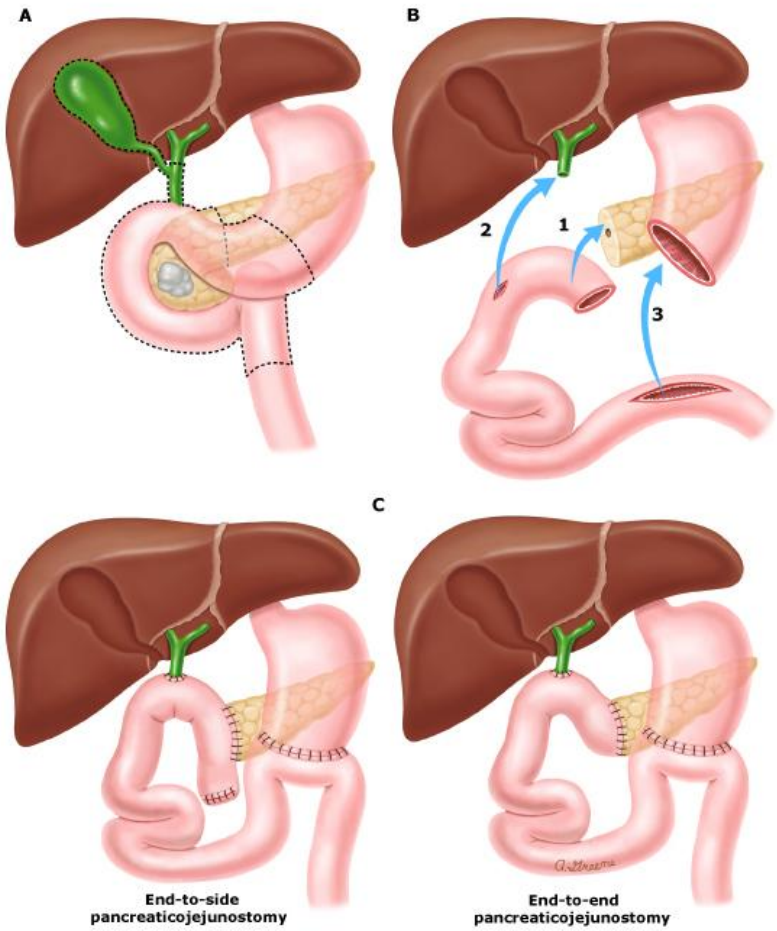
Abdominal Surgery Rotation
Section 7- Whipple resection

1. Surgical considerations

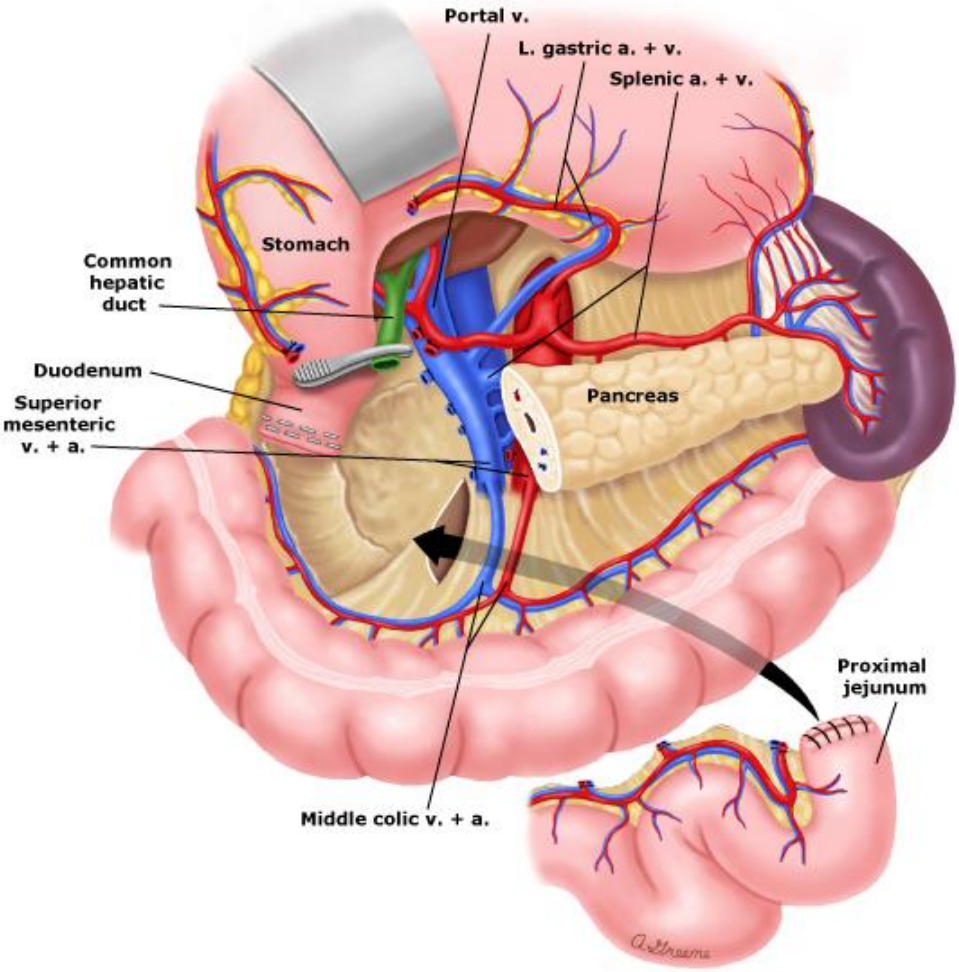
The Whipple resection consists of a pancreaticoduodenectomy followed by anastamosis of the pancreas, liver and stomach to the jejunum. Some patients with potentially unresectable disease will undergo staging laparoscopy prior to laparotomy. If diffuse carcinomatosis is discovered the operation is aborted at that point.

If the tumor is deemed resectable then the procedure is done as follows (Figure from Reber, 2011):

- Head of the pancreas is mobilized
- Gallbladder is removed
- Pancreas is transected
- The stomach is transected proximal to the pylorus
- Once the jejunum is transected the specimen is removed and the multiple anastamoses are performed



The pancreatic head and duodenum are supplied by the superior mesenteric artery with venous drainage from the superior mesenteric vein and the portal vein. This necessitates mobilization and transection of all three vessels (SMA, SMV and PV) as shown below (from Reber, 2011). In some cases the tumor may be adherent to the SMV or PV in which case the involved segment of vein will need to be resected and repaired. The tail of the pancreas and spleen are supplied by the splenic artery, a branch off the celiac trunk, and therefore should remain viable post-operatively.



The operative time can be as short as 80 mins if laparoscopy only is performed and resection is cancelled. The actual Whipple procedure can take 4-5 hours, or up to 8 hours if the tissue is friable and the anastamoses are difficult to construct.

The Whipple resection is commonly performed for pancreatic carcinoma and while the post-operative 5-year survival is only 15-25%, without treatment 5-year survival is a dismal 1-5%. In-hospital mortality following the procedure is influenced by surgical volume of the center performing the surgery; with low-volume center (≤2/year) in-hospital mortality ranging from 12-16% compared to 4% at high-volume (≥5/year) centers (Birkmeyer et al., 1999). At Stanford, there are three general surgeons who perform Whipples: Dr. Norton, Dr. Visser and Dr. Poultsides who together perform ~80 whipple procedures per year making Stanford a very high-volume center.

In one prospective, case-control study (Böttger and Junginger, 1999) the prevalence of complications after Whipple procedure was 25% for surgical complications (anastamotic leak, pancreatic fistula, intra-abdominal fluid collections, wound infections) and 18.5% for other complications (pneumonia, respiratory compromise requiring re-intubation, PE, acute MI). This study also identified post-operative major complications as an important predictor of surgical mortality. In another recent study of 216 patients undergoing pancreaticoduodenectomy complications were observed in 33% of patients with the most common being pancreatic leak and abdominal fluid collection (Fathy et al., 2008). In addition to the type of anastamosis performed, intra-operative transfusion of 4 or more units of blood was an independent predictor of post-operative complications.

Given the overall high prevalence of complications after Whipple resection we have a crucial role in intra-operative management and mitigation of risk factors as described in the sections below.

2. Pre-operative assessment

Patients are expected to follow general NPO guidelines. See section 1A for specific details. In general bowel preparation has fallen out of favor in abdominal surgery secondary to concern about dehydration and electrolyte shifts.

3. Intra-operative anesthetic management

Rapid sequence induction may be indicated if the patient presents with bowel obstruction or ileus putting them at risk for aspiration. A thorough clinical history will aid in the decision-making prior to induction. Maintenance of anesthesia will depend on whether an epidural has been placed preoperatively (see section 6 below on *Pain management*).

4. Intra-operative monitoring

The length of the surgery, potential for blood loss, fluid shifts and possible use of an epidural all make the placement of an arterial line routine in this procedure. Expect to place two large bore IVs for fluid resuscitation and for delivery of blood products. The use of intra-operative TEE is becoming more common in the GOR. Preoperative cardiac screening should be performed in all patients but the presence of CAD, valvular abnormalities or systolic dysfunction may warrant intra-operative TEE. If you and your attending feel that patient safety will be enhanced with intra-operative TEE, contact Daryl Oakes (Cardiac) or Rosario Garcia (Cardiac/GOR) for help with set-up and intra-op readings.

5. Fluids and transfusion

The Whipple resection is a long and extensive surgery and therefore large fluid losses can be expected. While intraoperative fluid resuscitation is important, there is some evidence that overzealous fluid administration can lead to increased postoperative morbidity (delayed recovery of bowel function, increased anastamotic breakdown) and extended hospital stay. *See section on liver resections for a thorough review of the topic.*

Blood loss can be significant and a type and cross of at least 2 units should be obtained preoperatively. Please see section 7G Blood transfusion for more information.

6. Pain management

Approximately 90% of patients with periampullary cancer experience severe pain and it is the most common indication for surgical resection. The high prevalence of preoperative chronic cancer pain in this population makes perioperative pain management critical but also presents unique challenges.

The Whipple resection is performed through a midline abdominal or chevron incision (see Figure) with average pain scores of 7-9/10. Classically, pain has been managed with preoperative placement of a thoracic epidural; however, there is debate about efficacy and cost-effectiveness of this strategy. Benefits of epidural analgesia include improved suppression of surgical stress response, lower blood loss and earlier recovery of bowel function. Several studies have attempted to address the most effective pain management strategy after Whipple resection (and other major abdominal surgeries) and these will be briefly reviewed here.

The first randomized trial to evaluate the effect of epidural analgesia on postoperative morbidity involved 53 patients randomized to receive epidural or intravenous analgesia for major intra-abdominal, intrathoracic or vascular surgery (Yeager et al., 1987). The results were striking: patients who received epidural analgesia had significantly decreased mortality (0 vs 16%, p=0.04), morbidity (32 vs 76%, p=0.002) and hospital cost was $9,000 lower ($11,218 vs $20,380, p=0.02).

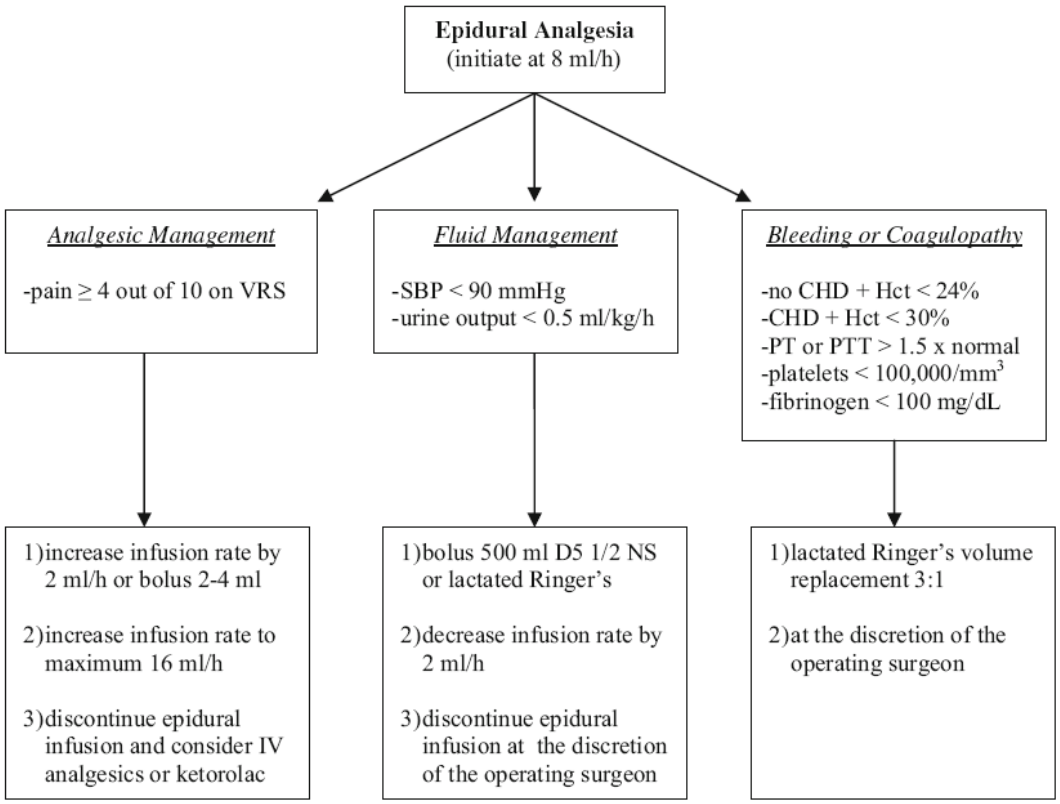
In 2001, a Veterans Affairs multi-center trial of 1,021 patients undergoing major intra-abdominal surgery was conducted (Park et al., 2001) which failed to replicate the impressive results discussed above. Five hundred and seven patients were randomized to the systemic analgesia group and five hundred and fourteen patients were randomized to the epidural analgesia group. Baseline characteristics as well as primary endpoints (death, major cardiac and pulmonary complications) and secondary endpoints (sepsis, pneumonia, GI bleed) were all equivalent between the two groups. A sub-group analysis suggested improvement in outcomes with epidural analgesia specifically for aortic surgery patients and the majority of the manuscript discussion focuses on this secondary finding.

In a recent study by Marandola et al. (2008), 40 patients were randomized to receive a T9-10 thoracic epidural with ropivicaine (10mg/hr) and morphine (0.25mg/hr) or continuous intravenous morphine at 0.8 mg/hr starting intraoperatively prior to jejunal reconstruction. Patients treated with epidural analgesia had significantly lower pain scores on day one at the three time points measured and lower incidence of opioid-related side effects (respiratory depression, sedation, confusion). While the results are interesting it is a very limited study. The change in visual analog scale scores (1-2 points on a 10 point scale) is unlikely to be clinically significant and pain relief was only assessed on postoperative day 1 while the average hospital length of stay post-Whipple is 8-10 days.

In a more thorough study of 233 patient undergoing pancreaticoduodenectomy, Pratt et al. (2008) compared clinical and economic outcomes for patients receiving epidural or intravenous analgesia. Their institution has a standardized protocol for pancreatic resections as shown in Figure 2 below; all patients in this study were treated according to this algorithm. One hundred eighty five patients received epidurals and forty eight patients were treated with intravenous analgesia only after declining epidural placement. Baseline characteristics were similar in both groups; however, operative time was 91 minutes longer in the intravenous group owing to the larger proportion who underwent staging laparoscopy prior to laparotomy (27% in IV group vs. 8% in epidural group). Pain control was statistically

better with epidural analgesia on POD 1 and 2, however overall pain at rest averaged over the first 4 days was equivalent. Patients with epidural analgesia did clinically worse with longer time to recovery of bowel function, higher rate of respiratory complications, ileus, pancreatic fistulas, hemodynamic compromise and need for interventions such as antibiotics and TPN. Economic outcomes were overall similar with a higher operating room cost observed with intravenous analgesia which was offset by lower hospital room costs from shorter length of stay. Further analysis was also conducted on a group of 58 patients whose epidurals were aborted defined as removal prior to postoperative day 4 secondary to hemodynamic compromise or inadequate pain control. This group experienced higher postoperative complications, required more aggressive fluid resuscitation, more frequent blood transfusions and suffered respiratory compromise at a rate 3 times higher than those with a functional epidural. In addition, this group incurred hospital costs 20% higher than functional epidural or intravenous analgesia patients. Risk factors for a nonfunctional epidural included age >75 years and low preoperative hematocrit (<36%).

Figure 2: Beth Israel Deaconess algorithm for analgesic management after pancreaticoduodenectomy, from Pratt et al. (2008). VRS- verbal ranking scale (0 to 10).



Overall, the most effective pain management strategy for Whipple resection and other major abdominal surgery remains up for debate. It is clear, however, that a functioning epidural provides superior pain relief in the immediate postoperative period. Anesthesiologist experience, patient factors and surgeon preference all play an important role in the decision to place a preoperative epidural- what do you think?

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