

Original Article

Applying Endoanal Ultrasound for Anal Fistula: A Single Instrument Approach

Wei-Ting Lin¹
Ren-Hao Chan²
Bo-Chuan Chen²
Shao-Chieh Lin²
Jenq-Chang Lee²
Bo-Wen Lin²

¹Department of Emergency,

²Division of Colorectal Surgery, Department of Surgery, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan

Key Words

Endoanal ultrasound;
Anal fistula

Purpose. In this study, we compared the clinical practice of endoanal ultrasound.

Methods. The data of 45 patients with a clinical diagnosis of anal fistula from May 2015 to January 2016 were collected in this retrospective study. All the patients had received endoanal ultrasound. We used a BK Diagnostic Ultrasound System with a 6-12 MHz endo-probe that provided a 360° image. Eleven patients underwent both endoanal ultrasound and fistulography. A total of 16 patients received injected hydrogen peroxide during examination.

Results. The mean performance time of endoanal ultrasound was approximately 4 minutes (SD: 2 minutes and 10 seconds), with times ranging from 1 minute and 20 seconds to 9 minutes and 20 seconds. Thirty-four patients received fistulotomy or fistulectomy. The accuracy of endoanal ultrasound was 88.23% and its sensitivity and specificity were 86.2% (25/29) and 100% (5/5), respectively. The accuracy of fistulography was 75%, and its sensitivity and specificity of fistulography in our study were 66.7% (4/6) and 100% (2/2), respectively.

Conclusions. Because of its high accuracy and low cost, endoanal ultrasound is feasible for clinical practice. We consider endoanal ultrasound to be an effective, and first-line pre-operative assessment for anal fistula.

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Anal fistula (also commonly called “fistula-in-ano”) is frequently the result of a previous or current anal abscess. It occurs in up to 50% of patients with abscesses. Its incidence in the United States was approximately 0.18% to 0.69% in historical reports, and it exhibited a surgical condition with a prevalence rate of 8.6 cases per 100,000.¹ It is generally occurred in men (men/women ratio: 4:1) and typically in the fourth decade of life.⁷

Despite anal fistula being well defined and actively studied, some complicated cases still present

colorectal surgeons with very challenge surgical problems. To reduce the risk of post-operative fecal incontinence and recurrence, it is critical to identify the anatomic course of the fistula in relation to the anal internal/external sphincter and to be informed about the existence of an anal sphincter defect before surgery.⁸

In the pre-operative assessment of anal fistula, image modalities such as fistulography, computed tomography, endoanal ultrasound, or magnetic resonance imaging (MRI) may be useful. The purpose of our study was to evaluate the effectiveness and diagnostic

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Correspondence to: Dr. Bo-Wen Lin, Division of Colorectal Surgery, Department of Surgery, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, No. 138, Sheng-Li Road, Tainan 704, Taiwan. Tel: (886)-6-235-3535 ext. 5181; Fax: (886)-6-276-6676; E-mail: wen276@gmail.com

accuracy of endoanal ultrasound combine with hydrogen peroxide injection.

Method and Material

We retrospectively collected data on 45 patients who were diagnosed with anal fistula from May 2015 to January 2016 at National Cheng Kong University Hospital. They had all undergone endoanal ultrasound during follow up in the colorectal outpatient clinic. Sixteen patients had previously received anal operation before the endoanal ultrasound exam. Of the 45 patients studied, 29 patients underwent only endoanal ultrasound; 11 patients underwent both endoanal ultrasound and fistulography; 3 patients underwent both endoanal ultrasound and abdominal computed tomography; and 2 patients underwent both endoanal ultrasound and MRI.

All the ultrasound scans were performed by qualified colorectal surgeons. All the patients received standard anorectal preparation with an enema 1 hour before the endoanal ultrasound program. We used a BK Diagnostic Ultrasound System with a 6-12 MHz endo-probe that provided a 360° image. The patients lay in the left decubitus position. The probe was gently inserted into the middle rectum and then withdrawn slowly through the anal canal. If an external opening existed during examination, then hydrogen peroxide was routinely injected using a catheter during the procedure. A total of 16 patients were injected with hydrogen peroxide during examination. Four patients were injected with hydrogen peroxide but procedure failure because patient can't tolerate or the high resistance of the fistula tract. A total of 25 patients did not find the external opening during the procedure.

We defined the complete fistula tract as a tube-like and hypoechoic structure. The internal fistula opening was identified as a hypoechoic area in the intersphincteric plane, as a defect in the internal anal sphincter, or as a subepithelial breach that connected to the fistulous tract through an internal sphincter defect. After hydrogen peroxide injection, the hypoechoic tract became bright because of reflection from the gas with acoustic shadowing deep in the tract. We track whe-

ther anal fistula tract through the external sphincter to determine the type anal fistula. The fistula tract through external sphincteric muscle was transsphincteric type, and the fistula tract along intersphincteric plane was intersphincteric type. (External sphincter and internal sphincter muscle were hyperechoic structure under ultrasound)

The clinical variables documented were age, sex, performance of the procedure, and the detection of an internal orifice (Table 1).

Results

A total of 45 patients received endoanal ultrasound (40 men and 5 women). The mean age was 47 years, with age ranging from 21-73 years. Twenty-nine patients (64.4%) had not undergone anal operation previously; 16 patients (35.6%) had undergone anal operation, including debridement or anal fistulotomy. Of these 45 patients, 11 patients did not receive an operation. Eight patients were lost to follow-up; 2 patients refused an operation despite our recommendation; and 1 patient preferred to receive the operation at another hospital for personal reasons (Fig. 1).

The mean performance time of endoanal ultrasound approximately 4 minutes (SD: 2 minutes and 10 seconds), with times ranging from 1 minute and 20

Table 1. Clinical data of all 45 patients with suspected anal fistula prior to examination

	Patient didn't have previous anal operation	Patient had previous anal operation	
Number	29	16	
Male	26	14	
Female	3	2	
Mean age (y/o)	47.14	46.94	47.07
Mean performed time	3 minutes 59 seconds	4 minutes 20 seconds	$p = 0.44$
Hydrogen peroxide injection	9	7	
Echo only	22	7	
Echo + fistulography	5	6	
Echo + CT	1	2	
Echo + MRI	1	1	

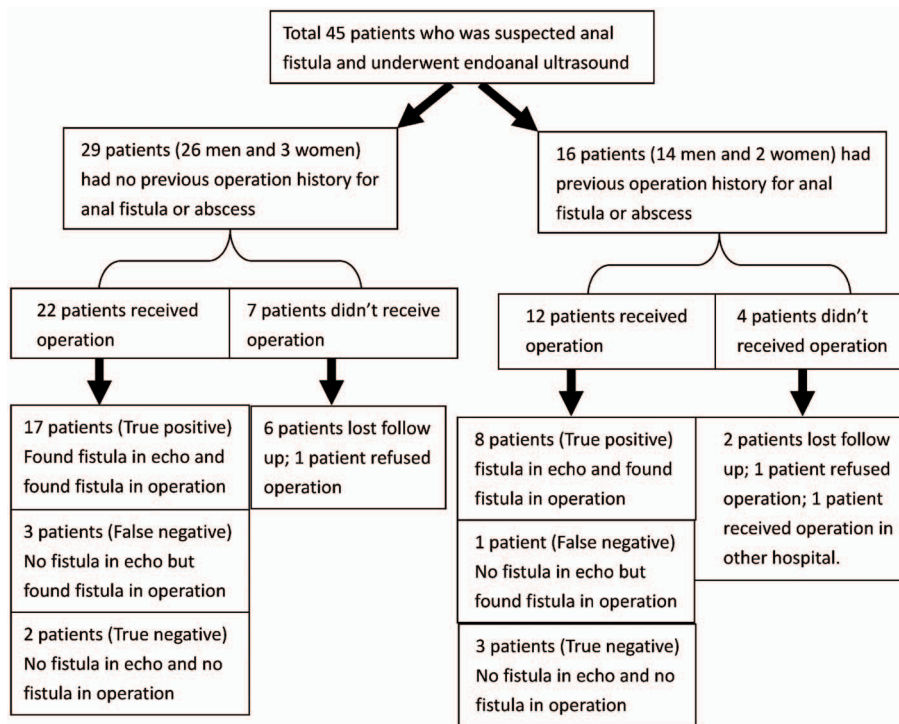


Fig. 1. Flow diagram of all the patients.

seconds to 9 minutes and 20 seconds. Previous anal operation did not affect the performance time of endoanal ultrasound (3 minutes and 59 seconds versus 4 minutes and 20 seconds, $p = 0.44$). Under endoanal ultrasound examination, the number of patient was diagnosed as anal fistula was 35. Eight patients (22.8%) had intersphincteric anal fistula, 25 patients (71.4%) had transsphincteric anal fistula, one patient (2.8%) had infralelevator anal fistula and one patient (2.8%) had mixed type with intersphincteric and transsphincteric fistula. There were 10 patients who did not diagnosed as anal fistula after endoanal ultrasound examination, but three patients were confirmed anal fistula after operation (After operation, two patients were diagnosed as intersphincteric type and one patient was transsphincteric type).

A total of 34 patients had received fistulotomy or fistulectomy. A comparison of the endoanal ultrasound and operation results revealed 25 true positives, 5 false negatives, and 4 true negatives (Table 2). The accuracy of endoanal ultrasound was 88.23%, and its sensitivity and specificity of endoanal ultrasound diagnoses were 86.2% (25/29) and 100% (5/5),

respectively.

A total of 16 patients had received hydrogen peroxide injection during examination. Only one patient had not undergone operation. A comparison of the endoanal ultrasound and operation results for these patients revealed, 12 true positives, 2 true negatives, and 1 false negative. The accuracy rate was 93.33% (14/15); the accuracy rate for the group without hydrogen peroxide was 84.2% (15/19) (Table 3). A comparison of the accuracy rate of endoanal ultrasound with/without hydrogen peroxide injection revealed

Table 2. Accuracy of endoanal ultrasound and fistulography for anal fistula diagnosis

Endoanal ultrasound	Operation finding	
	Positive finding	Negative finding
Positive	25	0
Negative	4	5

Fistulography	Operation finding	
	Positive	Negative
Positive	4	0
Negative	2	2

Table 3. Accuracy of endoanal ultrasound with/without hydrogen peroxide injection

	Operation finding	
	Positive finding	Negative finding
Endoanal ultrasound with hydrogen peroxide injection		
Positive	12	0
Negative	1	2
Endoanal ultrasound without hydrogen peroxide injection		
Positive	13	0
Negative	3	3

that the accuracy rate was not significantly higher for examination with hydrogen peroxide than without, $p = 0.412 > 0.05$.

A comparison of the endoanal ultrasound and operation results of the patients with and without previous anal operation revealed an accuracy of 86.36% for the patients without previous anal operation and an accuracy of 83.33% for those with. There was no obvious significant change between these two groups of patients ($p = 0.81 > 0.05$).

A comparison of the fistulography and operation results revealed 4 true positives, 2 true negatives, 0 false positive, and 2 false negatives (Table 2). The accuracy of the fistulography was 75%, and the sensitivity and specificity of fistulography diagnosis for anal fistula in our study were 66.7% (4/6) and 100% (2/2), respectively.

Discussion

Anal fistula is often defined as an abnormal communication between two epithelial line surfaces, typically between the anal canal and perianal skin. Most of anal fistula types have a non-specific origin and generally termed idiopathic or cryptoglandular. Parks et al.⁵ described the predominant classification system, which classified anal fistula into four types: intersphincteric (the tract extends through the internal sphincter to the intersphincteric space and then to the perineum), transsphincteric (the tract extends through the internal and external sphincters into the ischio-rectal fossa and then to the perineum), suprasphinc-

teric (the tract extends superiorly through the intersphincteric space to above the puborectalis muscle, into the ischio-rectal fossa, and then to the perineum), and extrasphincteric (the tract extends from the perianal skin through the levator ani muscles to the rectal wall completely outside the sphincter mechanism). Intersphincteric, transsphincteric, suprasphincteric, and extrasphincteric fistula type account for 70%, 24%, 5% and 1% of anal fistula cases, respectively.^{5,9}

Most anal fistula types are easily managed through operation alone, but up to 25% of complicated cases may reoccur.¹⁰ Confirming the definite relationship of every fistula to the perianal anatomic structure and spaces is necessary to reduce recurrence and post-operative stool incontinence.⁶ Successful surgical intervention for anal fistula is based on accurately assessing of the primary track, its internal opening, and any secondary extensions.¹⁸ A proper operative imaging technique may facilitate preventing recurrence and anal sphincter injury.

Pomerri et al.¹¹ reported that endoanal ultrasound is safe, rapid, and well tolerated by patients. Generally, endoanal ultrasound facilitates identifying the sphincters and inter-sphincteric plane; however, infection cannot be distinguished from fibrosis, and insufficient depth penetration prevents identifying secondary ramifications and deep abscesses.^{12,13} Three large studies confirmed favorable results when implementing the aforementioned fistula classifications, with accuracy rates of 82.8%,¹¹ 95%¹⁵ and 92%.¹⁶

As a contrast material that enhances the fistula track, hydrogen peroxide has proved useful when combined with endoanal ultrasound and three-dimensional endoanal ultrasound in improving the reliability of ultrasound imaging of anal fistula.¹¹ Ultrasound scanning with hydrogen peroxide enhancement is a method that is less invasive, simpler to manipulate, and less expensive than other methods.⁴ Endoanal ultrasound can be performed during operation and is most effective when used by the surgeon as an adjunct to digital examination and the probing of the fistula tracts. It is also an excellent modality for follow-up.¹⁴

Cho et al.³ determined three criteria for the internal opening of anal fistulas under endoanal ultrasound: an appearance of root-like budding formed by the inter-

sphincteric track that contacts the internal sphincter (criterion I), an appearance of root-like budding with an internal sphincteric defect (criterion II), and asubepithelial breach connecting to the inter-sphincteric track through an internal sphincter defect (criterion III). Regarding accuracy, combining these three criteria has resulted in sensitivity, specificity, positive predictive value, and negative predictive value rate of 94%, 87%, 81%, and 96%, respectively.^{2,3}

Buchanan et al.¹³ reported that MRI is the most accurate pre-operative technique for classifying of anal fistulas and is most effective for evaluating the primary track and any extensions. Studies have shown that MRI is highly predictive of patient outcomes and superior to all other clinical examinations.^{12,19} MRI facilitates not only accurately demonstrating disease extension but also assist colorectal surgeons in predicting prognosis, making therapy decisions, and monitoring therapy.²⁰ The advantages of MRI include high intrinsic soft-tissue resolution, which shows the track system in relation to the surrounding anatomical structures, and multiplanar imaging capability.

However, MRI has some disadvantages in the clinical treatment for anal fistulas. It is expensive and time-consuming. Real-time correlations are not possible.¹⁷ MRI also has a limitation in determining the location of the internal opening because the dentate line is not discernable on MRI.¹³

Fistulography is traditionally a simple radiologic procedure for pre-operative assessment of anal fistula; however, the accuracy rate, which ranges from 20% to 50%, is questionable. The accuracy in our study was 75%. This technique may facilitate assessing the extent of anal fistula but cannot confirm the relationship of the fistula to the sphincter muscles because the sphincter muscles are not directly imaged,¹¹ which means that the relationship between the anal fistula tract and anal sphincter remains unclear and must be estimated during operation. Secondary fistulous tracks often fail to fill with contrast material, and the level of the internal opening in the anal canal is difficult to visualize because of the absence of precise anatomic landmarks.²⁰

Under the Taiwan health insurance system, the most inexpensive exam is endoanal ultrasound (NT\$

800), and the most expensive exam is MRI (NT\$ 11,500). The costs of fistulography and computed tomography are NT\$1,020 NT and NT\$5,035 NT, respectively. These prices show the cost benefit of endoanal ultrasound.

Conclusion

Because of its high accuracy and low cost, endoanal ultrasound is feasible for clinical practice. The adequate use of hydrogen peroxide injection for enhancement can enable colorectal surgeons to identify the internal opening and primary tract. We consider endoanal ultrasound to be an effective first-line, pre-operative assessment for anal fistula.

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原 著

經肛門超音波在肛門瘻管之應用 — 單一機構之經驗

林威廷¹ 詹仁豪² 陳柏全² 林劭潔² 李政昌² 林博文²

國立成功大學附設醫院 ¹急診部 ²外科部大腸直腸外科

目的 在肛門瘻管的術前評估，經肛門超音波的臨床運用。

方法 從 2015 年 5 月到 2016 年 1 月，收集 45 個臨床懷疑是肛門瘻管的病人，全部病人都有接受經肛門超音波檢查，使用的超音波機器型號為 BK Diagnostic ultrasound system，合併使用 6-12 赫茲的 360 度影像超音波探頭。有 11 個病人同時接受肛門瘻管 X 光檢查。其中有 16 個病人有接受經 H₂O₂ 的注射。

結果 經肛門超音波的平均操作時間為四分鐘（標準差為兩分鐘十秒），時間範圍從一分二十秒到九分二十秒，總共有 34 個病人接受開刀。經直腸超音波的診斷準確率為 88.23%，而敏感度和特異度為 86.2% (25/29) 和 100% (5/5)。而肛門瘻管 X 光檢查的準確率為 75%，其敏感度和特異度為 66.7% (4/6) 和 100% (2/2)。

結論 因為較高的診斷準確率和較低成本花費，經直腸超音波可以提供更有用的臨床實際應用。經直腸超音是對於肛門瘻管有效的第一線術前評估。

關鍵詞 經直腸超音波、肛門瘻管。