Diagnosis and Treatment of Crohn’s Disease Using Radiographic Imaging

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Abstract
Crohn’s disease is an inflammatory bowel disease that can affect any part of the gastrointestinal tract ranging from the mouth to the anus, causing a variety of symptoms. Radiographic imaging is used to diagnose Crohn’s disease. Many of the older, conventional techniques can still be effective. However, with the development of Computed Tomography, Magnetic Resonance Imaging, Ultrasound, and Endoscopy, diagnosis of Crohn’s disease is much easier. It is still unclear which modality offers more advantages and is best for diagnosing this disease. Video Capsule Endoscopy (VCE) is appealing since it offers the ability to visualize Crohn’s disease lesions without the patient receiving a radiation dose or experiencing pain. Therefore, VCE could be the future for diagnosis of Crohn’s disease.
Diagnosis and Treatment of Crohn’s Disease Using Radiographic Imaging

Radiographic imaging plays an important role in the diagnosis of many disease processes. One of which is Crohn’s disease. “Crohn’s disease (CD) is a chronic transmural inflammatory disease of the gastrointestinal tract, usually occurring in younger patients, and characterized by remitting and relapsing episodes” (Martinez, Ripolles, Paredes, Blanc, & Marti-Bonmati, 2008, p.141). Crohn’s can be found in both men and women and is hereditary. About 20% of people diagnosed with this disease have a blood relative with some form of inflammatory bowel disease. Crohn’s is generally diagnosed between the ages 20 to 30, but people of all ages may suffer from the disease. Also, people of Jewish heritage have a greater risk of developing the disease while people of African American heritage have less risk. The incidence of Crohn’s is approximately 5-10 per 100,000 per year with a prevalence of 50-100 per 100,000 (Just Crohn’s, 2006).

Symptoms and Causes

There are various symptoms people get that may be indicative of Crohn’s disease. The most common symptoms are abdominal pain and diarrhea. However, other symptoms such as rectal bleeding, weight loss, arthritis, skin problems, inflammation in the eyes, and fever are also possible. Although the cause for Crohn’s disease is uncertain, there are various theories that explain factors that may contribute to this disease. These factors may include heredity, environment, and the immune system. The main theory for cause of Crohn’s is that the body’s immune system reacts to good bacteria and food as it would to a foreign body and tries to fight it off. As a result, white blood cells gather in the lining of the intestines and cause chronic inflammation (Just Crohn’s, 2006).
Diagnosing Crohn’s disease

Traditional radiological techniques for diagnosing Crohn’s disease include enteroclysis and small bowel follow-through imaging. In recent years, more methods have been proposed for diagnosis such as the use of Computed Tomography, Magnetic Resonance Imaging, Ultrasound, and Endoscopy.

Conventional Radiology

Conventional radiology techniques (small bowel enteroclysis and small bowel follow-through) show typical small bowel changes. (See Fig.1 and Fig.2)

Irregular thickening and distortion of the valvulae conniventes, loops adhesions (mass-like effect) or separated loops due to wall thickening, and mesenteric inflammatory infiltration can be observed by the above imaging techniques (Saibeni et al., 2007).

Fluoroscopic techniques effectively show subtle and early mucosal disease. Also they are readily available, affordable, well tolerated by the patient, easy to perform, consistent, reproducible, and easily understood by referring clinicians (Kirwadi & Hampton, 2007).
However, there are a couple disadvantages to conventional methods. As Gourtsoyiannis et al. (2006) found in their study of Crohn’s disease, one disadvantage is that there is limited information regarding the extramural-mesenteric extension of the disease. Another is the radiation exposure implied on the patients and even more concern for those at a young age. With that being said, “Conventional enteroclysis is still considered the gold standard of the radiological evaluation of patients with suspected or known Crohn’s disease as it carries a high negative predictive value and allows identification of even subtle mucosal abnormalities” (Gourtsoyiannis et al., 2006, p.1915).

**Computed Tomography (CT)**

The use of CT in evaluation for Crohn’s disease has gained popularity, particularly in the United States. “The ability of Computed Tomography (CT) to image the bowel wall and surrounding fat directly has become a major diagnostic tool in the detection of Crohn’s disease” (Gossios & Tsianos, 1997, p.160). Gossios and Tsianos (1997) explain how diagnosis of Crohn’s disease can often be based on the symmetrical thickening of the bowel wall, segmental distal ileal distribution, and abscesses seen with CT. It has proved to be extremely useful in detecting the extraluminal component of the disease and has a significant effect on clinical management. Findings with the use of CT may include bowel wall thickening, luminal narrowing, fistulas, sinus tracts, abscesses, inflammatory streaking of fat and fibrofatty proliferation of the mesentery and regional and retroperitoneal lymphadenopathy are present.

![CT scan](image)

*Fig.3* CT demonstrates the circumferential markedly thickened ascending colon wall. Fibrofatty proliferation of the mesentery and regional and retroperitoneal lymphadenopathy are present.

planes, and mesenteric changes such as thickening and interloop abscesses. (See Fig.3) The most common abnormality detected by CT is thickening of the bowel wall. There are, however, disadvantages of using CT. Early mucosal disease may be missed, it has a high radiation burden and need for intravenous contrast, and large volumes of oral contrast or nasojejunal intubation to ensure good bowel distension (Kirwadi & Hampton, 2010). “Non-enhanced CT scan is also used in the diagnosis of post-surgical complications (intra-peritoneal abscesses, anastomotic deiscence, extra-abdominal abscesses and fistulas, incisional hernias, ascites, volvulus, bowel adhesions, etc.)”(Saibeni et al., 2007, p.3281). Recently, development of multislice helical CT scanners has improved visualization of the small bowel and abdomen in general, with higher spatial and temporal resolution acquiring isotropic voxel slices in a single breath-hold scan (Saibeni et al., 2007).

**Magnetic Resonance Imaging (MRI)**

One of the most appealing aspects of using Magnetic Resonance Imaging (MRI) for studies involving Crohn’s disease is the lack of radiation exposure to patients. This becomes important in young patients especially those who may need follow-up examinations. “The characteristic discrete, longitudinal or transverse ulcers of Crohn’s disease can be demonstrated on MR enteroclysis (MRE), following optimal distension and homogenous opacification of the bowel lumen” (Gourtsoyiannis et al., 2006, p.1922). A study was done by Saibeni et al. (2007) demonstrating the following:

Magnetic resonance (MR) imaging is a non-invasive, non-ionizing radiation diagnostic technique able to obtain multiplanar diagnostic information about intra- and extra-mural involvement of the small bowel by Crohn’s disease and its complications.
MR evaluation of the small bowel had no clinical application and was still considered an experimental technique until the late Nineties mainly because of poor quality in depicting the gastrointestinal tract. Later, MR technical improvement (multichannel and phased-array coils, faster gradients; fast and ultrafast gradient echo and steady state sequences) allowed a deeper insight into luminal and extra-luminal structures with higher spatial resolution during breath-holding (p.3282).

As also explained by Saibeni et al. (2007), the use of intravenous paramagnetic contrast agent is a powerful tool to detect the precise localization of the disease, or to evaluate the persistence of inflammation despite active therapy. MRI is also an excellent tool to demonstrate thickening of the bowel wall. (See Fig.4)

**Ultrasound**

The first attempts to study Crohn’s disease by means of Ultrasound (US) date back to the late Seventies. For Crohn’s disease, main Ultrasound findings include thickening and stiffness of the gut wall, modifications or lack of its echostratification, reduction of peristalsis, mesenteric fibro-fatty proliferation, and lymph node enlargement. The use of US has also been proposed in the follow-up of patients with Crohn’s disease, not only when an abdominal complication (strictures, abscesses, or fistulas) is suspected, but also

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**Fig.4** Coronal (a) true FISP and (b) post-gadolinium 3D FLASH images in a patient with Crohn’s disease. In (a) and (b), wall thickening is demonstrated on a distal ileal loop. Conventional enteroclysis is in full agreement with MRE regarding the location and length of the involved segment.

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in asymptomatic patients in order to identify the occurrence of complication(s) at an earlier stage. (See Fig.5) US can also be helpful for follow-up Crohn’s patients after surgery to detect endoscopic recurrence after respective surgery. The use of US has been proposed as a possible tool in assessment of the disease activity. However, further research needs to be done to suggest the use of this technique in routine clinical practice (Saibeni et al., 2007).

**Video Capsule Endoscopy (VCE)**

The introduction in Capsule Endoscopy has made available, for the first time and painless endoscopic method to evaluate the entire small bowel. (See Fig.6) It has shown diagnosis of non-stricturing other imaging modalities 2010). At first, Crohn’s a contraindication for VCE asymptomatic strictures capsule retention. The first disease in patients using VCE came from unexpected findings of small bowel lesions. The majority of these patients only had
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obscure gastrointestinal bleeding with no symptoms of Crohn’s disease and had been thoroughly evaluated with an extensive endoscopic and radiologic diagnostic work-up before performing VCE. “Thus, the presence of these unexpected findings a VCE suggested its superiority in detecting Crohn’s disease lesions in patients with mild clinical suspicion and negative traditional imaging studies” (Saibeni et al., 2007, p.3283). VCE does, however, have some disadvantages. There is a possibility of missing disease due to excessive small bowel content or rapid transit. It occasionally does not visualize the entire small bowel due to strictures or slow transit, and it may detect nonspecific mucosal changes and does not evaluate the wall thickening and extra-luminal complications associated with Crohn’s disease.

**Treatment**

The main treatment for Crohn’s disease is medication to stop intestinal inflammation and to prevent flare-ups and to keep the patient in remission. A few people have severe, persistent symptoms or complications that may require a stronger medication, a combination of medication, or surgery. The type and severity of symptoms a patient experiences determines the treatment needed. Initial treatment for patients with mild symptoms involves the use of various medicines. Patients with severe symptoms may be treated with corticosteroids administered through a vein or biologics. It is important in this case to control the disease. Ongoing treatment is designed to find a medicine or combinations of medicine that keeps Crohn’s disease in remission. Surgery may be needed if no medicine is effective, if serious side effects from medicine occur, if symptoms can be controlled only with long-term use of corticosteroids, or if the patient develops complications such as fistulas, abscesses, or bowel obstructions (WebMD, 2010, Treatment Overview, ¶1).
Approximately two-thirds to three-quarters of people with Crohn’s will eventually undergo surgery as part of the therapeutic management of their illness. Complications of Crohn’s disease that may require surgery include: intestinal obstructions or blockage, excessive bleeding in the intestine, perforation of the bowel, formation of a fistula or abscess, and toxic megacolon. A strictureplasty can be performed to widen the strictured area without removing any portion of the small intestine. Sometimes a resection is performed to remove the affected section of the intestine. For people with severe Crohn’s disease, a colectomy or procotocolectomy may be done to remove the entire colon or both the colon and rectum (Crohn’s & Colitis, 2009, Surgery for Crohn’s disease section, ¶3).

**Conclusion**

Crohn's disease, also known as regional enteritis, is a type of inflammatory bowel disease that may affect any part of the gastrointestinal tract from mouth to anus, causing a wide variety of symptoms. The average onset is between 15 and 30 years of age, but can occur at any age. Many people with Crohn’s disease have symptoms for years prior to becoming diagnosed. Early diagnosis of this disease is essential, and radiographic imaging plays an important role in this. Among these techniques are Computed Tomography, Magnetic Resonance Imaging, and other imaging modalities.

Imaging, ultrasound, and endoscopy. There are many pros and cons affiliated with diagnosing Crohn’s using radiographic imaging. (See Fig.7) Although it is still uncertain which modality best demonstrates this disease, all techniques have their advantages and should be considered in the diagnosis of Crohns. It is important to utilize modern radiographic techniques to improve patient care and save the lives of patients with Crohn’s disease.
References


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