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Reflux can affect children and young people, as well as adults, of all ages. Reflux happens to all of us from time to time, but when it causes painful symptoms that happen regularly, or additional problems, healthcare professionals call it acid reflux, gastro-oesophageal reflux disease, or GORD for short. For more information, see the section on what is meant by 'reflux, regurgitation and heartburn'? Reflux can sometimes affect children and young people who have problems with their muscles and nervous system, such as cerebral palsy. It can also affect children who have asthma. Being overweight can make reflux symptoms worse, so if a child or young person is overweight, losing weight may help. The healthcare team can give more help and advice about this. See the NICE guideline on overweight and obesity management. If a child or young person has reflux, the healthcare professional will ask questions to find out as much as possible about the problem, and will ask specifically about their symptoms. The healthcare professional will also ask about how the child is generally, and if there are any other symptoms or health concerns. They may ask questions about the child's previous medical history and your family history to find out if the child is at particular risk of reflux. If the healthcare professional thinks that there may be something else causing the symptoms, they may find it helpful to do tests, or they may suggest seeing a specialist. For more information, see the section on what tests might be needed? This page was last updated: 14 January 2015 Gastroesophageal reflux disease (GERD) is a chronic digestive disorder that occurs when gastric acid from the stomach abnormally flows back up into the esophagus. Gastroesophageal refers to the stomach and esophagus, and reflux means to flow back or return. Gastroesophageal reflux happens when the lower esophageal sphincter (LES) muscle relaxes abnormally, allowing stomach contents to go back up the esophagus. The LES is a muscle located at the bottom of the esophagus that opens to let food into the stomach and closes to keep food in the stomach. When this muscle relaxes too often or for too long, acid refluxes back into the esophagus, causing vomiting or heartburn. Vomiting occurs when stomach contents go all the way up the esophagus and heartburn occurs when stomach contents only go part of the way up the esophagus. GERD is very common in infants and is the most common cause of vomiting during infancy, as infants are more likely to experience weakness of the LES muscle, allowing it to relax when it should remain shut. Gastroesophageal reflux (GER) is the return of acidic stomach juices, or food and fluids, back up into the esophagus. Everyone has Gastroesophageal reflux (GER) GERD from time to time. Anyone who has ever burped and had an acid taste in their mouth has had reflux. The lower esophageal sphincter occasionally relaxes at inopportune times, and usually, all your child will experience is a bad taste in the mouth, or a mild, momentary feeling of heartburn. GER occurs in more than two-thirds of healthy infants, and half of these infants experience regurgitation or spitting up that spontaneously resolves without medication by approximately 1 year of age. When the reflux causes intolerable discomfort or complications, patients should be evaluated by a doctor for gastroesophageal reflux disease (GERD). Your child may be experiencing gastroesophageal reflux disease (GERD) if they experience: Symptoms that prevent them from feeding, include vomiting, coughing, or difficulty breathing. Signs & symptoms of GER more than 2 times a week over a few months GER for more than 12 to 14 months Gastroesophageal reflux disease (GERD) in kids is usually caused by immaturity of the LES that results in weakness of the muscle. However, certain foods, medications, developmental disorders and underlying diseases can also cause GERD in children. Some foods seem to affect the muscle tone of the lower esophageal sphincter (LES), allowing it to stay open longer than normal. These include, but are not limited to: Chocolate Carbonated drinks High-fat foods. Other foods increase acid production in the stomach, resulting in heartburn when reflux occurs, including: Citrus foods Tomatoes and tomato sauces Spicy foods. Medications and dietary supplements that can irritate your childs esophagus and lead to GERD include: Antibiotics, such as tetracycline and clindamycin Bisphosphonates taken orally, such as alendronate (Fosamax), ibandronate (Boniva) and risedronate (Actonel, Atelvia) Iron supplements Potassium supplements Quinidine Pain relievers, such as Ibuprofen, Advil, Motrin and Aspirin If your child has GERD, ask their doctor if medications they take may affect their symptoms. Risk factors for GERD The following conditions may increase the likelihood of your child developing GERD: Birth defects Premature birth Down syndrome Cerebral palsy Head injury Food allergies Obesity Exposure to tobacco smoke Narrow or short esophagus Eosinophilic esophagitis GERD symptoms Heartburn, also called acid indigestion, is the most common symptom of GERD. Heartburn is described as a burning chest pain that begins behind the breastbone and moves upward to the neck and throat. It can last as long as two hours and is often worse after eating. Lying down or bending over after a meal can also contribute to heartburn. Many children who are diagnosed with GERD will experience a dry cough, wheezing or trouble swallowing, instead of classic heartburn. Although each child may experience symptoms differently, signs of GERD in infants can include: Fussiness around mealtimes Hiccups Refusal to eat Frequent vomiting Gagging. Symptoms in children may include: Belching Stomachache Choking Frequent cough Coughing fits at night Wheezing Frequent upper respiratory infections (colds) Frequent ear infections Rattling in the chest Frequent sore throat in the morning Sour taste in the mouth. The symptoms of GERD often resemble those of other gastrointestinal conditions, includingeosinophilic esophagitis. At CHOC, we thoroughly assess each patient to ensure proper diagnosis. Why is GERD a concern in kids? GERD is a concern in kids because when stomach contents come up into the esophagus during reflux, infants and children can experience difficulty breathing, episodes of pneumonia and chronic coughing or wheezing. Although rare, infants and children can stop breathing for brief moments due to episodes of gastroesophageal reflux. Gastroesophageal reflux is usually diagnosed through physical examination and a review of your childs medical history. Along with a physical examination and medical history review, our gastroenterology specialists at CHOC will evaluate: Medications the child is taking that may irritate the lining of the stomach or esophagus. Evidence of poor weight gain due to reflux. The types of foods the child is eating. Information about the childs feeding and mealtime patterns. In some cases, other diagnostic tests will be used to help determine whether the child has GERD or another gastrointestinal condition: Endoscopy.A test that uses a small, flexible tube with a light and a camera lens at the end (endoscope) to examine the inside of part of the digestive tract. Tissue samples from inside the digestive tract may also be taken for examination and testing.Learn more about endoscopy procedures at CHOC. pH monitoring.Used to measure the acidity inside of the esophagus, this test is helpful in evaluating the extent of GERD. A thin plastic tube is placed into a nostril, guided down the throat, and then into the esophagus. The tube stops just above the lower esophageal sphincter, which is at the connection between the esophagus and the stomach. The end of the tube inside the esophagus contains a sensor that measures pH, or acidity. The other end of the tube outside the body is connected to a monitor that records the pH levels for a 24- to 48-hour period. Normal activity is encouraged during the study, and a diary is kept of symptoms experienced, or activity that might be suspicious for reflux, such as gagging or coughing. It is also recommended to keep a record of the time, type, and amount of food eaten. The pH readings are evaluated and compared with the patients activity for that time period to help determine possible GERD triggers. Bravo pH studies.In older children, the pH study can be done without an external wire. At the end of the upper endoscopy, the physician attaches a small capsule (approximately the same size as a pencil eraser) to the wall of the esophagus. The capsule sends information to a device outside the childs body that records reflux events. This data collection device is about the size of a cell phone and can be attached to the childs belt or waistband. The device needs to be within 3 feet of the patient during the 48 hours of recording time. Some patients say that they can feel the capsule while it is in place, causing mild, temporary discomfort. After the second day of collecting information about the childs reflux, the Bravo capsule falls off the lining of the esophagus, travels through the gastrointestinal tract and is eventually passed in the patients stool. It does not have to be retrieved. In most cases GERD can be relieved through diet and lifestyle changes. Your childs doctor might recommend the following diet and lifestyle adjustments to help alleviate their symptoms: For infants Infants with GERD should be held upright for 30 minutes after feedings. If bottle-feeding, keep the nipple filled with milk so the baby does not swallow too much air while eating. Try different nipples to find one that allows the babys mouth to make a good seal with the nipple during feeding. Adding rice cereal to feeding may be beneficial for some infants. We typically recommend adding 1 teaspoon of rice cereal per ounce of formula. Burp the baby several times during bottle- or breast-feeding. The baby may reflux more often when burping with a full stomach. For children Watch their childs food intake and limit fried and fatty foods, peppermint, chocolate, drinks with caffeine (such as colas, Mountain Dew and tea), citrus fruit and juices and tomato products. Offer their child smaller portions at mealtimes, and include small snacks in-between meals if the child is hungry. Caregivers should avoid letting the child overeat. Allow him or her to let you know when he or she is hungry or full. Do not allow the child to lie down or go to bed right after a meal. The evening meal should be served at least two hours before bedtime. When symptoms of GERD arent improved with diet and lifestyle changes, or in more severe cases, treatment can also include: Medications.If needed, our specialists may prescribe medications to help with reflux. There are medications which help decrease the amount of acid the stomach makes, which cuts down on the heartburn associated with reflux. One group of this type of medication is called H2-blockers. Medications in this category include famotidine (Pepcid) and ranitidine (Zantac). Another group of medications is called proton-pump inhibitors. Medications in this category include omeprazole (Prilosec) and lansoprazole (Prevacid). These medications are taken daily to prevent excess acid secretion in the stomach. Another type of medicine we may prescribe is one that helps the stomach empty faster. If food does not remain in the stomach as long as usual, there may be less chance of reflux occurring. A medicine in this category that can be prescribed is metoclopramide (Reglan) or a very low dose of the antibiotic erythromycin. This medicine is usually taken three to four times a day, before meals or feedings, and at bedtime. Tube feedings.Some babies with reflux have other conditions, such as congenital heart disease or prematurity. In addition to having reflux, these babies may not be able to eat or drink very much without becoming sleepy. Other babies are not able to tolerate a normal amount of formula in the stomach without vomiting and do better if a small amount of milk was given continuously. In both of these cases, tube feedings may be recommended. Formula or breast milk is given through a tube that is placed in the nose, guided through the esophagus, and into the stomach (nasogastric tube). Nasogastric tube feedings can be given in addition to or instead of what a baby takes from a bottle. Surgery.In severe cases of reflux, a surgical procedure called fundoplication may be performed. This operation may be recommend if the child is not gaining weight due to vomiting, has frequent, severe respiratory illnesses such as pneumonia or has severe irritation in the esophagus.Learn more about surgery at CHOC. Many infants who suffer from gastroesophageal reflux disease will outgrow it by the time they are about a year old, as the lower esophageal sphincter becomes stronger. For others, medications, lifestyle, and diet changes can minimize the reflux, vomiting and heartburn cau URL of this page: Also called: GER in Children, GERD in Children The esophagus is the tube that carries food from your mouth to your stomach. If your child has reflux, his or her stomach contents come back up into the esophagus. Another name for reflux is gastroesophageal reflux (GER). GERD stands for gastroesophageal reflux disease. It is a more serious and long-lasting type of reflux. If your child has reflux more than twice a week for a few weeks, it could be GERD. What causes reflux and GERD in children? There is a muscle (the lower esophageal sphincter) that acts as a valve between the esophagus and stomach. When your child swallows, this muscle relaxes to let food pass from the esophagus to the stomach. This muscle normally stays closed, so the stomach contents don't flow back into the esophagus. In children who have reflux and GERD, this muscle becomes weak or relaxes when it shouldn't, and the stomach contents flow back into the esophagus. This can happen because of: How common are reflux and GERD in children? Many children have occasional reflux. GERD is not as common; up to 25% of children have symptoms of GERD. What are the symptoms of reflux and GERD in children? Your child might not even notice reflux. But some children taste food or stomach acid at the back of the mouth. In children, GERD can cause: How do doctors diagnose reflux and GERD in children? In most cases, a doctor diagnoses reflux by reviewing your child's symptoms and medical history. If the symptoms do not get better with lifestyle changes and anti-reflux medicines, your child may need testing to check for GERD or other problems. Several tests can help a doctor diagnose GERD. Sometimes doctors order more than one test to get a diagnosis. Commonly-used tests include:Upper GI series, which looks at the shape of your child's upper GI (gastrointestinal) tract. You child will drink a contrast liquid called barium. For young children, the barium is mixed in with a bottle or other food. The health care professional will take several x-rays of your child to track the barium as it goes through the esophagus and stomach.Esophageal pH and impedance monitoring, which measures the amount of acid or liquid in your child's esophagus. A doctor or nurse places a thin flexible tube through your child's nose into the stomach. The end of the tube in the esophagus measures when and how much acid comes back up into the esophagus. The other end of the tube attaches to a monitor that records the measurements. Your child will wear the tube for 24 hours. He or she may need to stay in the hospital during the test.Upper gastrointestinal (GI) endoscopy and biopsy, which uses an endoscope, a long, flexible tube with a light and camera at the end of it. The doctor runs the endoscope down your child's esophagus, stomach, and first part of the small intestine. While looking at the pictures from the endoscope, the doctor may also take tissue samples (biopsy). What lifestyle changes can help treat my child's reflux or GERD? Sometimes reflux and GERD in children can be treated with lifestyle changes:Losing weight, if neededEating smaller mealsAvoiding high-fat foodsWearing loose-fitting clothing around the abdomenStaying upright for 3 hours after meals and not reclining and slouching when sittingSleeping at a slight angle. Raise the head of your child's bed 6 to 8 inches by safely putting blocks under the bedposts. What treatments might the doctor give for my child's GERD? If changes at home do not help enough, the doctor may recommend medicines to treat GERD. The medicines work by lowering the amount of acid in your child's stomach. Some medicines for GERD in children are over-the-counter, and some are prescription medicines. They include:Over-the-counter antacidsH2 blockers, which decrease acid productionProton pump inhibitors (PPIs), which lower the amount of acid the stomach makesProkinetics, which help the stomach empty faster If these don't help and your child still has severe symptoms, then surgery might be an option. A pediatric gastroenterologist, a doctor who treats children who have digestive diseases, would do the surgery. NIH: National Institute of Diabetes and Digestive and Kidney Diseases The information on this site should not be used as a substitute for professional medical care or advice. Contact a health care provider if you have questions about your health. Learn how to cite this page Reference ID: 0.9cfd733e.1748481746.eb0cb60 Radiographs used to examine abnormalities of the digestive system excluding the colonFor the barium meal test in espionage, see Canary trap.Medical diagnostic methodUpper gastrointestinal seriesNormal barium swallow fluoroscopic image, showing the ingested barium sulfate being induced down the oesophagus by peristalsis.SynonymsUpper gastrointestinal study, contrast radiography of the upper gastrointestinal tract, barium swallow, barium mealICD-10-PCSGroupMajor.minor [dead link]An upper gastrointestinal series, also called a barium swallow, barium study, or barium meal, is a series of radiographs used to examine the gastrointestinal tract for abnormalities. A contrast medium, usually a radiocontrast agent such as barium sulfate mixed with water, is ingested or instilled into the gastrointestinal tract, and X-rays are used to create radiographs of the regions of interest. The barium enhances the visibility of the relevant parts of the gastrointestinal tract by coating the inside wall of the tract and appearing white on the film. This in combination with other plain radiographs allows for the imaging of parts of the upper gastrointestinal tract such as the pharynx, larynx, esophagus, stomach, and small intestine such that the inside wall lining, size, shape, contour, and patency are visible to the examiner. With fluoroscopy, it is also possible to visualize the functional movement of examined organs such as swallowing, peristalsis, or sphincter closure. Depending on the organs to be examined, barium radiographs can be classified into "barium swallow", "barium meal", "barium follow-through", and "enteroclysis" ("small bowel enema"). To further enhance the quality of images, air or gas is sometimes introduced into the gastrointestinal tract in addition to barium, and this procedure is called double-contrast imaging. In this case the gas is referred to as the negative contrast medium. Traditionally the images produced with barium contrast are made with plain-film radiography, but computed tomography is also used in combination with barium contrast, in which case the procedure is called "CT enterography".[1]Barium meal examination showing the stomach and duodenum in double contrast technique with CO2 as negative contrast mediumBarium follow-through showing the small bowelEnteroclysis in double contrast technique showing stenosis of the small intestineVarious types of barium X-ray examinations are used to examine different parts of the gastrointestinal tract. These include barium swallow, barium meal, barium follow-through, and barium enema.[2] The barium swallow, barium meal, and barium follow-through are together also called an upper gastrointestinal series (or study), whereas the barium enema is called a lower gastrointestinal series (or study).[3] In upper gastrointestinal series examinations, the barium sulfate is mixed with water and swallowed orally, whereas in the lower gastrointestinal series (barium enema), the barium contrast agent is administered as an enema through a small tube inserted into the rectum.[2]Barium swallow X-ray examinations are used to study the pharynx[4] and esophagus.[2]Barium meal examinations are used to study the lower esophagus, stomach and duodenum.[2]Barium follow-through examinations are used to study the small intestine.[2]Enteroclysis, also called small bowel enema, is a barium X-ray examination used to display individual loops of the small intestine by intubating the jejunum and administering barium sulfate followed by methylcellulose or air.[5]Barium enema examinations are used to study the large intestine and rectum and are classified as lower gastrointestinal series.[2]Barium X-ray examinations are useful tools for the study of appearance and function of the parts of the gastrointestinal tract. They are used to diagnose and monitor esophageal reflux, dysphagia, hiatus hernia, strictures, diverticula, pyloric stenosis, gastritis, enteritis, volvulus, varices, ulcers, tumors, and gastrointestinal dysmotility, as well as to detect foreign bodies.[3][6] Although barium X-ray examinations are increasingly being replaced by more modern techniques, such as computer tomography, magnetic resonance imaging, ultrasound imaging, endoscopy and capsule endoscopy,[7] barium contrast imaging remains in common use because it offers the advantages of greater affordability, wider availability,[1][5] and better resolution in assessing superficial mucosal lesions.[7][8]Barium sulfate is swallowed and is a radio opaque substance that does not allow the passage of X-rays. As a result, areas coated by barium sulfate will appear white on an X-ray film. The passage of barium sulfate through the gastrointestinal tract is observed by a radiologist using a fluoroscope attached to a TV monitor. The radiologist takes a series of individual X-ray images at timed intervals depending on the areas to be studied. Sometimes medication which produces gas in the gastrointestinal tract is administered together with the Barium sulfate. This gas distends the gastrointestinal lumen, providing better imaging conditions and in this case the procedure is called double-contrast imaging.[9]Clinical status and relevant medical history are reviewed prior to the studies.[10] Patient consent is required.[3]A barium swallow study is also known as a barium esophagram and needs little if any preparations for the study of the larynx, pharynx, and esophagus when studied alone.[11][12]Amongst the uses of barium swallow are: persistent dysphagia and odynophagia despite negative esophagogastroduodenoscopy (OGDS) findings, failed OGDS, esophageal motility disorder, globus pharyngeus, assessment of tracheoesophageal fistula, and timed barium swallow to monitor the progress of esophageal achalasia therapy.[13] Barium sulfate suspension such as 100 ml or more of E-Z HD 200 to 250% concentration and Baritop 100% can be used. Water-soluble contrast agent such as Gastrografin (diatrizoate) and Conray (Iotalamic acid) is used instead of barium if oesophageal perforation is suspected. Low osmolar contrast medium with concentration of 300mg/ml is used instead of gastrografin if there is risk of aspiration or there is tracheoesophageal fistula.[13]A thick barium mixture is swallowed in supine position and fluoroscopic images of the swallowing process are made. Then several swallows of a thin barium mixture are taken and the passage is recorded by fluoroscopy and standard radiographs. The procedure is repeated several times with the examination table tilted at various angles. A total of 350450mL of barium is swallowed during the process.[14][15] Normally, 90% of ingested fluid should have passed into the stomach after 15 seconds.[16]Right anterior oblique (RAO) view is to see the oesophagus clearly, away from overlapping spine.[13] AP (anterior-posterior) view is also done to visualise the gastroesophageal junction.[13] AP and lateral views are also done to visualise the hypopharynx during swallowing at a frame rate of 34 per second. Left posterior oblique (LPO) position is used to identify hernias, mucosal rings, and varices.[13]Intravenous injection of Buscopan (Hyoscine butylbromide) 20mg or glucagon 0.3mg is used to distend the stomach and slow down the emptying of the contrast into the duodenum.[13]Right anterior oblique (RAO) view is used to demonstrate antrum and greater curve of stomach. Supine position is to demonstrate antrum and body of stomach. Left anterior oblique (LAO) view is used to see the lesser curve of stomach en face. This position is also used to check for gastroesophageal reflux when patient is asked to cough or swallow (water siphon test). Left lateral tilted with head up 45 degrees is used to demonstrate the fundus of the stomach.[13] To demonstrate the duodenal loop, the subject can lie down in prone position on a compression pad to prevent excessive barium flowing into the duodenal loop. Anterior view of duodenal loop can be seen at RAO position.[13] Duodenal cap can be visualised by taking images when subject lie down in prone position, RAO, supine, and then LAO positions or it can be seen on erect position with RAO and steep LAO views.[13] Total mucosal coating of the stomach is done by asking the subject to roll to the right side into a complete circle until RAO position. Arae gastriae in the antrum (fine reticular network of grooves) is visible if good coating is achieved.[13]Indications to do this procedure are: unexplained chronic abdominal pain with weight loss, unexplained diarrhea, anemia which is caused by gastrointestinal bleeding or dependent on blood transfusion where the cause cannot be explained despite OGDS or colonoscopy investigations, partial obstruction of bowel/small bowel adhesive obstruction suspected, and unexplained malabsorption of nutrients.[13] For barium follow-through examinations, a 6-hour period of fasting is observed prior to the study.[10]Barium is administered orally, sometimes mixed with diatrizoic acid (gastrografin) to reduce transit time in the bowel. Intravenous metoclopramide is sometimes also added to the mixture to enhance gastric emptying.[17] 600 ml of 0.5% methylcellulose can be given orally, after barium meal is given, to improve the images of small bowel follow-through by reducing the time taken for barium to pass through the small intestines, and increase the transparency of the contrast-filled small bowels.[18] Other methods to reduce transit time are to add ice cold normal saline after the administration of barium saline mixture[19] or to give a dry meal.[20]X-ray images are then taken in a supine position at intervals of 2030 minutes. Real-time fluoroscopy is used to assess bowel motility. The radiologist may press or palpate the abdomen during images to separate intestinal loops. The total time necessary for the test depends on the speed of bowel motility or transit time and may vary between 1 and 3 hours.[17]Enteroclysis is also known as small bowel enema.[21] It has been largely replaced by magnetic resonance enterography/enteroclysis[13] and computed tomography enterography/enteroclysis.[22]In addition to fasting for 8 hours prior to examination, a laxative may also be necessary for bowel preparation and cleansing.[12] The main aim of this study is to distend the proximal bowel through infusion of large amount of barium suspension. Otherwise, the distension of distal small bowel is generally similar with small bowel follow-through. Therefore, there is a need to pass a tube through the nose into the jejunum (nasojejunal tube) to administer large amount of contrast. This can be unpleasant to the subject, requires more staff, longer procedural time, and higher radiation dose when compared to small bowel follow-through. The indications for enteroclysis are generally similar to small bowel follow-through. Barium suspensions such as diluted E-Z Paque 70% and Baritop 100% can be used. After that, 600 ml of 0.5% methylcellulose is administered after 500 ml of 70% barium suspension is given. Bilbao-Dotter tube and Silk tube can be used to administer barium suspension. The subject should be fasted overnight, any antispasmodic drugs should be stopped one day before the examination, and Tetracaine lozenges can be used 30 minutes before the procedure to numb the throat for nasojejunal tube insertion.[13]The filling of the small intestines can be viewed continuously using fluoroscopy, or viewed as standard radiographs taken at frequent intervals. The technique is a double-contrast procedure that allows detailed imaging of the entire small intestine. However, the procedure may take 6 hours or longer to complete and is quite uncomfortable to undergo.[23]Zenker's diverticulum as seen in a barium swallow examinationEnteroclysis has shown to be very accurate in diagnosing small bowel diseases, with a sensitivity of 93.1% and specificity of 96.9%. It permits detection of lesion which may not be seen with other imaging techniques.[7] There is no significant difference in terms of detection of clinically significant findings, sensitivity or specificity between enteroclysis and CT enterography.[1] Enteroclysis compares favorably with wireless capsule endoscopy and double-balloon endoscopy in the diagnosis of mucosal abnormalities of the small bowel.[24]The interpretation of standard barium swallow examinations for assessing dysphagia is operator and interpreter dependent. It has poor sensitivity for subtle abnormalities but is more sensitive in detecting esophageal webs and rings than gastroscopy.[4] The best initial evaluation of suspected oropharyngeal dysphagia is a barium study.[25] Barium swallow studies remain the main investigation of dysphagia.[26] Barium studies may detect pharyngeal tumors that are difficult to visualize endoscopically.[27]Barium follow-through examinations are the most commonly used imaging technique in assessing patients with Crohn's disease, although CT and magnetic resonance imaging are widely accepted as being superior.[1] However Barium examinations remain superior in the depiction of mucosal abnormalities.[24] The features of Crohn's disease are well described by barium follow-through examinations, appearing as a typical "cobblestone pattern", but no information is obtained regarding extraluminal disease.[28] Radiographic imaging in Crohn's disease provides clinicians with objective evaluations of small bowel regions that are not accessible to standard endoscopic techniques.[29] Because of its length and complex loops, the small intestine is the most difficult part of the gastrointestinal tract to evaluate. Most endoscopic techniques are limited to the examination of proximal or distal segments, hence Barium follow-through remains in most centres the test of choice for the investigation of abdominal pain, diarrhoea and in particular diseases manifesting mucosal abnormalities such as coeliac and Crohn's disease.[26]Barium swallow studies are better than endoscopy at demonstrating the anatomic findings in gastroesophageal reflux disease after anti-reflux surgery.[30]Barium fluoroscopic examinations have some advantages over computed tomography and magnetic resonance techniques, such as higher spatial resolution and the ability to examine bowel peristalsis and distension in real time.[31]Many infections and parasitic infestations produce patterns of the luminal surface, which are best seen on Barium examinations. Certain parasites are seen as filling defects outlined by Barium and Barium examinations play an important role in the diagnosis of intestinal infections and infestations as compared to other techniques.[32] Barium studies show tapeworms and roundworms as thin, linear filling defects of the bowel.[33] Because roundworms have a developed alimentary tract, barium may outline the parasites' intestinal tracts on delayed images. In Strongyloidiasis barium studies show intestinal wall oedema, thickening of intestinal folds with flattening, and atrophy of the overlying mucosa.[33] Schistosomiasis caused by infection with flatworms have an appearance resembling colitis ulcerosa, with inflammatory polyps, ulcers, fibrosis, wall thickening, loss of haustration, and stenosis in Barium X-rays.[33] Anisakiasis is demonstrated by Barium X-rays as bowel wall oedema, thickening, ulceration, or stricture due to inflammation. Sometimes worms are seen as long, thread-like, linear filling defects up to 30cm long.[33] In Typhlitis Barium studies show oedema, ulceration, and inflammation of bowel wall resulting in wall thickening.[33] In pseudomembranous colitis, barium studies show pancolitis with thumb printing and shaggy margins as well as plaque-like eccentric, nodular or polypoid appearance.[33]Barium studies and computer tomography are the most common tools used to diagnose gastrointestinal lymphoma. Barium contrast is more sensitive in the demonstration of subtle mucosa and sub-mucosa abnormalities but computer tomography is the method of choice for determining the extent of disease and staging as well as related complications such as fistulation and perforation. Submucosal nodules or masses form a bull's-eye or target appearance on barium studies.[34]Barium in the lungs resulting from aspiration during a barium swallowRadiographic examinations involve radiation exposure in the form of X-rays.[28]Although barium ions are toxic, their use is generally regarded as safe because the small amounts of barium ions available in solution and absorbed by the gastrointestinal tract are deemed to be negligible; however, isolated cases of barium encephalopathy have been described following absorption of barium from the intestinal tract.[35]Constipation and abdominal pain may occur after barium meals.[35]The formation of baroliths, which may need to be removed surgically, is a complication of the use of barium sulfate.[35]Barium sulfate may cause serious peritoneal irritation.Leakage of barium sulfate into the abdominal cavity may occur in people with duodenal ulcers or other perforations and may lead to peritonitis, adhesion, and granulomas; it is associated with a high mortality rate.[12] Leakage of barium into the mediastinum or peritoneal cavity may lead to endotoxic shock, which is often fatal; as a result, the use of barium as a contrast agent is contraindicated when there is a suspicion or possibility of compromise of bowel wall integrity.[35]Aspiration or inhalation of barium sulfate into the lungs during oral application can lead to serious respiratory complications leading to fatal aspiration pneumonia or asphyxiation.[35]Hypersensitivity and allergic reactions are rare but some additives contained in barium preparations may induce immune reactions.[35]Complete gastrointestinal obstruction is a contraindication for barium studies.[17]Barium sulfate as a contrast medium was evolved from the prior use of bismuth preparations which were too toxic. The use of bismuth preparations had been described as early as 1898. Barium sulfate as a contrast medium in medical practice was introduced largely as a result of the works of Krause a director of the Bonn Polyclinic, now the medical faculty of the University of Bonn and his colleagues Bachem and Gunther. In a paper read in 1910 at the radiological congress they advocated for the use of barium sulfate as an opaque contrast medium in medicine.[36]^ a b c d Murphy, KP; McLaughlin, PD; O'Connor, OJ; Maher, MM (Mar 2014). "Imaging the small bowel". Current Opinion in Gastroenterology. 30 (2): 13440. doi:10.1097/mog.0000000000000038. PMID24419291. S2CID41111179.^ a b c d e f British Medical Association (2013). BMA Illustrated Medical Dictionary. Dorling Kindersley Ltd. ISBN978-1-4093-4966-2.^ a b c Daniels, Rick (2010). Delmar's guide to laboratory and diagnostic tests (2nded.). Clifton Park, NY: Delmar/Cengage Learning. 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