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Canal of Nuck Hydrocele

There is a difference in the content of the inguinal canal between males and females. During development of the female fetus the round ligament of the uterus descends into the inguinal canal to the labium major. The peritoneal fold that descends with the round ligament accompanying the gubernaculum during descend is named the canal of Nuck. This structure is homologous to the processus vaginalis of the male anatomy. In normal female development, the canal of Nuck obliterates in a superior to inferior direction, a process that begins at about the 7th month of gestation and is completed by about one year of age. If the canal begins normal closure at the superior portion but remains patent in the inferior portion fluid can accumulate and develop into an encysted hydrocele of the canal of Nuck. Should this communication fail to close completely it results in a patent canal of Nuck and the development of an indirect hernia or communicating hydrocele. Hydroceles of the canal of Nuck are very rare. Herniation of the ovary is most common, occurring in up to 20% of cases possibly due to tension from the round and ovarian ligaments. Herniation of an ovary carries a risk of torsion on the axis of the vascular pedicle, a complication that occurs in up to a third of patients with a herniated ovary. In females a hydrocele of the canal of Nuck presents as a painless, translucent, fluctuating, and non-reducible swelling in the inguinal area and labium majora most often in a girl younger than 5 years of age. The prevalence is even higher in premature infants. The condition more commonly occurs on the right side, but up to 10% of cases are bilateral. Hydrocele of the canal of Nuck is classified into three types. The most common type corresponds to an encysted hydrocele of the cord in which no communication with the peritoneal cavity occurs, forming an encysted fluid collection along the tract of descend from the inguinal ring to the testis or labia majora. The second type corresponds to communicating hydrocele when there is a persistent reducible communication with the peritoneal cavity. The third type is a combination of the previous two as a result of the inguinal ring constricting the hydrocele like a belt so that part is communicating and part is enclosed, giving this type the name of hourglass type. This type of hydrocele is bound to trauma and infection of the residual hematoma created causing symptoms of pain and tenderness on the affected inguinolabial side. If the canal of Nuck as normal evagination of the parietal abdominal wall does not disappear, it causes an indirect inguinal hernia or hydrocele of the canal of Nuck. The canal of Nuck is derived from the abdominal wall and divided into two layers. The outer wall histologically consists of a fibrous form of various thickness, including smooth muscle fibers, and the inner wall consists of single-layered mesothelial cells. When the secretion and absorption of fluid become unbalanced in the secretory membrane on the inner wall, a hydrocele forms due to swelling of the pouch. This hypersecretion can be caused by infection, injury, inappropriate

lymphatic drainage or a combination of these factors. Hydrocele of the canal of Nuck should be considered in differential diagnosis for inguinal swelling in a girl. The differential diagnosis also includes indirect inguinal hernia, femoral hernia, abscess, tender adenopathy, Bartholin's cyst, posttraumatic hematoma and even a cystic lymphangioma. Evaluation using US or MRI is utilized to reach a correct diagnosis. US is the preferred modality of diagnosis. An encysted hydrocele most often contains anechoic fluid usually with an elongated morphology. A hernia of the canal of Nuck may contain peritoneal fluid, omental fat, ovary, fallopian tube, uterus, bowel, or urinary bladder. Management of asymptomatic hydrocele or a canal of Nuck hernia requires surgery consisting of dissection of the hydrocele and high ligation of the hernia or hydrocele sac including closure of the deep inguinal ring. The presence of an ovary within the canal of Nuck warrants early surgical intervention to avoid risk of torsion and ovarian loss. The closure of the hydrocele or hernia can be performed laparoscopically.

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Febrile Neutropenia

Febrile neutropenia (FN) is a common life-threatening complication of management of children with malignancy occurring in approximately one third of episodes of neutropenia. Febrile neutropenia is the occurrence of fever during a neutropenic episode. Neutropenia is defined as an absolute neutrophil count of < 500 cells/mm3 or expected to decrease to < 500 cells/mm3 during the next 48 hours. Fever is defined as a single oral temperature measurement greater than 38.5 degree centigrade sustained over a one-hour period. FN remains as one of the most concerning complication of cancer chemotherapy, being a major cause of morbidity and mortality if not managed promptly. The primary anatomic sites of infection include the gastrointestinal tract since chemotherapy induces mucosal damage allowing invasion of opportunistic organisms. Vascular access also provides a portal of entrance. In children upper respiratory tract infections are the most frequent clinically documented infections. Fever is often the sole sign of occult infection in the neutropenic host. Over time a shift has occurred from FN associated mainly with gram-negative bacteria to FN associated with gram-positive organisms. Also, an increase in antibiotic resistance strains such as beta-lactamase producing gram negative bacteria, vancomycin resistant enterococci and methicillin resistant staph aureus. Fungal infections are rarely detected at the beginning of a febrile neutropenic episode. Risk is stratified in FN into low and high risk.

Factors used for risk stratification include durations of neutropenia (> 10 days), depth of neutropenia (< 100/mm3), type of malignancy, state of disease (remission, progressive disease, recurrence), bone marrow involvement, type of management, and additional associated conditions. Relative risk of infection is related to both the degree and duration of neutropenia, with risk of infection greater in neutrophil counts < 500 cells/mm3 and greatest with < 100 cells/mm3, and children with longer duration of neutropenia (> 7-10 days). Low risk patients have good performance status, few comorbid conditions, adequate hepatic, and renal function, with an expected neutropenic duration of less than seven days. High risk patients have clinical signs of hypotension, pneumonia, new onset abdominal pain, renal or hepatic changes, and neurological changes with an expected duration of neutropenia beyond seven days. Initial evaluation includes history, physical exam, blood cultures, urinalysis, urine culture, stool culture, ESR, CRP, CBC, and biochemistry (CMP). Interleukins (IL)-6, IL-8, IL-10, CRP and procalcitonin (PCT) are predictive markers of bacteremia and severe sepsis. The combination of an elevated PCT and IL-10 has a sensitivity of 100% and specificity of 89% for the prediction of initial bacteremia. Procalcitonin is a useful marker for early diagnosis of sepsis and during treatment response. With respiratory symptoms a chest film is in order. Patients with prolonged FN and high risk are recommended to under thoracic high-resolution CT to reveal evidence of fungal infection. US might be helpful for diagnosis of hepatosplenic fungal infection. Standard of care in FN high risk children include hospitalization and treatment with intravenous wide spectrum empiric antibiotics until fever subsides and neutrophil count > 500 cells/mm3. Empiric monotherapy could include antipseudomonal penicillin (piperacillin-tazobactam and ticarcillin-clavunate acid), antipseudomonal cephalosporins (cefepime, ceftazidime) and carbapenems (meropenem or imipenem). No difference in treatment failure, mortality or adverse reaction is seen when penicillin's are compared to cephalosporin or carbapenems. Carbapenems are associated with more episodes of pseudomembranous colitis. Double therapy should be used depending on culture results or clinical signs. In patients with persistent fevers who become clinically unstable, the initial antibacterial therapy should be escalated to include coverage for resistant gram negative, gram positive and anaerobic bacteria. In low-risk patients intravenous antibiotics may be initiated and continued in the hospital or as outpatient if there can be adequate follow-up. Patients recovering phagocyte counts are good candidate for outpatient management. Oral antibiotics used in pediatrics studies are fluoroquinolone monotherapy, fluoroquinolone and amoxicillin-clavunate, and cefixime. Colony stimulating factors (G-CSF) may be used as primary or secondary prophylaxis in children with cancer and continued during FN. In neutropenic high-risk children, empiric antifungal treatment should be given for persistent or recurrent fever of unclear etiology that is unresponsive to prolonged antibiotic therapy. Amphotericin-B or caspofungin is efficient in children for empiric antifungal therapy. These patients include those with acute myeloid leukemia, high risk acute lymphoblastic leukemia, relapsed acute leukemia, or children undergoing allogeneic hematopoietic stem cell transplantation.

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Umbilical Hernias

Umbilical hernias in children are very common surgical condition affecting approximately 800,000 children in the Unites States each year. They result from the incomplete closure of the umbilical ring and are found in up to 10-30% of newborns. The incidence of umbilical hernia is associated with race, birth weight and certain syndromes. African American infants are 6-10 times more likely than Caucasian infant to have an umbilical hernia. Infants weighting less than 1200 gm. are nearly four times more likely to have an umbilical defect. Children with Beckwith-Wiedemann and Down syndrome also have an increased risk of umbilical defects. Umbilical hernia repair is the most common elective general surgery procedure performed in children between one and 17 years old. Most of these hernias close spontaneously within the first few two years of life. The likehood of a defect closing depends on the size of the defect and the age of the child. Due to the high rate of spontaneous closure associated with a low rate of incarceration and other complications is the main reason why expectant management is recommended in infants and young children. Management of incarcerated or strangulated hernias includes surgical repair at the time of presentation or within one to 2 weeks if the incarcerated umbilical hernia can be manually reduced. Age of two years is the earliest age when surgical repair of asymptomatic umbilical hernia should be considered should the defect cause symptoms of pain, bowel obstruction, or incarceration. Though it is widely accepted that most asymptomatic umbilical hernia should be repaired after age of four, the reality is that greater than 50% of children are three years of age or younger at the time of repair. The main relative indications for early repair of umbilical hernia include a fascial defect greater than 2 cm, enlargement of the defect over time, or the presence of a proboscoid hernia. A proboscoid umbilical hernia have a small defect with a large amount of redundant overlying skin which many times cause significant stress to parents. Parental anxiety over a complication of the cosmetic appearance of the hernia are other reason surgeons repair them early in life. Public insurance, lower income, and female sex are independently associated with repair of asymptomatic umbilical hernias in children earlier than recommended by current guidelines. A fact probably associated with more visits to the ER

by these group of patients. Acute or chronic intermittent incarceration episodes and evident strangulation which per se are extremely rare events are absolute indications for umbilical hernia repair as soon as possible. Surgeons may be incentivized to optimize clinical revenue, or motivated or comply with expectations set by referring providers that early repair should be performed. The diagnosis of an umbilical hernia is with the physical exam. The diameter of the defect and the length of the hernia should be measured and recorded to compare findings with the next follow-up visit. The rate of recurrence and unplanned related hospital revisits after pediatric umbilical hernia repair are low, though patients less than 4 years of age are at a higher risk of both recurrence and unplanned hospital cost when compared with children repaired between 4 and 10 years of age The main reason for these findings is due to children having larger fascial defect and less developed fascia, with lower tensile strength than older children. Repair of an umbilical hernia is typically done through a curved infraumbilical incision as an outpatient procedure. The umbilical stalk is dissected from the skin and inverted toward the abdominal cavity. The fascial defect is closed with interrupted transverse absorbable sutures. The umbilicus is tackled to the fascia and the skin closed. Proboscoid umbilical hernia with excess of skin should undergo umbilicoplasty techniques of which there are several. Repair should be performed before school age to avoid psychological disturbances for the child. Laparoscopic umbilical hernia repair has been described and it entails making two lateral port incisions. Other surgeons use a transumbilical technique repair of the defect.

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