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Near-Infrared Spectroscopy

Near-infrared spectroscopy (NIRS) is a noninvasive monitoring method to measure cerebral and somatic oxygenation during a surgical procedure. NIRS is based on the differential absorption of varying wavelengths of light by hemoglobin as it associates with oxygen. It provides a regional measurement of oxygen content in a localized tissue bed. The main purpose of NIRS is to evaluate regional tissue perfusion and oxygenation continuously. It has been used as standard of care during cardiac surgery to monitor the possible associated neurologic dysfunction from the hemodynamic changes occurring during the procedure. Cerebral hemoglobin oxygen saturation measured with NIRS (rSO_{2c}) is utilized to monitor and titrate brain oxygen delivery preoperatively, during cardiopulmonary bypass, and postoperatively in the pediatric intensive care unit. Somatic/renal NIRS (rSO_{2s}) has also been proposed, as an estimate of somatic oxygen delivery and as a measure of optimized systemic perfusion, coupled with cerebral NIRS. A near-infrared spectrometer equipped with two independent emittent–sensor pairs is used for simultaneously measurement of rSO_{2c} and rSO_{2s} by cerebral and splanchnic sensors applied to the forehead and renal region, respectively. For example, during thoracoscopy pleural absorption of CO₂ causes acidosis which in turn causes vasoconstriction and reduced cerebral oxygenation signaled as such by the cerebral NIRS sensor placed in the head. Low intraoperative cerebral NIRS values are associated with worse neurological outcomes. Also, perioperative periods of diminished cerebral oxygen delivery, as indicated by rSO_{2c}, are associated with one-year brain MRI abnormalities among infants undergoing reparative heart surgery. NIRS has recently been used in cases of non-cardiac neonatal surgery helping understand neonatal physiological changes occurring in these patients.

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Choledochal Cyst Type II

Choledochal cysts are dilatation of the extrahepatic and/or intrahepatic biliary tree causing myriad of complications in children. Choledochal cyst type II is the rarest of all types of choledochal cysts commonly described as diverticular malformation of the common bile duct with an otherwise normal intra- and extrahepatic biliary tree. Such diverticular cysts may be either small or very large occurring in less than 2% of all reported cases of choledochal cysts. The pathogenesis of this type of choledochal cyst remains speculative between an acquired and congenital process, with the common channel theory of insertion of the bile duct into the pancreatic duct allowing pancreatic enzymes to reflux into the common bile duct causing inflammation, weakness and eventual fibrosis, as the most plausible explanation. Others believe that the diverticulum is a remnant of an earlier stage of bile development or an end-stage healing of prenatal rupture of the common duct. Symptoms associated with this type of cyst includes abdominal pain, cholangitis, jaundice, fever and pancreatitis. First diagnostic study should be an abdominal ultrasound. This can be followed by an MRCP to precisely delineate the rare biliary anatomy. The management of choledochal cysts is surgical excision whenever possible. Removal of the diverticulum is an accepted mode of treatment, leaving patent the native extrahepatic biliary tree. This procedure can be performed either open or laparoscopically with good results. If the cyst has a wide opening to the biliary tree or dilatation of the common bile duct is present (mixed variety) excision and bilio-enteric reconstruction is needed. Whatever technique the surgeon chooses, before removing the diverticular cyst, an intraoperative cholangiogram should be done to delineate precisely the surgical anatomy including demonstrating a normal appearing common bile duct with free flow of contrast into the duodenum and proximally into the intrahepatic ductal branches. Long-term follow up is needed to assess surgical outcome, notably complications such as stricture formation or the development of malignancy.

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Sacral Nerve Stimulation

Sacral nerve stimulation (SNS), also known as sacral neuromodulation, is a novel well-established therapy utilized for fecal incontinence in adults. In children, sacral nerve stimulation has proven to

be effective in dysfunctional elimination syndrome, dysfunctional voiding, urinary retention, urgency, fecal soiling and recently constipation. SNS has also been found to be a valuable tool for intraoperative guidance in anorectal malformations allowing direct neuromuscular response to be identified helping surgeons operate closer to the individual anatomy. Electrical stimulation of sacral nerve roots has been shown to have a positive effect on peristalsis in the large bowel in patients with spinal cord injury. The procedure consists of placing programmable stimulators subcutaneously which delivers low amplitude stimulation via a lead to the sacral nerves usually assessed through the S3 foramina. Placement of the electrode using local anesthesia is preferred to ensure perfect positioning based on sensory reaction to stimulation. The most common complaint after the procedure is pain from mechanical pressure or stimulation, and lead migration. SNS has been found recently to improve defecation in adolescent suffering from slow transit constipation refractory to intensive medical therapy. This needs to be confirmed in larger prospective studies with longer follow-up. Experience using SNS in smaller children is lacking.

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