



**Pediatric Anesthesia
& Pain Management**

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Guidelines for the Anesthetic Management of Pediatric Liver Transplantation

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Set Up

Equipment

1. Hot Lines x2, Drip line for CVP, Level 1 if >50 kg
2. Humidifier
3. Baxter syringe pumps x2, Dopamine drip on one of them

Drugs:

1. Fentanyl 50-100 µg/kg
2. Rocuronium for RSI
3. Isoflurane/Air/Oxygen
4. D50W
5. Dopamine Drip (6 mg/kg dopamine/50cc D5W in 60cc syringe, 3 µg/kg/hr).
6. Epinephrine diluted to 10 and 1 µg/ml
7. CaCl₂ 10%
8. NaHCO₃
9. Heparin 10 U/kg
10. SoluMedrol 15 mg/kg
11. Ampicillin 50 mg/kg (25 mg/kg for subsequent doses q6h)
12. Ceftriaxone 50 mg/kg x1 dose
13. Furosemide 1 mg/kg

Preoperative Assessment

Establish primary diagnosis.

Some primary renal anomalies and diseases are associated with other syndromes of importance, such as collagen vascular disease, congenital heart disease, etc.

Establish secondary diagnoses

1. Portal hypertension, associated with
 - a. Associated with preoperative thrombocytopenia
 - b. GI bleeding
 - c. Coagulopathy
 - d. Accentuated intraoperative blood loss.
2. Hepatorenal Syndrome
3. Hepatic Encephalopathy and intracranial hypertension
4. Electrolyte abnormality. Know the most recent Na, K, Ca, and Mg and correct if possible preoperatively. Severe hyperkalemia (K>6) should be corrected by dialysis prior to surgery.
5. Anemia due to UGI bleeding.

Monitoring & Vascular Access

1. Routine monitors include noninvasive BP on the arm, ECG, core temperature, ETCO₂, SpO₂.

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2. 2 Rapid Infusion lines are required hung with 1 liter bags of Normosol. These should be attached to Hot Line fluid warmers. Level I warmers should be used for teenagers.
3. Invasive monitors are required.
 - a. Intra-arterial monitoring via femoral artery.
 - b. CVP monitoring is required for all patients in order to guide volume management and for postoperative vascular access. Place a triple-lumen CVP line in a jugular or subclavian vein.
 - i. One lumen is attached to CVP transducer
 - ii. Second lumen is attached to carrier fluid, and a dopamine drip at 3 µg/kg/min running off a Baxter syringe pump.
 - c. Swan-Ganz monitoring of PA pressures may be necessary in the infrequent patient with symptomatic cardiomyopathy or with echo-demonstrated cardiac dysfunction.
 - d. All patients have bladder catheters inserted prior to surgery.

Temperature Maintenance

1. Hat
2. Wrap extremities in cotton then plastic wrap
3. Bear Hugger to lower extremities using adult lower body blanket for all sized patients. Set at 38 degrees.

Induction of anesthesia

1. Routine sedative premedication is appropriate.
2. The goal of induction of anesthesia, as for all patients, is to protect against the risk of aspiration and to minimize cardiovascular changes. The induction technique is therefore tailored to the medical conditions of the patient. Generally a modified RSI with fentanyl and thiopental, using rocuronium for relaxation, is appropriate.

Maintenance of anesthesia/Phases of surgery

1. The anesthetic maintenance is based upon high dose opioid low dose volatile agent titrated against hemodynamics. Nitrous oxide is never used during maintenance of anesthesia to eliminate problems with gas diffusion into bowel. Air/oxygen is used to maintain high-normal oxygenation.
2. Pre-Anhepatic Phase: Normalize acid/base abnormalities and electrolyte abnormalities. Establish euvoemia conservatively. Establish diuresis with dopamine ± furosemide.
3. Anhepatic Phase: Normalize acid/base, establish mild metabolic alkalosis, mild hypercalcemia (>1.1). Correct hyperkalemia.
4. Reperfusion Phase: 100% O₂ prior to unclamping. Turn off volatile agent sufficiently early to eliminate gas from circulation. Empiric therapy with epinephrine 0.25-0.33 µg/kg and CaCl₂ 10 mg/kg at unclamping. Repeat boluses of epinephrine to maintain cardiac output and BP. SoluMedrol 15 mg/kg. May re-introduce volatile agent and air to inhaled gases.
5. Arterial Anastomosis: Heparin 10 U/kg. Usually done without clamping aorta.
6. Biliary Anastomosis: Either duct to duct (about 30 minutes) or Roux-en-Y (about 2 hours).

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Fluid management:

1. Underlying hypovolemia should be corrected if present, then fluid management should be conservative to prevent postoperative edema.
2. Appropriate fluid:
 - a. Normosol if the Hct is >30 and no clinical coagulopathy is present
 - b. FFP if the Hct is >30 and a clinical coagulopathy is present
 - c. PRBC if the Hct is <30.
 - d. Platelets (0.1 Units/kg, minimum 2 units) should be given early in surgery if the platelet count is <100,000, but should not be administered after reperfusion of the liver unless thrombocytopenia is causing bleeding.
 - e. Cryoprecipitate (0.2 Units/kg) is given to treat hypofibrinogenemia.

Emergence and Recovery

Children are left intubated and ventilated postoperatively

Postoperative analgesia

Long acting opiates should be administered prior to the conclusion of surgery to prevent rebound hypertension from occurring after discontinuation of volatile anesthetic
