INTRODUCTION

Crohn’s disease is a chronic inflammatory condition of the gastrointestinal tract. One of the more common manifestations of Crohn’s disease is perianal Crohn’s disease which includes perianal fistulas and abscesses. Based on population based studies, the lifetime risk of developing a fistula in a patient with Crohn’s disease is between 21%–23% (1,2). Significant morbidity can result from fistulizing Crohn’s disease, including scarring, abscesses, and even proctectomy in 10%-18% of cases (3–5). Several studies have shown that failure to correctly diagnose occult abscesses or fistulas can lead to recurrent disease, sphincter injury with risk of fecal incontinence, conversion of a simple fistula into a complex fistula, and further surgery (6–11). Once the fistulizing process becomes complex, chances for healing are greatly reduced (7). Therefore, it is imperative to correctly diagnose abscess and fistula anatomy in the early course of the disease, before starting treatment. An imaging modality such as endoscopic ultrasound (EUS) should be able to accurately assess the perianal process and guide medical and surgical therapy.

PRESENTATION AND TREATMENT

Patients with perianal Crohn’s disease will typically present with rectal pain, purulence or bloody discharge, or perianal swelling with associated erythema (Figure 1). Inspection and palpation of these areas is then done to further delineate the pathology present. However, because perianal Crohn’s disease leads to pain, induration and scarring, digital rectal exam (DRE), even by experienced colorectal surgeons, is very inaccurate (as low as 62% in one prospective study) (12). Therefore, it is useful to fully assess the perianal process with an imaging modality such as EUS and MRI prior to treatment. In fact, a recent retrospective series reported improved outcome for the patients with Crohn’s perianal fistulas when EUS was used to guide combination medical and surgical therapy (13). Frequently an exam under anesthesia may be required secondary to patient pain. Ideally this is done after the EUS so that the surgeon can use the ultrasound findings as a virtual roadmap. Surgical management can include procedures such as incision and drainage, fistulotomy, and the placement of non-cutting setons. Medical therapy typically involves agents such as antibiotics (ciprofloxacin or metronidazole), immunomodulators (azathioprine or 6-mercaptopurine), and infliximab. The best outcome for treatment of perianal fistulas in Crohn’s disease is achieved when surgical and medical management is combined (14–16).
After the patient has had an exam under anesthesia (EUA) and the setons have been placed, it is our practice to treat with all three agents initially (i.e. cipro 500 mg twice daily, azathioprine 2.5 mg/kg/day and infliximab 5 mg/kg at 0, 2, and 6 weeks and then every 8 weeks). Once the fistulas have healed (as demonstrated by EUS) we discontinue the antibiotic and remove the seton (13).

**TECHNICAL ASPECTS OF EUS FOR FISTULIZING CROHN’S DISEASE**

EUS has added a new dimension to the assessment of perianal fistulas in Crohn’s patients. The major role of EUS is to ascertain the location of fistulas in relation to anal sphincters and to identify any abscess that may be present. In general, examinations are done at the time of colonoscopy or flexible sigmoidoscopy because it is important to assess the degree of proctitis present. A careful DRE is performed first, palpating the suspected area of fistulization. The rectal EUS is then performed. Several different instruments can be utilized including a radial scanning echoendoscope, a blind rigid radial probe, and an electronic biplane probe. We primarily use the radial echoendoscope. This instrument can image using different frequencies (5–20 MHz). The higher frequencies provide finer details but less depth of penetration. The scope is advanced under direct visualization to 20–25 cm and imaging is performed upon withdrawal of the endoscope. The main limitations to EUS imaging in this setting are stenosis and pain. The radial echoendoscope is less than 13 mm in diameter and it is rare to find a stricture that the scope can not traverse. In addition, the patient is usually sedated because the procedure is usually performed after colonoscopy thus eliminating any pain the procedure may cause. However, if necessary, additional light sedation can be given..

**Appearance on Ultrasound**

Two discrete rings of tissue can be seen when using a radial scanning echoendoscope to examine the anorectum (Figure 2). The inner hypoechoic ring of tissue represents the internal anal sphincter, which is formed by the thickened continuation of the circular smooth muscle of the rectum. It is usually about 3 cm in length. The outer hyperechoic ring of tissue represents the external anal sphincter, which is formed by the downward extension of the skeletal muscle of the puborectalis. It is generally 4 cm in length. The lower end of the anal canal is identified by the loss of the IAS hypoechoic signal as the endoscope is withdrawn. The upper end of the anal canal is identified by the hyperechoic sling of the levator ani posteriorly and loss of the EAS anteriorly (17). Any break or thinning in the IAS or EAS is abnormal and needs to be investigated further.

On ultrasound, an active fistula appears as hyperechoic beads (air) within a hypoechoic (inflammatory) tract. By applying gentle pressure on the fistula tract with the ultrasound probe, one can usually visualize air bubbles moving within the tract itself. This process can be visualized disrupting one or both of the discrete rings (sphincters) described above (Figure 3).

**ACCURACY**

The destructive and recurrent nature of perianal Crohn’s disease makes accurate imaging more difficult than with simple fistula-in-ano. In fact, one study of Crohn’s perianal fistula found that approximately 80% of the fistulas in these patients are considered complex
(18). Initial endosonographic studies showed promising results with a sensitivity for assessing fistulas of >90% (19,20). In one of the first EUS studies performed, the authors reported unsatisfactory results for EUS versus DRE in evaluation of fistula-in-ano (21). DRE was found to be more accurate (85%) than EUS (72%) in evaluating fistulas. However, this difference was not statistically significant. In addition, there were some limitations to this study. The rigid nature of the probe used prevented good acoustic coupling higher in the rectum, therefore inhibiting imaging of higher fistula tracks. The focal length of the probe used was only 3 cm, which limited imaging to no deeper than the EAS. To overcome these limitations, we typically use an inflatable balloon probe on a flexible echoendoscope and utilized both radial and linear scanning instruments to ensure thorough imaging of the fistulas.

Since that study several authors have shown ultrasound to be an accurate modality to diagnose perianal fistulas in Crohn’s disease. A prospective blinded study compared EUS to Computed Tomography (CT) in 25 Crohn’s patients with perianal involvement. A 5 MHz radial scanning probe was used, and surgery or fistulography was used as the gold standard. EUS was found to be more accurate than CT (82% versus 24%, respectively) (22).

Four prospective studies have compared MRI to EUS in evaluation of perianal fistulas (23–26). Two of these studies focused on Crohn’s perianal fistulas (25,26). One study comparing MRI and EUS for Crohn’s perianal fistulas found endosonography to be the most sensitive modality for imaging fistulas (25). In this study of 22 patients, EUA was used as the gold standard. The agreement with EUA was found to be 82% for EUS, and 50% for MRI. EUS was performed using a linear 7 MHz probe. The poor sensitivity of MRI in this study could be due to the use of a body coil instead of a pelvic phased array coil which provides better spatial resolution (27). Our group reported the results of a prospective triple-blinded study assessing the accuracy of rectal EUS, MRI, and EUA for evaluation of perianal fistulas in 34 patients with Crohn’s disease perianal fistulas. All three modalities demonstrated accurate agreements with the gold standard (EUS 91, MRI 87%, and EUA 91%). Furthermore, if any 2 of the 3 modalities were combined, 100% accuracy could be achieved (26).

**Contrast-enhanced and 3-D EUS**

In an attempt to increase the sensitivity of EUS, several centers have employed various techniques to improve accuracy including using hydrogen peroxide as a contrast agent and utilizing a 3-D ultrasound processor. Hydrogen peroxide is used to form air bubbles within the fistula track thus making it hyperechoic and potentially more easily visible on ultrasound. Typically 3% hydrogen peroxide is used and injected via a catheter into the external opening of the fistula. This can be par-

(continued on page 43)
The Role of Endoscopic Ultrasound in Crohn’s Perianal Fistulas

INFLAMMATORY BOWEL DISEASE: A PRACTICAL APPROACH, SERIES #20

特别有用的是脓肿、肉芽组织和
疤痕组织，它们都可能看起来部分
性比，因此识别它们很困难 (28)。在这
些情况下，氢过氧化物对比增强的
超声波对提高识别脓肿的准确性
起到了理论上的作用。大多数研究
表明这种对比方法在非IBD患者的
研究中效果最好，与标准超声
波相比 (17,29–31); 其他研究则
发现非对比超声波同样准确 (32)。
虽然使用氢过氧化物增强的研
究主要集中在非Crohn’s相关的
脓肿，可以假定对Crohn’s相关的
脓肿同样有效。使用氢过氧化物的一
个局限是它会导致声影，使深部组
织的信息几乎无法确定 (32)。我们经
验中，7 MHz线性扫描
超声波探头通常可以显
示脓肿中的空气，从而使得氢过氧化物
增强变得不必要。此外，将轻柔
的压力施加在脓肿之后可以推动
空气气泡，使脓肿更容易识别 (26)。我
们主要在那些在超声波上显示为
部分性的脓肿患者中使用氢过氧化物对
比，目的是识别脓肿与非活跃
脓肿之间的区别 (脓肿组织在氢过氧化物
增强的超声波上不会变得更亮)。

The use of a 3D-ultrasound processor provides mul-
tiplanar views of the fistula theoretically making identi-
fication of the internal opening easier. Buchanan, et al
utilized 3-D endosonography for 19 patients with sus-
pected complex or recurrent fistula-in-ano (including 4
patients with Crohn’s disease) In this study, there was no
significant difference between 3D-EUS and hydrogen-
peroxide enhanced 3D-EUS in classifying internal
openings (90% versus 85%), primary tracts (81% versus
71%), or secondary tracts (68% versus 63%) (32).

THE USE OF EUS TO MONITOR HEALING

Recently EUS has evolved from just being a tool
employed in the initial evaluation to becoming a valu-
able tool for monitoring fistula healing. Several authors
have shown that endosonography can provide valuable
information on the internal activity of the fistula tract
during treatment. (13,33–37). This information is
important because, several studies have now clearly
demonstrated that with infliximab even after the fistula
stops draining clinically there is persistent inflamma-
tion present in the internal aspect of the fistula (35,37).
In addition, the patients in whom the fistulas become
inactive have a lower rate of relapse of their perianal
disease (13,33). Recently, we published our results uti-
лизizing EUS to guide combination medical and surgical
treatment for perianal fistulas (13). We typically do not

Figure 4a. A young man with an anterior trans-sphincteric
fistula (arrow) before treatment

Figure 4b. Same patient after treatment with infliximab, aza-
thioprine and seton placement. Fistula tract is now inactive
(arrow).

Figure 4a. A young man with an anterior trans-sphincteric
fistula (arrow) before treatment

Figure 4b. Same patient after treatment with infliximab, aza-
thioprine and seton placement. Fistula tract is now inactive
(arrow).
remove setons nor stop antibiotics until the inflammatory activity of the fistulas has improved significantly on EUS (Figures 4a and 4b). Utilizing this approach in 21 patients, we were able to achieve long-term fistula healing in 16/21 (76%) patients. No recurrent abscesses occurred in this cohort. Although preliminary, these results indicate that EUS can be helpful in directing therapeutic decisions in this difficult clinical setting.

CONCLUSION

Perianal Crohn’s disease can cause significant morbidity if not evaluated and treated accurately. Endosonography appears to be an accurate, well-tolerated imaging modality for finding and classifying anal fistulas. The use of hydrogen peroxide and 3-D ultrasound may enhance EUS in complex fistulas. EUS can be helpful in both monitoring fistula healing and guiding treatment in patients with Crohn’s perianal fistulas.

References

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