



# **PEDIATRIC SURGERY Update\***

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### **Intercostal Cryoanalgesia**

Intercostal cryoanalgesia refers to the localized freezing of intercostal peripheral nerve through the application of a cryoprobe which achieves freezing temperatures. Intercostal cryoanalgesia achieved by application of a cryoprobe at -60 degree C for two minutes to the intercostal nerve to induce axonotmesis. When the intercostal nerve axon is frozen, the transmission of an electrical signal along the axon is prevented providing analgesia to that dermatome. Thereafter Wallerian degeneration of axons occurs starting at the point of injury and moving toward the nerve endings. Axonal regeneration eventually occurs since the fibrous neural structures including the perineurium and epineurium are preserved. Axonal regeneration occurs at a rate of one to 3 mm/day. This regeneration process is completed in approximately 4-6 weeks after freezing injury. Intercostal cryoanalgesia has been utilized for the acute and chronic control of pain after thoracotomy. In children intercostal cryoanalgesia is used during bar placement for the Nuss procedure of pectus excavatum deformities. The greatest advantage of using peripheral nerve freezing for pain control during the Nuss procedure is the long period of analgesia provided to the child. Cryoanalgesia provides pain control for a maximum of two months until axonal regeneration occurs. The clinical experience to date demonstrates a significant reduction in length of hospital stay and decrease postoperative opioid requirements in pectus excavatum patients managed with intercostal cryoanalgesia when compared to thoracic epidurals. Transient post-cryoanalgesia intercostal neuralgia is reported to occur in up to 20% of patients and may be the result of an incomplete cold temperature axonal injury. A minority of patients does complain about persistent paresthesia long term. Ultrasound-guided percutaneous intercostal analgesia for mastectomy has also demonstrated a potential benefit of long-term pain control for patients.

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## Bronchopleural Fistula

Bronchopleural fistula (BPF) is a sinus tract communication between the main stem, lobar or segmental bronchus and the pleural space. BPF is considered a serious complication after pneumonectomy or any other pulmonary resection. Other common causes of BPF include after pulmonary infection causing necrosis, persistent spontaneous pneumothorax, chemotherapy or radiotherapy from malignancy or tuberculosis. BPF are classified as early if it develops during the first seven days after the insult, intermediate if they occur between eight and 30 days and late if they present after 30 days. The list of causes of BPF is numerous but most cases occur after lung resection (pneumonectomy, lobectomy or segmentectomy). Postoperative BPF is classified as acute, subacute or chronic. Symptoms can include tension pneumothorax, asphyxiation, dyspnea, hypotension, subcutaneous emphysema, cough with expectoration, tracheal or mediastinal shift, persistent air leak and a reduction in pleural effusions in chest films. Chronic cases develop more insidious symptoms such as failure to thrive, malaise and fever. If a BPF occurs early in the postop period, it is usually caused by mechanical failure of bronchial stump closure and requires urgent surgery as symptoms can be catastrophic. Most children with BPF present symptoms in the first two weeks after lung resection. Diagnosis of BPF is made using clinical, radiographic and bronchoscopic findings that confirm air leak from a bronchus to the pleural space. CT Scan can reveal the fistulous tract between the bronchus and pleura. Initial management of BPF is chest tube drainage of air and fluid from the pleural cavity. Suture closure of the opened bronchial stump using a vascularized flap coverage with video-assisted thoracoscopic approach is curative for the BPF presenting in the first two weeks. Other times the BPF can be closed using a muscle flap to fill the pleural space through a formal thoracotomy. Children with mechanical ventilation have a more complicated disease course due to the persistent air leak and incomplete lung expansion. BPF cause significant morbidity, prolonged hospitalization and mortality.

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## Appendiceal Stump Bleeding

Lower gastrointestinal bleeding arising from the appendix is an extremely rare condition. Several pathologic conditions have been reported to be related to bleeding from the appendix such as Crohn's disease, appendicitis, intussusception, angiodysplasia, neoplasm, endometriosis, erosion of the appendiceal mucosa and stump granuloma. The use of CT-Scan in conjunction with colonoscopy may aid in making an accurate diagnosis with regard to appendiceal bleeding. Gastrointestinal bleeding from the appendiceal stump after appendectomy is also extremely rare. The bleeding may drain into the peritoneal cavity, the retroperitoneum or into the lumen of the bowel presenting as hematochezia or melena. The cause of the bleeding is usually a small intramural branch of the appendiceal artery at the appendiceal stump. Appendiceal bleeding may be managed by endoscopic clipping, arterial embolization or surgical cecal resection if massive. Granulomatous appendicitis characterized by appendicular granulomas can also present with lower gastrointestinal bleeding. Granulomas are chronic inflammatory lesions consisting of clusters of epithelioid histiocytes accompanied by multinucleated giant cells and lymphocytes. This condition accounts for less than 2% of all appendicitis and only 5010% of them develop Crohn's disease. Subacute appendicitis produces granulomatous reaction in relation to a secondary inflammatory response to acute appendicitis or phlegmonous process managed conservatively with postponed appendectomy. The definitive management of granulomatous appendicitis is appendectomy with a good long-term prognosis. Appendiceal stump granuloma bleeding can be managed expectantly since as soon as the inflammatory process subsides the bleeding will stop.

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