

## Intensive Care Nursery House Staff Manual

### Common Neonatal Surgical Conditions

**INTRODUCTION:** Approximately 15% of all infants admitted to the UCSF ICN have a primary surgical diagnosis (in addition to those with congenital heart disease). For many of the other patients, surgical problems develop during their hospitalization. Appropriate care of these infants requires close cooperation and communication between the ICN medical team and the Pediatric Surgeons. This section deals with some common neonatal surgical conditions. Others are covered in the sections on Necrotizing Enterocolitis (P. 133) and Pulmonary Hypoplasia and Diaphragmatic Hernia (P. 85).

#### **GENERAL GUIDELINES:**

- Patients in the ICN with surgical problems are managed jointly by the medical and surgical teams. Each patient should be discussed at least once daily with the Pediatric Surgical team.
- Notify Pediatric Surgery as soon as you are aware of a pending admission or birth of a patient with a surgical problem.
- When patient returns from the Operating Room, obtain sign-out from the Surgical Resident and discuss orders for postoperative care. Also, obtain sign-out from the Anesthesia Resident regarding (a) anesthesia, other drugs, and fluids that the patient received and (b) events during the operative procedure.
- Notify Pediatric Surgery immediately if there are any major changes in the condition of a surgical patient.
- Do not begin feedings on a surgical patient without first discussing it with the Pediatric Surgeons.
- Whenever possible, accompany your patient to the Operating Room. It is an excellent opportunity for learning and for discussing post-operative management with the surgical team.

#### **1. ESOPHAGEAL ATRESIA WITH OR WITHOUT TRACHEO-ESOPHAGEAL FISTULA (TEF):**

##### **A. Diagnosis and preoperative management:**

- Esophageal atresia may often be suspected prior to the first feeding by a history of polyhydramnios or observation of copious oral secretions than require very frequent suctioning.
- Attempt to pass feeding tube with radiopaque line into the stomach. If the tube does not pass, leave in place and obtain chest x-ray and KUB.
- Do not obtain contrast study. This may result in aspiration.
- If the tube curls up in blind esophageal pouch and there is no air in bowel, assume a diagnosis of esophageal atresia.
- If the tube curls up in blind esophageal pouch and there is air in the distal bowel, assume a diagnosis of esophageal atresia with distal TEF.
- Call Pediatric Surgery.
- Keep infant in a position with the head up to prevent aspiration.

- Place Replogle tube on continuous suction to drain the blind pouch.
- Avoid bag and mask ventilation and nasal CPAP to prevent over-distension of the stomach. If the baby needs respiratory assistance, intubate the infant.
- If the baby has severe lung disease and a distal TE fistula, ventilation of the lungs may be extremely difficult because of the low resistance through the fistula into the stomach and bowel. Notify surgery immediately as the baby may need immediate closure of the fistula or an emergency gastrostomy with placement of a distal esophageal balloon to facilitate adequate ventilation.
- Examine infant carefully for other anomalies associated with VATER or CHARGE, including vertebral abnormalities, radial anomalies, choanal atresia, imperforate anus, renal abnormalities, congenital heart disease, coloboma or evidence of Down syndrome.

#### **B. Post operative management:**

- Regular maintenance IV fluids with extra boluses of normal saline as needed for oliguria, hypotension, or poor perfusion. If infant requires >15 mL/kg of extra fluid, consider starting dopamine at 5 mcg/kg/min to ↑ blood pressure and perfusion to kidneys.
- If a chest tube is in place draining the area of the anastomosis, **do not connect the pleuravac to suction** without consulting with the Attending Surgeon. The chest tube is usually in place for 7-10d until x-ray studies show no leak at the anastomosis.
- If the anastomosis is under tension, the surgeons will often want to keep the baby on muscle relaxants postoperatively for a few days to a week, to prevent disruption of the anastomosis.
- Do not extubate until the baby is extremely stable on very low ventilatory settings, because **positive pressure mask ventilation must be avoided** to prevent transmission of pressure to the esophagus, which may rupture the anastomotic suture line.
- If the baby needs to be reintubated, the most experienced person should do this. Faulty (*i.e.*, esophageal) intubation could result in injury to the anastomosis.
- Leave the orogastric or nasogastric tube in place until x-ray studies show no leak at the anastomotic site, and Pediatric Surgery agrees to removal of the tube. If the tube accidentally comes out, **do not reinsert tube** without consulting with the Attending Pediatric Surgeon, as you may damage the anastomosis.
- X-ray contrast study should be done at approximately 10 days postoperatively to assess for leakage at the anastomotic site prior to starting oral feedings. Gastrostomy tube feedings and NG tube feedings may be started earlier.

## 2. INTESTINAL OBSTRUCTION

### A. Diagnosis and preoperative management:

- Intestinal obstruction should be suspected with maternal history of polyhydramnios, large amount ( $>20$  mL) of gastric fluid at birth, bilious or non-bilious emesis, or progressive abdominal distension.
- Common causes include duodenal, jejunal, ileal, or colonic atresia, malrotation with mid gut volvulus, meconium ileus with associated cystic fibrosis, meconium plug, Hirschsprung's disease, imperforate anus, and hypoplastic left colon.
- Infants with bowel atresia may pass meconium.
- The higher the obstruction, the more prominent is the vomiting. The lower the obstruction, the more prominent is the distension.
- Make infant NPO, start IV, and monitor electrolytes, urine output and weight.
- Place Repleglo tube to continuous suction and measure output.
- Obtain KUB looking for
  - "double bubble" sign of duodenal atresia. If present, no further GI workup is needed and patient should go to surgery when stable.
  - multiple dilated loops of bowel indicating a more distal obstruction
  - intraperitoneal calcifications suggestive of perforation with meconium ileus
  - air throughout bowel to the rectum suspicious for Hirschsprung's disease
  - bubbly-appearing stool filling the bowel suggestive of meconium ileus and cystic fibrosis
- Upper GI contrast study (with dilute Hypaque<sup>TM</sup> or Gastrograffin<sup>TM</sup>) may be required to assess for malrotation and possible volvulus.
- Contrast enema using Gastrograffin<sup>TM</sup> or dilute Hypaque<sup>TM</sup> may be done to identify an area of obstruction or to relieve meconium plug or meconium ileus.
- Suspect acute **volvulus** secondary to malrotation if the baby has signs of shock, metabolic acidosis or peritonitis. If there are signs suggesting volvulus, emergency operation is indicated since gut viability may be threatened.
- Suspect **Hirschsprung's disease** with repeated episodes of abdominal distension or very delayed passage of meconium. Diagnosis can be made with suction rectal biopsy. If no ganglion cells are seen, a surgical biopsy will confirm the diagnosis.
- Infants with Hirschsprung's disease are at risk for development of fatal toxic megacolon until the bowel has been decompressed by corrective surgery or colostomy. Surgeons may choose to decompress initially with rectal irrigation. This is different from simple enemas.
- **Imperforate anus** may be the sole abnormality or may be part of the VATER association. Look carefully for evidence of recto-vaginal, recto-urethral or perineal fistula. Ultrasound may help determine if the defect is low (and easily repaired) or high (requiring colostomy drainage). These patients will need eventual workup for tethered spinal cord and urinary tract anomalies.

**B. Post operative management:**

- IV fluid replacement at maintenance levels with parenteral nutrition (see P. 136) starting within 2d of operation. Intermittent fluid boluses may be required in the first 48h to maintain adequate urine output and to treat hypotension and hypoperfusion. Consider early use of low-dose dopamine (3-5 mcg/kg/min).
- If there has been extensive bowel manipulation, the baby may require baseline fluid administration 1.5 times normal (*i.e.*, 150 mL/kg/d) because of capillary leak. Use Lactated Ringer's Solution with 5% or 10% dextrose for at least the first 24h after operation.
- Maintain Replogle tube to continuous suction and measure output. If drainage is more than 10 mL/kg per 12h shift, replace volume loss with an equal volume of 0.45% NaCl.
- Replogle tube may be removed when drainage is minimal and non-bilious.
- After the baby has passed stool, start feedings with small volumes and advance slowly over the next 48h to ensure that baby is not developing abdominal distension secondary to postoperative ileus or to stricture at the anastomotic site.

**3. OMPHALOCELE AND GASTROSCHISIS:****A. Diagnosis and preoperative management:**

- Often diagnosed prior to delivery by ultrasound.
- Resuscitation team should be present at delivery.
- Because fluid losses from the exposed bowel can be massive, the lower half of the infant's body should be placed in a sterile bowel bag (turkey bag) with some sterile 0.9% NaCl at the bottom to keep the environment moist. Close the bag above the defect
- With gastroschisis or large omphalocele, make sure that the blood supply to the bowel is not kinked by the weight of the bowel. The baby may be placed on his side (right side down or with towels underneath the bowel bag) to help support the externalized intestine and insure adequate blood flow.
- Place baby under radiant warmer to prevent hypothermia from high heat loss from the exposed bowel.
- Insert a Replogle tube to continuous suction to prevent bowel distension.
- Notify Pediatric Surgery.
- Start IV maintenance fluids and prophylactic antibiotics. IV fluid requirement may be as high as 300mL/kg/day, especially for gastroschisis.
- Omphalocele is a herniation of bowel, and occasionally other organs including stomach and liver, into the umbilical cord and they are usually covered by a peritoneal sac, which may rupture prior to or during birth.
- Omphalocele has a high association (>50%) with other anomalies, especially congenital heart disease, chromosomal abnormalities, Pentalogy of Cantrell and Beckwith-Wiedemann syndrome. Therefore chest x-ray, renal ultrasound, and echocardiogram should be obtained prior to operation.

- Gastroschisis is a herniation of abdominal contents through a small right sided abdominal wall defect lateral to the umbilical cord. The exposed bowel is never covered by a peritoneal sac. Only approximately 10% of infants with gastroschisis have associated abnormalities, usually intestinal atresias.

#### B. Surgical management:

- If there is adequate space within the abdominal cavity, a primary closure of the abdominal wall may be done, often with a gastrostomy tube for decompression. Usually this is possible for omphaloceles, which tend to be small, and occasionally for small gastroschises.
- Often a 2-stage procedure is required with the initial placement of a sterile Goretex™ silo to cover the bowel. Each day, the silo is tightened by the Surgeons so that the bowel is gradually pushed back into the abdominal cavity. The final closure is performed in the operating room with removal of the silo and, occasionally, placement of a mesh graft to help close the anterior abdominal wall.
- Risks of silo include infection and bowel necrosis. To decrease infection rate, the silo should be closed within 4-7d.
- The surgeons will insert a central Broviac catheter for parenteral nutrition. This is often not necessary with primary repair of small omphaloceles.

#### C. Post operative management:

- Check chest X-ray immediately post-operatively to evaluate lung fields and position of catheter.
- If primary closure has been difficult or if a silo is used, the baby will require assisted ventilation and will usually be kept on muscle relaxants for at least the first few days after operation
- Ensure adequate ventilation and oxygenation by increasing inspiratory and end expiratory pressures to maintain adequate lung volume and tidal volume as abdominal girth increases secondary to capillary leak syndrome.
- Replacement of the bowel inside the abdomen and tightening of the silo will lead to increased intra-abdominal pressure that will decrease diaphragmatic excursion and make ventilation more difficult.
- The increased intra-abdominal pressure may also lead to decreased urine output.
- Provide adequate pain relief, usually by continuous infusion of morphine.
- Maintain good hydration and avoid hypotension postoperatively to ensure adequate bowel perfusion. For the first 24h postoperatively, use D10% Lactated Ringer's solution at 1.5 times maintenance (i.e., 150 mL/kg/d). Frequent extra boluses of normal saline may be required to maintain adequate urine output. Consider early use of dopamine.
- Continue preoperative antibiotic therapy.
- After 48 hours postoperatively, consider starting central parenteral nutrition (see P. 136 for guidelines).
- Maintain Replegole tube to continuous suction, record volume of fluid drainage, and replace with 0.9% NaCl if the amount exceeds 10 mL/kg per 12h shift.

- If infant is receiving muscle relaxants, insert indwelling urinary catheter for accurate measurement of urine output.
- When infant is ready to start enteral feedings, use an elemental formula such as Pregestimil™, start with small volumes and advance slowly (see section on Feeding of Preterm Infants, P. 50). Infants with gastroschisis are at very high risk for necrotizing enterocolitis (see P. 133).
- Because infants with gastroschisis are also at increased risk for intestinal atresia, observe infant closely for abdominal distension as feedings are advanced.
- Infants who require secondary closure of their abdominal wall defect will usually not be on full enteral feedings until at least 3 weeks postoperatively.