallway at least 3 times daily • Patient may shower on POD 3. • Expectations regarding early postoperative mobilization will be clearly conveyed to patients with patient education bundle. • The Acute Pain Service (APS) on-call resident or equivalent anesthesia provider on call should be notified for any patients who are unable to ambulate due to leg weakness from an epidural.
Early Urinary Catheter	• Foley catheter removed within 24 HRS FOR WOMEN AND 48 HRS FOR MEN

Removal Surgeons, residents, fellows PACU Nursing Floor Nursing	
Defined Discharge Criteria Surgeons, residents, fellows OR Nursing	• Patient must have adequate pain control on oral medications • Patient tolerating clear liquid diet
Drains Surgeons, residents, fellows OR Nursing	• Drain Management per Surgeon Preference
Post Op VTE Surgeons, residents, fellows CPC / pre-op Nursing OR Nursing PACU Nursing Floor Nursing	Post Op VTE • Pneumoboots for all • Pharmacologic 1. Heparin, Lovenox, or alternative blood-thinning agent per institutional best practice 2. Adjust according to epidural or regional catheter guidelines