**University of Rochester Medical Center**

**HPB Enhanced Recovery after surgery**

**Whipple Procedure**

**Pre-Op and Day of Surgery**

**Pre-admission**

**One Week before Surgery**

1. Medication Review

   Anticoagulants:
   *Inhibitors of Coagulation Cascade*
   Coumadin (Warfarin), Pradaxa (Dagigatran), Xarelto (Rivaroxaban), Eliquis (Apixaban), Lixiana (Endoxaban), Lovenox (Enoxaparin), Arixtra (Fondiparinux), Fragmin Daltaparin),Heparin, Refludan (Lepirudan), Angiomax (Bivalirudin), Argatroban

   *Inhibitors of Platelet Function*
   Aspirin, Plavix(Clopidogrel), Effient (Prasugrel), Pletal (Cilostazol), Persantine (Dipyridamole), Disgren/Grendis/Triflux/Aflen (Triflusal), Brilinta (Ticagrelor), Ticlid (Ticlopidine)

   Alternative Medications with Bleeding Potential:
   Ginger, Dan Shen, European Mistletoe, Gingo Biloba, Peony, Vitamin E, Garlic, Ginseng, Fish oil/Omega 3 Fatty Acids, Dong Quai, Ephedra, Feverfew, St Johns Wort

   *Stop specified medications 5 days prior to surgery (except Aspirin)*
   - Aspirin: Hold aspirin, may continue 81 mg ASA if stent or recent CVA.
   - If patient requires bridging: stop therapeutic anticoagulation 5 days prior to surgery, start therapeutic Lovenox 5 days prior to surgery. LAST DOSE Lovenox will be 24 hours prior to surgery.

2. Chlorhexidine (hibiclens) wash or antimicrobial soap the evening before surgery or the morning of surgery.
3. Assess nutritional status based on weight loss and pre-albumin
   - Nutritional supplements in addition to normal diet.
     - Impact: drink 3 (8 oz) cartons each day –or-
     - Ensure or Boost: drink three cans daily for 5 days prior to surgery
4. Labs:
   - Type and screen- 4 units of PRBC on hold
   - CBC with differential
   - PT/INR, PTT
   - CMP
   - Baseline Troponin level if patient considered at high risk for perioperative MI (see Goldman cardiac risk index RCRI in appendix)
5. Consultation visit: Provide patient with HPB enhanced recovery after surgery documentation to be reinforced at surgical discussion visit. Reinforcing steps of post-operative care.

6. Schedule consults if needed: pulmonary, cardiac, anesthesia

## Day before Surgery

1. Diet:
    - Regular diet
    - Impact drink 3 (8 oz) cartons, or Ensure/ Boost three cans
    - Gatorade or apple juice 24 oz the evening before surgery.
    - No solid foods after midnight and no liquids 4 hours before surgery.
2. Meds: Bowel prep -1 bottle of magnesium citrate. Drink one bottle at 5pm
3. Shower evening prior or in the morning before surgery with Chlorhexidine (hibiclens) wash or antimicrobial soap

## Day of Surgery (Intra-operative)

1. Lines /Tubes:
    - Minimum of two 16-guage peripheral lines
    - Central line (optional) at discretion of anesthesiologist and attending surgeon if inadequate IV access.
    - Arterial line
    - Foley catheter
    - Nasogastric tube
        - Orogastric tube if Robotic procedure.
    - JP x 1: 15 or 19 French Blake Drain attached to bulb suction- 1 or 2 drains (Surgeon discretion)
    - Insertion of wound catheters or TAP blocks per surgeon discretion
    - Possible Esophageal Doppler probe (Cardio Q) for goal directed therapy

2. Medications:
    - Heparin 5000 units subcutaneous injection in SSC/pre-anesthesia area.
    - Intrathecal morphine injection 100-200mcq prior to induction
    - Pre-operative antibiotics:
      **(1)** Invanz (Ertapenem) **if allergic to Invanz**
      (**2**) Ciprofloxacin 400mg every 12 hours and Metronidazole 500mg every 8 hours
      (**3**) **If allergic to Cipro or Flagyl,** Cefoxitin 2 grams every 8 hours.
    - Magnesium 2-g IV prior to leaving OR.
    - Nausea/vomiting prophylaxis:
        - Ondansetron 4 mg IV near the end of the procedure.
        - Scopalamine Patch placed in pre-anesthesia area.
        - Haldol 0.5-1 mg if high risk for nausea/vomiting
    - Tylenol 1000 mg IV intra-op prior to leaving operating room.
    - Consider Bupivicaine TAP block
        - 0.25% bupivacaine 1mL/kg – 80 mL
        - 0.5% Bupivacaine 0.5ml/kg – 40 mL

3. Fluids:
    - Use of goal directed therapy guided by pulse pressure variation or Esophageal Doppler probe (Cardio Q)
        - Guidelines for goal directed therapy per Anesthesia algorithm.
    - Do not use normal saline. Preferred is plasmalyte. Use Ringers lactate if plasmalyte not available
    - Total volume of fluid should not exceed 2 liters above predicted losses, which include end blood loss, urinary output, and insensible losses.

4. Activity: Extubate in OR
5. Positioning: SCD's, Bair Hugger, and padding of all pressure points
6. Bair Hugger or Bair paw activated on arrival to the operating room. Underbody Bair Hugger in place.
7. Room temperature in the operating room set at 75 degrees F and not turned down until active body warming in place ( see #6) and patient temperature is >36.
8. Labs:
    - ABGs as directed by Anesthesia
    - Intraoperative glucose control – goal glucose <150
    - Thromboelastogram (TEG) if bleeding encountered
    - Troponin level 6-12 hours after surgery if patient at high risk for peri operative MI (see Goldman cardiac risk index RCRI in appendix)

**Post-Op Whipple Procedure:**

**PACU and POD O**

**PACU**

1. Diet: sips or ice chips for comfort.
2. Lines/Tubes:
    - Nasogastric tube to low wall suction.
    - Arterial line remove if plan for transfer to WCC5 floor.
3. Fluids: LR/ Plasmalyte at 84 mL/ hour.
4. Medications:
    - IV Hydromorphone 0.4 mg every 10 minutes
    - Midazolam 0.5 mg IV every hour
5. Labs:
    - CBC
    - CMP, Calcium, Mg, Phos
    - PT/INR
    - ABG
    - Glucose & every 4 hours

**POD O**

1. Location: Admission to WCC5 PCU (Progressive Care Unit) status unless requires step down 8-1400 or SICU per surgeon discretion.
2. Patient Care:
   - Vital signs every **2 hours x 4 hours, then every 4 hours from admission to unit.**
   - **Continuous pulse oximetry monitoring for 24 hours from admission to unit.**
   - Sequential compression device.
   - NGT to low intermittent wall suction if present.
   - Foley to gravity
   - JP drain to bulb suction
   - Central line if present.
   - Cough and deep breathe with head of bed elevated
   - Incentive Spirometer every 1 hour while awake
   - Respiratory- O2 (Oxygen) titrate to maintain SPO2 greater than or equal to 90%

3. Diet: sips or ice chips
4. Medications:
   - PCA (dilaudid or morphine). If Duramorph given, absolutely no continuous rate for first 24 hours.
     - Avoid basal rate unless necessary.
     - Small dose, frequent demand regimen – Morphine 1-mg, Dilaudid 0.1-mg, every 6 minutes.
   - For breakthrough pain: hydromorphone 0.4 mg IV every 2 hours x 3 doses.
   - Tylenol (Ofirmev) IV 1000mg every 8 hours
   - Ketorolac (Toradol) IV 15-30 mg every 8 hours (3 days total) – hold for elevated creatinine, elderly patient.
   - Heparin subcutaneous 5000 units every 8 hours **IF** normal renal function **and < or = to 75 years of age.**
     - Every 12 hours **IF** impaired renal function **and/or > 75 years of age**
   - Lispro / Humalog Insulin sliding scale - every 4 hours.
   - Proton pump inhibitor IV
   - **IF** patient on pre-operative beta blockade, start lopressor 5 mg IV every 6 hours with hold parameters.
     - Hold for SBP<100mm/Hg, HR<60 bpm
   - Replete magnesium: Magnesium sulfate 2g IV
   - Nausea/vomiting prophylaxis-Zofran 4mg IV push every 8 hours

5. IVF: NPO except sips or ice chips and 84 ml/ hour (Plasmalyte or LR)
6. Labs:
   - Glucose every 4 hours
   - Troponin 6-12 hours after surgery in high risk patients for perioperative MI (see Goldman cardiac risk index RCRI in appendix)
7. Activity
   - OOB to chair. Walk by evening.

**Post-Op Whipple Procedure:**

**POD 1**

**Patient admitted to or remains in ICU**:

- Patient need for ICU: unexplained tachycardia, pulmonary issues, bleeding concern, urinary output issues, hypotension, AND/OR mental status issues

**WCC5 PCU patient**

1. Lines and Tubes:
   - Remove nasogastric tube.
   - Continue Foley catheter.
   - Continue central line.
   - Oxygen supplementation - wean as able for oxygen saturation >92%.
   - JP drain to remain on bulb suction

2. Patient Care:
   - Vital signs every 4 hours unless clinical course justifies every 2 hours.
   - SCD- remain
   - Consultation to physical therapy (PT)
   - Home care consultation

3. Diet:
   - Clear liquid diet
   - Chew gum for 20 minutes three times daily if amenable.
   - Nutritional supplements: Ensure Clear – 1 box three times on Day 1.

4. IVF: LR 84 ml/hour unless tolerating >1000 ml oral intake, consider decrease to LR 42ml/hour
   - If MAP <60 give 500 mL bolus and call chief
   - If HR > 120 check CBC and pain assessment and call chief
   - If Urine output < 120 mL for 4 hours, may give 500 mL bolus and call chief after 1 liter of bolus.

5. Medications:
   - PCA (dilaudid or morphine).
     - Avoid basal rate unless necessary.
     - Small dose, frequent demand regimen – Morphine 1-mg, Dilaudid 0.1-mg, every 6 minutes.
   - For breakthrough pain: hydromorphone 0.4 mg IVP every 2 hours x 3 doses.
   - Tylenol (Ofirmev) IV 1000mg every 8 hours
   - Ketorolac (Toradol) 15-30 mg every 8 hours
   - Heparin subcutaneous 5000 units every 8 hours

- Lispro / Humalog Insulin sliding scale
- Proton pump inhibitor IV – Protonix 40 mg IV
- Continue lopressor 5 mg IV every 6 hours with hold parameters if started.
    - Hold for SBP<100mm/Hg, HR<60 bpm
- Magnesium sulfate 2g IV
- Zofran 4mg IV push every 8 hours as needed.
- Review home medications and restart as necessary.

6. Labs :
    - CMP, Calcium, Magnesium, phosphorus
    - CBC
    - glucose every 4 hours
    - Troponin level in patients at high risk for perioperative MI

7. Activity:
    - Out of bed for 6 hours
    - Ambulate 3 times today. (Walk in hall by evening)
    - Incentive Spirometry 10 x every 1 hour while awake
    - Consults to physical therapy
    - Consult with Endocrinology if uncontrolled glucoses > 200

**Post-Op Whipple Procedure:**

**POD 2**

**If remains on oxygen -pulmonary toilet, consider more aggressive diuresis, nebulizers, baseline issues and CxR.**

1. Lines/Tubes :
   - Remove nasogastric tube if present
   - Remove Foley catheter
   - Continue central line
   - JP drain to bulb suction

2. Patient Care/Activity:
   - Vital signs every 4 hours
   - Incentive spirometry every hour while awake
   - Cough and deep breathe with head of bed elevated
   - SCD's remain while in bed
   - Ambulate in hall 4 times per day
   - Physical therapy daily as needed.
   - Enoxaparin (Lovenox) home teaching
   - Home care consultation

3. Diet:
   - Advance to full liquids as tolerated
   - Nutritional supplements three times daily.
     - Impact, Ensure/Boost or Glucerna if diabetic

4. IVF: D51/2 NS + KCL 20 meq/ liter bag at 42 mL/hour. Discontinue if >1000 mL oral intake.
5. Medications:
   - PCA to continue, consider decreasing dosing.
   - Start oral narcotics:
     - Oxycodone immediate release 5mg every 4 hours for mild pain (1-3)
     - Oxycodone IR 7.5 mg every 4 hours for moderate pain (4-6)
     - Oxycodone IR 10 mg every 4 hours for severe pain (7-10)
   - Hydromorphone 0.4 mg IVP every 2 hours for breakthrough pain.
   - Tylenol oral 500 mg every 6 hours
   - Ketorolac (Toradol) 15-30 mg every 8 hours
   - Pantoprazole 40 mg oral daily
   - Heparin subcutaneous 5000 units every 8 hours
   - Lispro / Humalog Insulin sliding scale
   - Magnesium oxide 400 mg oral daily
   - Convert beta-blocker to oral if taking
   - Zofran 4mg IV push every 8 hours as needed.
   - Colace 100 mg twice daily
   - MiraLax 17 gm by mouth daily
   - Review home medications and restart as necessary.

6. Labs:
    - CMP, Calcium, Magnesium, Phosphorus
    - CBC
    - Glucose every AC/HS
    - Troponin level in patients at high risk for perioperative MI

**Post-Op Whipple Procedure:**

**POD 3**

1. Lines/Tubes:
   - Place peripheral IV & remove Central line if present
   - Continue JP drain on bulb suction

2. Patient Care/Activity:
   - Vital signs every 4 hours
   - Incentive spirometry every hour while awake
   - Cough and deep breathe with head of bed elevated
   - SCD's remain while in bed
   - Ambulate in hall 4 times per day
   - Physical therapy daily as needed.
   - Enoxaparin (Lovenox) home teaching.
   - Home care consultation and discussion.

3. Diet:
   - Advance to regular diet as tolerated.
   - Nutritional supplements three times daily.
     - Impact, Ensure, Boost, or Glucerna (if diabetic)
     -
4. IVF: Discontinue IV fluids. IV fluids at 42 mL/hour if inadequate oral intake.
5. Medications:
   - Discontinue PCA.
   - Oral narcotics:
     - Oxycodone immediate release 5mg every 4 hours for mild pain (1-3)
     - Oxycodone IR 7.5 mg every 4 hours for moderate pain (4-6)
     - Oxycodone IR 10 mg every 4 hours for severe pain (7-10)
   - Hydromorphone 0.4 mg IVP every 2 hours for breakthrough pain.
   - Tylenol 650 mg oral every 6 hours
   - Ketorolac (Toradol) 15-30 mg every 8 hours
   - Pantoprazole 40 mg oral daily
   - Heparin subcutaneous 5000 units every 8 hours
   - Lispro / Humalog Insulin sliding scale
   - Magnesium oxide 400 mg oral daily
   - Convert beta-blocker to oral if taking
   - Zofran 4mg IV push every 8 hours as needed
   - Colace 100 mg twice daily
   - MiraLax 17 gm by mouth daily
   - Review home medications and restart as necessary

6. Labs:

- CMP, Calcium, Magnesium, Phosphorus
- CBC
- glucose every AC/HS
- Troponin level in patients at high risk for perioperative MI

**Post-Op Whipple Procedure:**

**POD 4**

1. Lines/Tubes:
   - JP drain to bulb suction. Removal per surgeon.

2. Patient Care/Activity:
   - Vital signs every 4 hours
   - Incentive spirometry every hour while awake
   - Cough and deep breathe with head of bed elevated
   - SCD's remain while in bed
   - Ambulate in hall 4 times per day
   - Physical therapy daily as needed.
   - Enoxaparin (Lovenox) home teaching.
   - Home care consultation and discussion.
     - Disposition determined (home, SNF, rehabilitation)
     - Social work consultation for home needs.
   - Diabetic teaching if newly diagnosed. Endocrinology consultation if same.

3. Diet: Regular diet. Nutritional supplements to continue three times daily.
   - Impact, Ensure, Boost, or Glucerna (diabetic)
4. IVF: IV to heparin lock

5. Medications:
   - Oral narcotics:
     - Oxycodone immediate release 5mg every 4 hours for mild pain (1-3)
     - Oxycodone IR 7.5 mg every 4 hours for moderate pain (4-6)
     - Oxycodone IR 10 mg every 4 hours for severe pain (7-10)
   - Hydromorphone 0.4 mg IVP every 2 hours for breakthrough pain.
   - Tylenol 650 mg oral every 6 hours
   - Ketorolac (Toradol) 15-30 mg every 8 hours
   - Pantoprazole 40 mg oral daily
   - Heparin subcutaneous 5000 units every 8 hours
   - Lispro / Humalog Insulin sliding scale
   - Restart oral hypoglycemic or 75% of preoperative insulin regimen.
   - Magnesium oxide 400 mg oral daily
   - Convert beta-blocker to oral if taking
   - Zofran 4mg IV push every 8 hours as needed
   - Colace 100 mg twice daily

- MiraLax 17 gm by mouth daily
- Reconcile home medications.

6. Labs:
    - Glucose every AC/HS
    - No routine labs. CBC, CMP, Ca, Mg, Phos as needed.

**Post-Op Whipple Procedure:**

**POD 5**

1. Lines/Tubes:
   - Remove JP drain per attending surgeon. Do not obtain JP amylase unless instructed by attending.

2. Patient Care:
   - Vital signs every 4 hours
   - Incentive spirometry every hour while awake
   - Cough and deep breathe with head of bed elevated
   - SCD's remain while in bed
   - Enoxaparin (Lovenox) home teaching.
   - Diabetic teaching if newly diagnosed.
   - JP Teaching if drain not removed.
   - Disposition discussed and determined (home, SNF, rehabilitation)

**3.** Activity:
   - Ambulate in hall 4 times per day
   - Stair climbing with physical therapy
   - Shower with soap and water, no bath

4. Diet: regular diet. Nutritional supplements.
5. IVF: IV to saline lock
6. Medications:
   - Oral narcotics prn:
     - Oxycodone immediate release 5mg every 4 hours for mild pain (1-3)
     - Oxycodone IR 7.5 mg every 4 hours for moderate pain (4-6)
     - Oxycodone IR 10 mg every 4 hours for severe pain (7-10)
   - Hydromorphone 0.4 mg IVP every 2 hours for breakthrough pain.
   - Tylenol 650 mg oral every 6 hours
   - Ketorolac (Toradol) 15-30 mg every 8 hours
   - Pantoprazole 40 mg oral daily
   - Heparin subcutaneous 5000 units every 8 hours
   - Lispro / Humalog Insulin sliding scale
   - Restart oral hypoglycemic or 75% of preoperative insulin regimen.
   - Magnesium oxide 400 mg oral daily
   - Zofran 4mg IV push every 8 hours as needed
   - Colace 100 mg twice daily
   - MiraLax 17 gm by mouth daily
   - Milk of magnesia 30 mL by mouth if no bowel movement

7. Labs: No routine labs with exception of glucose every AC/HS. Order as needed.

**Whipple Discharge and Follow up:**

**Discharge and Follow up**

1. Discharge Assessment (Discharge Criteria):
   - Tolerating Diet AND
   - Tolerating pain medication AND
   - Clearance by Physical therapy AND
   - Glucose well controlled & comfortable with Insulin teaching AND
   - Bowel function returned AND
   - Social issues Resolved (consult case manager as needed)
   - If the patient does not meet discharge criteria then address active issues and document reason for continues admission
   - If patient meets discharge criteria then discharge and follow up.

2. Patient ready for discharge:
   - Controlled glucoses (<200)
   - If glucoses > 200 and was not diabetic before surgery then schedule appointment with Endocrine.
     - If patient was a diabetic prior to surgery schedule follow up with PCP.

3. Discharge Medications:
   - Oxycodone 5mg - 10 mg every 4-6 hours prn , 2 week supply
   - Colace 100 mg oral twice daily
   - MiraLax 17 gm oral daily prn
   - Insulin sliding scale if needed.
   - PPI 30 day supply with 6 refills
   - Reglan, Creon if taking as inpatient. Discharge with 30 day supply.

4. Discharge Instructions:
   - Standard Whipple Discharge Instructions
   - Track diarrhea
   - Monitor for: drain, G-tube, pancreatic insufficiency, diabetes as needed
   - JP drain document (if applicable), consider bile bag

5. Schedule Follow up appointments:
   - NP visit in 1 week
   - Surgeon within 3 weeks
   - PCP within 1-2 weeks
   - Endocrine consult if needed.
   - Long term follow up appointments as needed

**Whipple Procedure**
**APPENDIX:**

1. **<u>If fever > 37.6 C / 104 F or unexplained Leukocytosis</u> :**
   - Blood culture
   - U/A and urine culture
   - Confirm line out
   - Wound check
   - CxR
   - C difficile if diarrhea
   - If fever persists CT chest, abdomen and pelvis with IV and by mouth contrast

2. **<u>If tachycardia > 100 :</u>**
   - Review medications
   - Review labs
   - Repeat CBC
   - Consider fluid bolus
   - Consider adequate pain management
   - Consider CT
   - If tachycardia persists assure adequate pain management, Consider fluid bolus, Consider PR protocol, Consider EKG/Cardiac workup

3. **<u>If Emesis :</u>**
   - Acute abdominal series
   - Make NPO
   - IV antiemetic
   - If emesis persists CT scan abdomen and pelvis with IV/PO contrast, consider NGT
   - If suspect delayed gastric emptying consider NGT and or Reglan
   - If suspect ileus place NGT

4. **<u>If biochemical leak (is drain amylase > or = to 3x serum amylase regardless of volume:</u>**
   - Give 150 mcq subcutaneous Octreotide every 8 hours TID.

5. **<u>Goldman cardiac risk index RCRI</u>**

   **Six independent predictors of major cardiac complications**
   - High-risk type of surgery (examples include vascular surgery and any open intraperitoneal or intrathoracic procedures)
   - History of ischemic heart disease (history of MI or a positive exercise stress test, current complaint of chest pain considered to be secondary to myocardial ischemia, use of nitrate therapy, or ECG with pathologic Q waves; do not count prior coronary revascularization procedure unless one of the other criteria for ischemic heart disease is present)
   - History of HF (heart failure)
   - History of cerebrovascular disease
   - Diabetes mellitus requiring treatment with insulin
   - Preoperative serum creatinine > 2.0mg/dl (177 micromol/L)

**Rate of cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest according to the number of predictors**

- No risk factors-0.4 percent (95% CI:0.1-0.8)
- One risk factor-1.0 percent (95% CI: 0.5-1.4)
- Two risk factors-2.4 percent (95% CI 1.3-3.5)
- Three or more risk factors-5.4 percent ( 95% CI 2.8-7.9)

6. **IV bolus**
   - If MAP <60 give 500cc bolus and call chief
   - If HR > 120 check CBC and pain assessment and call chief
   - If Urine output < 120cc for 4 hours (Patient otherwise well) give 500cc bolus and call chief after 1 liter of bolus.