CVP in Laparoscopic Liver Resection

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Scott McCusker
Anthony Valente
Rates of Liver Resections

- National and global rates of liver resections are increasing.
  - Better knowledge of blood supply & anatomy
  - More surgical experience
  - People living longer, with increased interventions in late stage cancers.
Introduction

• Open approach utilizes low CVP <5mmHg as common practice
  – Less back pressure through hepatic vasculature
  – Less blood loss correlated with less transfusions and lower morbidity and mortality (results vary in RCTs)

• More are being done laparoscopically
  – Less pain, shorter hospital stay, less intraoperative bleeding, less transfusions
  – Similar morbidity and mortality compared to open

• To date there are no studies specifically examining the laparoscopic approach
  – Confounded with mixed approaches to blood loss
  – Very little representation of laparoscopic in literature
Introduction

• Laparoscopic liver resections require pneumoperitoneum
  – Intra-abdominal pressure of 15mmHg → reduced CO, SV, IVC compression and reduction of portal venous blood flow.
  – All exacerbated if a patient is hypovolemic
  – All exacerbated with pharmacologically induced low CVP
  – Potential for lowered end organ perfusion/damage
  – With a low CVP, pneumoperitoneum may favor the net inward flow of CO2 into liver vasculature → CO2 embolism (clinical significance?)
Research Question

**Population:** Patients undergoing elective major and minor laparoscopic liver resections.

**Intervention:** Allow for high CVP (10-12mmHg), CVP similar to intraperitoneal pressures, during elective major and minor laparoscopic liver resections.

**Comparison:** Current standard of low CVP (<5mmHg) in elective major and minor laparoscopic liver resections.

**Outcome(s):**
- **Primary:** Blood loss (in mls) in both low CVP and high CVP arms.
- **Secondary:** Transfusions, hypotension, morbidity (MI, Stroke, AKI, Liver injury), air embolism (positive Doppler, hemodynamic (SBP <90mmHg, and EtCO₂ change), and surgeon satisfaction between low and high CVP arms.
Methods (brief)

- Juravinski Hospital, 2 arm, parallel, randomized controlled trial.
- Patient, surgical staff, and researchers will be blinded to intervention. Anesthesiologist will NOT be blinded to CVP.
- **Exclusion criteria:** Previous liver resection; emergency procedures; atrial fibrillation (falsely elevated CVP); known impaired left ventricular function (EF \(<40\%)\); chronic renal failure; coagulopathy; preoperative anemia (Hb \(<100\) g/L); patients with tumors that actively invade major vessels.
- **Blood Loss outcome**
  - Suction bottle amount (mL) - amount of irrigation volume + volume of blood within surgical gauze (additional weight in gauze is to be assumed blood, and converted using 1.058g/mL in men, 1.055g/mL in women)
- **Blood transfusion outcome**
  - Transfusion threshold 80g/L or blood loss exceeding 1000ml during resection
Limitations

• Anesthesiologist not blinded, also is one to decide a need for transfusion (outcome). Major potential for bias.
  – Need for very strict transfusion guidelines, any deviations cannot be used in the study.
• Exact measurement of blood loss is impossible.
• Only 40-50 Laparoscopic cases each year, with exclusion criteria, difficult to obtain a sample large enough to find a significant difference in blood loss/transfusion requirements.
• Inter surgeon/anesthesiologist variability.
• Limited to one hospital site representing that region’s geographic distribution and co-morbidities
Implications

- Open procedures have substantially more blood loss than laparoscopic liver resections (no intra-abdominal pressure to counteract hepatic venous pressure).

- Common practice to lower the CVP <5mmHg during a liver resection to reduce blood loss. Whether this blood loss is significant in laparoscopic procedures has yet to be studied.

- If hypothesis is accurate:
  - Low CVP exposes a patient to procedural risks, air embolism, and hemodynamic instability with potential organ compromise.
  - Low CVP may no longer be appropriate for laparoscopic liver resections.
References


