Review Article

Gastrointestinal considerations related to youth sports and the young athlete

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Abstract: Young athletes, though often healthy, can carry a variety of symptoms that may impede their participation in sports or other activities. Typically we might think of musculoskeletal and respiratory problems primarily, however disorders of the gastrointestinal (GI) tract must also be considered. In some instances musculoskeletal complaints may bring to light activity of an underlying GI condition as is the case with inflammatory bowel disease. Gastrointestinal symptoms in the young athlete can be quite significant and a nuisance for participation. We aim to describe and discuss treatment options of a few conditions targeted specifically for your young athlete both that arise specifically from athletic participation and those GI disorders that are chronic in nature whose presence must not be neglected in the athlete.

Keywords: Athlete gastrointestinal issues; exercise induced transient abdominal pain (ETAP); runner's diarrhea; sports-related abdominal trauma; disordered eating

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Inflammatory bowel disease: pertinent issues for the athlete

Introduction

Inflammatory bowel disease (IBD) is a disorder of the digestive tract caused by a dysregulated immune system (1). A combination of genetic predisposition coupled by environmental factors that include infection and alteration of the intestinal flora is thought to be responsible for the onset of IBD. Because of the immune systems role in IBD, medical treatment consists of anti-inflammatory and immunosuppressant therapy.

IBD is divided into two categories which includes Crohn's disease (CD) or Ulcerative colitis (UC).

In CD, the intestinal inflammation can affect any region of the digestive tract. The distribution of inflammation is typically discontinuous with skip lesions of intermittent areas of diseased and healthy bowel mucosa. Inflammation in CD is transmural, affecting the entire thickness of the bowel wall, which can lead to strictures and fistula formation. Perianal disease is a unique feature found only in CD, distinguishing itself from UC (2,3).

UC presents as chronic, diffuse, superficial inflammation that starts in the rectum and extends continuously to potentially involve the entire colon (pancolitis). Small bowel involvement is absent. Patients with UC always present with rectal bleeding. Although growth failure can occur, it is more common in CD.

In addition to abnormalities of the digestive tract, there are a variety of extraintestinal manifestations involving the skin, liver, joints and eyes.

Erythema nodosum (EN) is defined as painful,

erythematous nodules that appear on the shins. These nodules typically resolve with IBD therapy and are more common in CD. Pyoderma gangrenosum (PG), an ulcerative skin disorder, is seen more often in UC. It can be preceded by skin trauma and as a result may involve an ostomy site. It typically affects the lower extremities, but can occur anywhere on the body. As with EN, PG responds to medical therapy for IBD (4).

Primary sclerosing cholangitis (PSC) is a liver disease associated with IBD (5). PSC causes inflammation, scarring and stricturing of the intra and extrahepatic bile ducts. It is typically associated with UC, but does not correlate with the degree or extent of bowel disease. The condition of the liver progressively deteriorates leading to eventual cirrhosis and liver failure requiring a transplant within 10 to 12 years of diagnosis. The incidence of colorectal cancer in patients with UC and PSC is significantly higher compared to UC patients without PSC. Colorectal dysplasia screening should be routinely performed based on current guidelines (6).

Arthropathy associated with IBD can be divided into type 1, which is pauciarticular, involving the peripheral joints, most commonly the knee, and type 2 which is polyarticular, most commonly involving the metacarpophalangeal joints (7). Type 1 arthropathy correlates with IBD activity, whereas type 2 arthropathy is independent of disease activity. Patients with IBD and lower back pain should be evaluated for spondylitis and sacroiliitis. Pain is typically associated with rest or inactivity and alleviated with exercise.

Ocular involvement includes episcleritis and uveitis (8). Episcleritis is painful, conjunctival injection that may be associated with episcleral nodules and typically coincides with bowel disease activity. There are no visual changes associated with this condition. In comparison, uveitis often leads to visual loss. Uveitis is independent of bowel disease activity, though may be associated with arthropathy.

Exercise and sports participation

Patients with IBD should be encouraged to participate in athletics and exercise as part of an overall goal to achieve healthy living. There is evidence to suggest that disease activity can improve with exercise in addition to medical treatment (9).

Many safety concerns for the athlete with IBD should be addressed. Patients experiencing a flare of their disease should not engage in strenuous physical activity until they are in remission.

Bone mineral density loss is a common finding in patients with IBD. The cause is thought to be multifactorial and includes ongoing inflammation, malabsorption (particularly vitamin D and calcium deficiency) and chronic use of corticosteroids (10). Patients with significant osteopenia should be evaluated by Endocrinology, have their Vitamin D levels monitored closely and perform routine bone density scanning. Those with severe bone mineral density loss should be cautious about participation in contact sports.

Arthropathy is a common extraintestinal manifestation of IBD as previously discussed. Sports participation should be limited to activities that are tolerated. In severe cases of arthropathy, a referral to Rheumatology may be necessary to assist with medical management and evaluation of the affected joints.

Immunologic response to vaccinations may be compromised in patients with underlying IBD (11). Patients should be tested for antibodies to Varicella and Hepatitis B to determine if they responded to their previous vaccinations. Patients who are prescribed immunosuppressant therapy should avoid live vaccinations in the future. If the initiation of immunosuppressant therapy for IBD is urgently required prior to vaccinating patients lacking Varicella antibodies, those patients will require Varicella-zoster immune globulin treatment if they are later exposed to individuals with active Varicella infection.

Immunosuppressant therapy is not a contraindication to sports participation. Influenza vaccinations using inactivated influenza vaccines should be administered annually. Basic hand hygiene should always be implemented and annual tuberculosis screening, especially with the use of certain immunosuppressive agents, should be performed.

Conclusions

Patients with IBD should be encouraged to live a healthy lifestyle that includes physical exercise and sports participation. There are many professional athletes that have IBD and serve as role models to children and young adults with IBD. There are support groups available, including the Crohn's and Colitis Foundation of America, which provide opportunities for valuable networking. The more involved and educated patients with IBD become with their medical care, the more empowered they will feel. With proper therapy and close monitoring of their disease by their Gastroenterologist, there is no limit to what these patients can achieve.

Exercise induced transient abdominal pain (ETAP)

Introduction

ETAP, commonly referred to as "stitch", is associated with running, swimming and horseback riding. It is a common condition that up to 70% of runners have experienced. It can affect any region of the abdomen, but tends to involve the lateral aspects with the right side more common than the left. Pain is described as cramping or sharp depending on the severity (12,13).

Shoulder tip pain (STP) is associated with ETAP. The shoulder pain tends to occur on the same side as the pain involved in ETAP. It is theorized that STP is actually referred pain involving the phrenic nerve and its association with the diaphragm.

Female athletes may be more prone to ETAP based on previous studies, although larger studies have found no evidence of gender preference. ETAP appears to be more prevalent in younger athletes as the occurrence of ETAP declines with age (14).

Etiology

There are many theories as to why ETAP occurs. The most accepted explanation involves irritation of the parietal peritoneum, although gastrointestinal ischemia, muscular cramping, ischemia of the diaphragm and stretching of the visceral ligaments of solid organs has been postulated (15,16).

Ischemia of the diaphragm is an unlikely explanation as it does not explain the distribution of pain in the lower abdominal region as well as activities prone to causing ETAP that require minimal respiratory exertion.

Stretching of the visceral ligaments is a well-supported theory. The premise is based on tension of ligaments connected to solid organs, including the stomach, to the diaphragm. Activities that joggle the body can create stress on these ligaments, which elicit pain. In addition, food and liquid consumption may expand the stomach and in turn stretch the ligaments connecting the stomach to the diaphragm. Arguments against this theory including pain that can occur in the lower abdominal quadrants and the fact that low-impact physical activities, such as swimming, have been associated with ETAP.

The theory of gastrointestinal ischemia suggests that ETAP is causes by a primary abnormality of the digestive tract. Compromised splanchnic blood flow has been demonstrated in athletes, but this involves extreme physical exertion, which is not a criterion in developing ETAP. Also, despite the association of food and liquid consumption with ETAP, which may lead to increased vascular demand, athletes can still experience ETAP without the prerequisite of caloric consumption prior to engaging in physical activity.

Muscle cramping involving the muscles of the abdominal wall is an intuitive explanation of the etiology of ETAP. Studies, however, utilizing EMG found no increased muscle contractions when the leads were placed on the specific site of the abdomen where the pain was occurring.

Irritation of the parietal peritoneum is thought to be the most likely cause of ETAP. It would explain the sharp pain associated with ETAP, along with the cessation of pain with rest and discontinuation of physical activity. The diffuse nature of the pain is consistent with peritoneal involvement along with the physical connection between the peritoneum and the phrenic nerve which could explain the association with STP. It is also postulated that increased friction between the visceral and peritoneal surfaces may be increased in the post-prandial state due to distention of the stomach and intestinal tract. Viscosity of the serous fluid between the visceral and peritoneal surfaces may further increase with the consumption of hypertonic fluids which is correlated with ETAP.

Prevention and treatment

ETAP is more likely to occur if the athlete has consumed food or a liquid beverage prior to performing a physical activity. Hypertonic solutions in particular tend to elicit ETAP. Strategies to prevent ETAP include avoiding food and liquid consumption two hours prior to physical activity, especially hypertonic solutions. Interestingly, some studies have suggested that recurrent ingestion of beverages prior to physical activity on a regular basis may in fact reduce the rate of ETAP. This finding is suggestive of a prophylactic form of conditioning.

Strengthening core musculature and improving posture has been shown to reduce the frequency of ETAP. In some cases, using a wide belt to support the abdomen and torso may be beneficial.

To achieve relief from pain during an episode, deep breathing, stretching the effected side and bending forward can be a helpful strategy. Simply stopping the physical activity, albeit impractical at times and frustrating, should offer the athlete immediate relief.

Runner's diarrhea

Introduction

Runner's diarrhea, also referred to as runner's trots, is a frequently experienced symptom of athletes. Athletes may experience symptoms throughout the gastrointestinal tract beyond diarrhea such as belching, nausea, vomiting, heartburn, flatulence, and even fecal incontinence (17). While upper symptoms may be expected during competition or intense exercise, it can be quite disturbing for young athletes to have the sudden onset of diarrhea during performance. There are some reports of up to 96% of endurance runners experiencing gastrointestinal distress symptoms (17), but this prevalence seems to decrease as the intensity of exercise decreases with some reports as low as 30% (18). Because this is often viewed as abnormal, it leads to presentation for physician evaluation. With the following information your athlete's mind should be put to ease with what has caused this to happen and how they can go about avoiding it or at least reducing its effect in the future.

Pathophysiology

Ultimately the pathophysiology of runner's diarrhea is not fully known. One proposed mechanism relates to blood shunting during exercise away from the gut to tissues of need leading to decreased splanchnic blood flow (19,20). The hypoperfusion this shunting causes, compounded with likely dehydration while participating in the activity, leads to direct tissue injury and disruption of the gut barrier subsequently causing the diarrhea. If hematochezia is present, it is likely this is the mechanism (20). Another proposed mechanism is the alteration of both small bowel and large bowel transit during periods of exercise leading to accelerated emptying (20,21). Additionally there is a mechanical model proposed for symptoms where repetitive damage is caused by the jostling of the abdominal contents during exercise leading to symptom production (22). It is important to note that regardless of the etiology, treatment is symptomatic.

Treatment

Treatment of runner's diarrhea greatly focuses on the reduction of competition to allow for the resolution of symptoms. For non-bloody diarrhea, it may be feasible to use an antimotility agent such as loperamide or diphenoxylate with atropine (21), however the utmost caution should be used given the young age of our patient population and risks of these medications. If the diarrhea is bloody a historical review, to include travel, should be undertaken as well as the recommendation to cease all activity as well as nonsteroidal anti-inflammatory drug (NSAID) use until symptoms abate. Additionally you may consider the addition of a H_2 receptor antagonist until symptoms relief achieved (23). If there is a pre-existing gastrointestinal condition it can be exacerbated by exercise and thus a good medical history will assist in treatment recommendations as they may differ based on the underlying process.

Prevention

While there is no guaranteed strategy for the prevention of runner's diarrhea, there are some nutritional recommendations that may help to diminish symptoms. All athletes and exercise participants need hydration and it has been witnessed that those who consume a hydration therapy containing multiple transportable carbohydrates such as glucose and fructose experience less gastrointestinal symptoms than those who consume a beverage with a single transportable carbohydrate, namely glucose (22). This can be an important counseling point for our young athletes when discussing hydration management both in directed visits and with sports participation physicals.

Though lacking a proven evidence base, it has been proposed that avoiding foods containing fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAPs) may be beneficial (24). FODMAPs increase water and fermentable substrates within the colon (25). The osmotic diarrhea effect of FODMAPs is typically seen in individuals with irritable bowel syndrome and people without this condition usually have normal gut function with the ingestion of such compounds. Not every runner needs to avoid a FODMAP containing diet, but this could be a consideration if symptoms persist despite other management. Some have even suggested an elemental diet two to three days prior to competition or running event (20,26).

Conclusions

All young athletes require good counseling regarding signs and symptoms to look for during sports participation. Touching on runner's diarrhea as a potential symptom prior to its presentation may help to allay some self-conscious

feelings, which may arise, should this condition present. If your young athlete should happen to deal with this you may reassure them what they are experiencing is self limited and not harmful.

Sports-related abdominal trauma

Introduction

The majority of abdominal injuries in children are due to blunt abdominal trauma (27). Abdominal injuries in athletes can range in severity from a mild abdominal strain to significant organ rupture and internal bleeding. The most common solid organ injuries are to the spleen, liver, kidneys, and pancreas. In a recent epidemiological study performed on a nationwide sample of US high schools, it was found that overall such are injuries are rare, however, they do occur (28). Football and wrestling accounted for two-thirds of the injuries with boys' contact sports such as wrestling, football, ice hockey, and lacrosse resulting in the highest rates of abdominal injuries (28).

Pathophysiology

Manifestations of organ injury depend on the location and severity of the organ involved. Significant kidney injury with trauma to the flank can result in muscle guarding, back and flank pain, nausea, vomiting, and occasionally hematuria. Intestinal damage is rare but can occur if there is enough force to the abdominal area and there have been case reports of bowel perforation. Blunt trauma to the right upper quadrant can occasionally lead to liver trauma and injury to the left upper quadrant can cause splenic lacerations or ruptures. Those athletes with injury to these organs can have signs and symptoms of tachycardia, hypotension, abdominal pain, nausea, vomiting, and referred shoulder pain (Kehr's sign). Pancreatic injury may not be obvious at first because of the retroperitoneal location of the organ, the lack of reliable signs and symptoms, and depending on the sensitivity of the imaging modality. However, occasional complications of pancreatic injury such as pseudocyst can present several weeks after injury (29).

A blow to the solar plexus can result in a momentary paralysis of the diaphragm and a sensation of having "the wind knocked out of you." (30). This usually occurs with a direct hit near the sternum and xiphoid process or falling onto a hard object such as a ball at that location. This type of injury does not usually require any intervention but assistance in normal breathing and reassurance may be required. Hernias can occur in sports due to a sharp increase in abdominal pressure due to muscle contraction or an applied external pressure resulting in pain and a palpable mass or bulge at the site of herniation.

Conclusions

It is imperative that a proper physical examination be performed and vital signs taken by a medical professional at the site of the injury to determine if an athlete needs to go the emergency department, however, we would advise further transport if there is any doubt.

Splenomegaly and the adolescent athlete

Introduction

Although there are many causes of splenomegaly one of the most commonly encountered is due to infectious mononucleosis (IM) due to either Epstein Barr Virus (EBV) or cytomegalovirus (CMV). Other etiologies to consider are sickle cell disease, malignancy, and trauma, however this list is not exhaustive. Once splenomegaly has been identified the more difficult aspect can be when to allow the young athlete to return to participation.

Examination

The sensitivity and specificity of physician examination for splenomegaly is quite variable. This calls into question the reliability of such examination, especially when the risk of splenic rupture, albeit rare, is on the table (31-34). Because of this the benefits of imaging, such as ultrasound (US) or computed tomography (CT) are seen and allow for the best counseling of your young athlete. Ultrasound is being widely turned to given its lack of radiation exposure and wide availability (31). The question then becomes, "who do I image?" Knowing the pitfalls of physical examination, any athlete you are caring for who has an illness or medical process that causes splenomegaly should be imaged if your index of suspicion is high as even light, noncontact, activities should be avoided initially (32). Imaging is not required for limiting participation, especially in IM as participation should be limited after the diagnosis is made. Once splenomegaly has been identified the next step is how to handle this information.

Returning to play and the potential consequences of splenomegaly

All athletes, regardless of age, want to know when they can return to play even before being told they are limited. Knowing the likely progression of splenomegaly or at least when the greatest risk for complication arises will allow for the best possible counseling of your patients. Splenic rupture is exceedingly rare, occurring between 0.1% and 0.2% of cases accounting for both traumatic and non-traumatic mechanisms (32). When it does occur, splenic rupture typically does so in the first 4 weeks of illness (33,34). With this it is generally deemed safe to return to light activity 3 weeks after the onset of illness which has caused or is known to cause splenomegaly. Contact activities can be considered at least 4 weeks after the onset of symptoms or once the spleen has returned to a normal size as identified via your imaging modality of choice. One caveat here is those patients who have an enlarged spleen at baseline without chronic condition. It is difficult to give a hardened recommendation for return to play timeline in this peculiar incidence, however longitudinal evaluations of spleen size in these athletes is required and once a steady state spleen size is identified, return to full activity would be appropriate.

Conclusions

Splenic imaging is not needed in IM as it carries return to play guidelines at baseline. Imaging of the spleen can assist in your recommendations for the active adolescent and do not be deterred from obtaining such studies. Erring on the side of caution when counseling young athletes may be reasonable, though the incidence of splenic rupture is quite low.

Eating disorders

Introduction

Both female and male athletes are at a higher risk of developing an eating disorder such as anorexia nervosa or bulimia nervosa compared to non-athletes (35). Athletes competing in sports with endurance, aesthetic, and weight class components as well as emphasizing low body mass such as wrestling, gymnastics, dance, figure skating, long and middle distance running, and rowing are at the highest risk (36). In 1992, the term female athlete triad was defined which required an eating disorder, amenorrhea, and osteoporosis to make a diagnosis. However, in 2007, this definition was changed to include low energy availability (with or without disorder eating), menstrual dysfunction, and/or low bone mineral density (37). Male athletes have a lower prevalence of eating disorders than female athletes, but a higher prevalence than male non-athletes (35). There has been data describing male athletes with low energy availability and disordered eating suffering from hormonal changes such as hypogonadotropic hypogonadism and low bone mineral density (36).

Pathophysiology

Disordered eating in athletes can lead to several gastrointestinal issues including epigastric discomfort and abdominal pain, delayed gastric emptying, gastroesophageal reflux, constipation, diarrhea, and even hematemesis. Other organ systems including the cardiorespiratory, endocrine, dermatological, musculoskeletal, neurological, and genitourinary systems can be involved in individuals with eating disorders (35). Additionally, female athletes with disordered eating have a 2-4 times the risk of developing a sport-related injury (38). Manifestations of eating disorders can often be very subtle and therefore careful vigilance must be maintained to diagnose the entity. Additionally, the American Medical Society for Sports Medicine (AMSMM) and the American College of Sports Medicine (ACSM) have collaborated to develop the Preparticipation Physical Examination monograph which is endorsed by the American Academy of Pediatrics to screen for an eating disorder (35). The Female Athlete Triad Coalition has also published an 11-question screening tool (39). Physical examination findings include a low body weight and BMI, bradycardia, orthostatic hypotension, and lanugo (37).

Treatment

Treating an eating disorder takes a multidisciplinary approach with a physician, mental health professional, and a dietitian working in collaboration with each other. For the pediatric population, utilizing family members is also very beneficial. Depending on the severity of their physical and mental health status, occasionally individuals need to be hospitalized or placed in a specialized treatment facility. It is extremely important that parents, coaches, athletic trainers, and health care providers take an active role to help athletes gain knowledge about the important role of nutrition in sports and monitor for any signs or symptoms of an eating disorder.

GI complaints can be quite cumbersome on their own let alone if they arise when you are trying to reach peak performance in whatever your athletic endeavor may be. Understanding that certain complaints arise specifically in relation to your young patient being an athlete is paramount to reaching the appropriate diagnosis and ultimately treatment plan. Considering chronic GI conditions your athlete may have, such as IBD, can be beneficial in the anticipatory guidance you offer. Additionally, certain conditions may require limitation from athletic participation, which can be a contentious subject in young patients, but a necessary teaching for appropriate management. Consideration of GI complaints in youth sports allows for proper education and treatment, hopefully with decreased complications and a better player/patient participation experience.

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Footnote

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