

What to Expect from Intestinal Ultrasonography

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Abstract: Thanks to increasingly number imaging techniques, sonography is no longer indicated solely for the examination of the parenchymal organs of the abdominal cavity, but also for the small and large intestine. It has an important role in differential diagnosis of pain in the right hypogastrium, particularly when acute appendicitis is suspected. Sonography is also used in patients suspected from acute diverticulitis. Other intestinal wall pathologies can be well identified by sonography though the image is often non-specific, and such lesions are difficult to identify in terms of aetiology.

A prominent position has endorectal sonography, an important method used mainly for diagnosis of rectal tumours. Unlike other techniques such as CT, it is useful in assessing tumorous infiltration of each of the intestinal wall layers or even the tumour's perirectal propagation. The method can be also used for examination of patients with perirectal abscesses or fistulae. However, endorectal sonography can be quite painful in this location, which is why in such cases we tend to prefer MR imaging.

Introduction

Sonography is the most frequently indicated diagnostic method for examination of the abdominal organs. Thanks to the constantly improving techniques of imaging it is now used not only for parenchymal organ examination but increasingly for sonographic visualisation of the small and large intestine. It is recommended in suspicion of acute inflammation, in cases of nonspecific bowel inflammatory diseases, tumour involvement or disordered intestinal patency [1].

Transabdominal sonography of intestine is very often required in patients with acute abdominal pain especially when acute appendicitis or diverticulitis is suspected. In both cases we encounter specific sonographic findings which make this examination very important. Endorectal sonography has its importance mainly for patients with rectal tumours.

Sonographic image of the intestine

Sonography enables to examine the small intestine loops as well as those of the colon. Visualised by sonography, the intestinal wall is not homogeneous; it is composed of a number of layers (Figure 1) – hypoechoic mucosa, hyperechoic submucosa, hypoechoic muscularis propria and a thin hyperechoic border on the surface consistent with serous membrane [2]. A pathologically altered intestinal wall is, as a rule, enlarged, congested, often with blurred stratification, and hypoechoic throughout.

As the diagnostic technologies keep improving, pathological development can be visualised. The problem is that most of the above described changes are largely nonspecific, and the diagnostician finds it hard to identify aetiology of the lesion, though well visible. Practically the only specific images are seen in acute appendicitis, diverticulitis and also in some cases of Crohn's disease.

Pain the right hypogastrium

Acute appendicitis

Sonography is very often indicated in cases of suspected acute appendicitis. The normal appendix (Figure 2) [3] is up to 6 mm wide, its wall is neither congested nor enlarged and it exhibits well-preserved stratification. An acutely altered appendix (Figures 3 and 4) is usually much easier to visualise, difficult to compress, congested, and enlarged to 7 mm in diameter and more. Depending on the extent of the inflammation, its stratification may or may not be preserved. The fact remains that if an acutely altered appendix is sonographically discernible, the diagnosis of acute appendicitis is practically straightforward. Sometimes, however, the appendix may be quite a problem to visualise. This can be due to poor surveyability in the ileocecal region as a result of intestinal pneumatosis or the patient's body habitus. Or else the problem may arise from a retrocoecal localisation of the appendix or from poor examinability caused by marked tenderness in the right hypogastrium. Another major problem rests in the search for the appendix in pregnant women where the altered relations in the abdominal

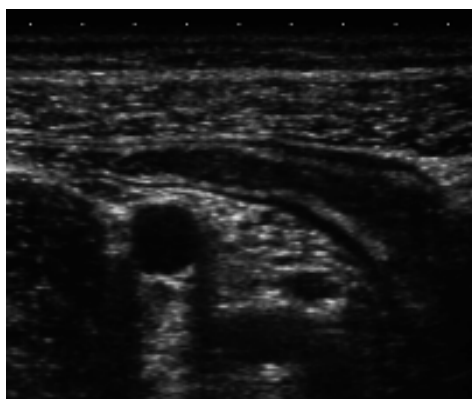


Figure 1 – Normal intestinal wall.



Figure 2 – Normal appendix.

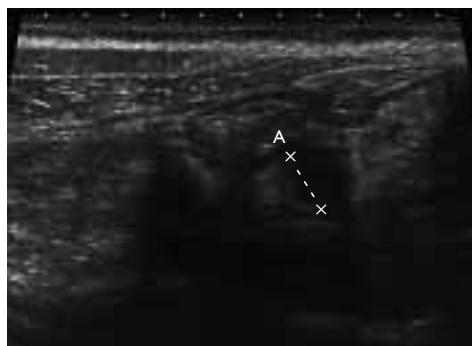


Figure 3 – Acute appendicitis – transversal scan.



Figure 4 – Acute appendicitis – longitudinal scan.

cavity may often make the examination quite unfeasible. Last but not least, the outcome of the examination may also depend on the diagnostician's experience.

Changes caused by chronic irritation of the appendix cannot be visualised by sonography. This is where the method helps to exclude other pathologies rather than to confirm the diagnosis.

In other words, sonography has a significant role in the differential diagnosis of pain in the right hypogastrum, i.e., mesenteric lymphadenitis (Figure 5), typhlitis (Figure 6) or terminal ileitis [4].

Crohn's disease

In diagnosing Crohn's disease, two sonographic pictures may appear apart from extraintestinal pathologies such as abscesses, fistulae or mesenteric lymphadenopathy [5, 6]. In the event of the first attack of the disease, what we usually find is an entirely non-specific picture of a hypoechoic distended wall with blurred stratification (Figure 7). However, if the patient has been treated for this

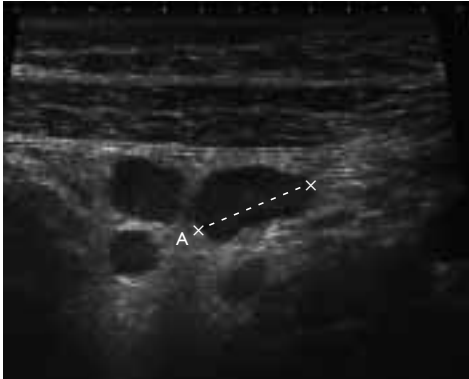


Figure 5 – Mesenteric lymphadenitis.

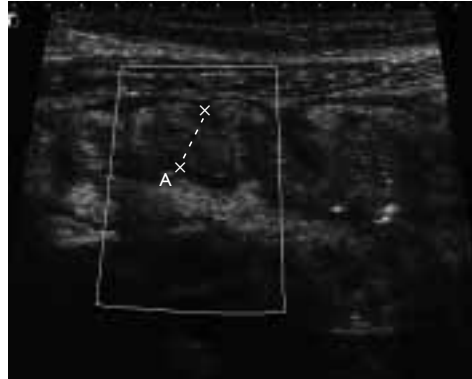


Figure 6 – Typhlitis.

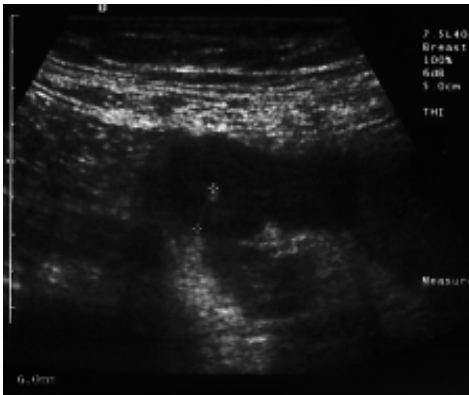


Figure 7 – Patient with M. Crohn, non-specific picture.



Figure 8 – Patient with M. Crohn, typical hyperechoic submucosa.

pathological condition for a longer period of time, what we see is one of a few specific sonographic pictures, namely an enlarged submucosa (Figure 8), a typical sign of the disease [7].

Pain in the left hypogastrium

Acute diverticulitis

Diverticula are often fairly well imageable by sonography, though incomparably worse than by, e.g., double contrast study of large abdomen. An acutely altered diverticulum (Figure 9) is also often well discernible on US scans [3]. The affected diverticulum and the intestinal wall around it are congested, fuzzy, hypoechoic with blurred stratification. Nevertheless, problems may arise if those changes are localised on the aboral sigmoid flexure, which is mostly very difficult to visualise by transabdominal sonography.

Ulcerative colitis

In the case of ulcerative colitis US usually provides a nonspecific picture [8]. The intestinal wall retains its stratification and is only slightly enlarged. Moreover, we are again encountered with problems in imaging the aboral portion of the sigmoid and rectum.

Tumours

Tumour changes in the intestinal wall are visualised as hypoechoic enlargement of the intestinal wall which is pathologically vascularised and marked by loss of stratification (Figure 10). Although the changes can be seen there, sonography in this particular indication can in no case replace other diagnostic methods such as CT or endoscopy (with the exception of rectal endosonography). We are more likely to come across cancer accidentally while investigating the region concerned for other reasons (e.g., pain in the right iliac fossa, targeted examination of a mass).



Figure 9 – Acute diverticulitis.



Figure 10 – Tumour of caecum.

Rectal endosonography

Rectal endosonography is an important diagnostic method, particularly as regards cancer of the rectum. Thanks to the fact that this method just as much as transabdominal sonography helps us to identify the anatomical stratification of the wall, we are better able than with CT to diagnose tumour infiltration of each layer or its perirectal propagation (Figure 11). Moreover, this method makes it possible to assess the tumour in relation to the anal sphincters [9], a relation of great importance for the patient's subsequent incontinence when the sphincters are infiltrated or when the tumour is too close to them. A distance of 15 mm between the oral edge of the sphincters and the aboral end of the tumour is regarded as the limit distance for the patient's postoperative continence to be preserved.

The method can also be used in other than cancer indications – perirectal abscesses, fistulae... (Figure 12). However, the procedure is very painful in such cases, which is why preference is given to MR, where the changes can be visualised very well.

One disadvantage of rectal endosonography is, that it can correctly visualise changes only up to a maximum of 10 cm from the anus. In the case of lesions localised further oralward, only their aboral portion can be visualised – if at all.

Another problem comes with artefacts at the site of biopsy during rectoscopy which regularly precedes endosonography. For that reason, the latter ought to be done a week after the former at the earliest.

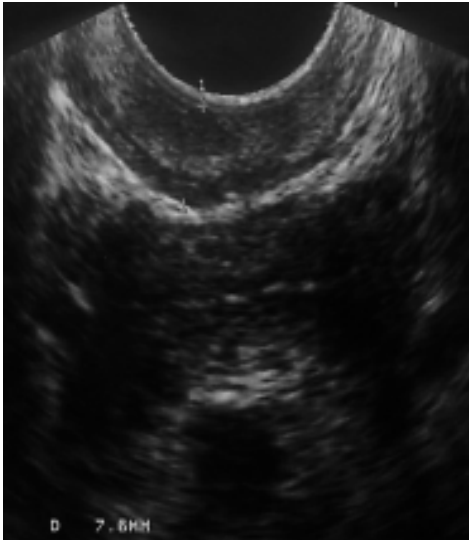


Figure 11 – Endorectal sonography – tumour of rectum with involvement of mucosa and submucosa.

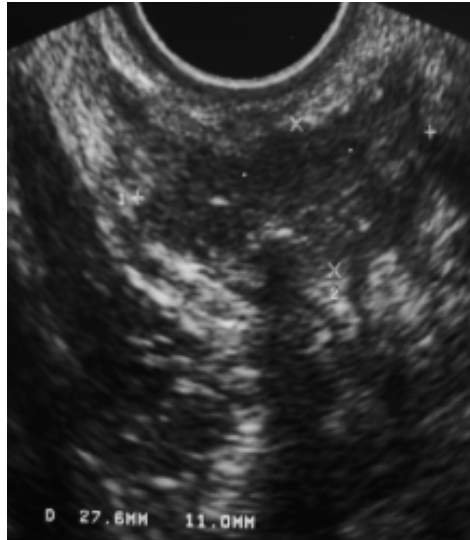


Figure 12 – Perirectal abscess.

Conclusion

Despite progressive development of modern imaging methods such as CT or MRI, due to its availability, non-invasive character and relatively great informative value, sonography is a diagnostic method which is very often indicated and reliable diagnostic method for abdominal organs including the small and large intestine. Pathological conditions of the intestinal wall are, as a rule, quite easy to be visualised by sonography. In general sonography can not replace other examination methods such as colonoscopy, CT, small or large bowel enema because it can not reliably visualize the bowel loops in the whole extent. Examination should rather be focused on the location of the pain or location of the suspected pathology respectively. Its ability to depict single layers of intestinal wall and their involvement by pathological process is a great advantage of sonography in comparison to the other imaging methods. This is crucial for example for staging of rectal tumours by endorectal sonography where we can evaluate not only the involvement of perirectal tissue but also infiltration of individual layers of the bowel wall and we can depict small superficial lesions. However, because the sonographic pictures of most of the pathologies with the exception of acute appendicitis, diverticulitis and sometimes also Crohn's disease are non-specific, the method can hardly identify the aetiology of the disease. It is also necessary to stress that the examination might be limited by poor visibility due to increased pneumatosis or developmental specificities of the patient. The result of sonographic examination also depends on the degree of experience of the physician.

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