REVIEW ARTICLE

Diagnostic Ultrasound to Evaluate Fecal Incontinence in Women: Clinical Overview and Current Applications

Steven M Minaglia

Assistant Professor, Division of Urogynecology and Pelvic Reconstructive Surgery, Department of Obstetrics, Gynecology and Women's Health, John A Burns School of Medicine, University of Hawaii, Honolulu, Hawaii, USA

Correspondence: Steven M Minaglia, Kapi'olani Medical Center for Women and Children, 1319 Punahou Street, Suite 824 Honolulu, Hawaii 96744, USA, Phone: (808)203-6500, Fax: (808)955-2174, e-mail: minaglia@hawaii.edu

Abstract

Ultrasound is now frequently used in the evaluation of women with pelvic floor disorders. It has been applied to such diverse disorders such as voiding dysfunction, urinary and fecal incontinence, and defecatory dysfunction. A well-defined application of ultrasound is in the evaluation of fecal incontinence, where visualization of the anal sphincter complex and puborectalis muscle helps quantify both structure and function. The purpose of this review is to outline the clinical problem of fecal incontinence and to define the role of ultrasound in the evaluation of fecal incontinence in women.

Objectives

- Outline the clinical problem of fecal incontinence
- Describe the anatomy of the anal sphincter complex
- Describe the role ultrasound plays in the evaluation of the fecal incontinent patient

Keywords: Ultrasound, fecal incontinence.

INTRODUCTION

The prevalence of fecal incontinence is similar in men and women. Whitehead, et al, reported an overall prevalence in community dwelling individuals of 8.9% in women and 7.7% in men.[1] Fecal incontinence occurred weekly in 2.7% of the study subjects. There are several identified risk factors including advancing age, multiple chronic illnesses, loose or watery stools, childbirth, and poor self-rated health. The prevalence of fecal incontinence is known to increase with age and occurs in 2.6% of 20 to 29-year-olds and 15.3% of people over 70.[1]

The use of ultrasound to evaluate women with fecal incontinence is a growing trend. Obstetrical anal sphincter laceration is the leading cause of fecal incontinence in young women and can be quantified easily by pelvic ultrasound.[2] Unfortunately, not all women who sustain an anal sphincter laceration at delivery are identified by clinical exam and peripartum ultrasound is infrequently performed. These observations have prompted many to employ diagnostic pelvic floor ultrasound in the evaluation of fecal incontinence in women at any age.

ETIOLOGY

Obstetrical anal sphincter laceration is the most common cause of fecal incontinence in young women. Sultan reported fecal incontinence after obstetric injury to occur in 20 to 50% of women at a median follow-up of 6 to 12 months.[3] In a separate publication, Sultan found that 35% of primiparous women and 44% of multiparous women sustained a sphincter laceration during vaginal delivery.[2] Other reported ranges of sphincter laceration in primiparous women following vaginal delivery include 7 to 34%.[4-6] Ultimately, sphincter laceration during vaginal delivery affects a significant number of women.

Not all women who sustain an anal sphincter laceration develop fecal incontinence. Frudinger, et al., evaluated 107 women with ultrasonographically detected anal sphincter defects. Women who were continent immediately postpartum remained continent at 10 years despite having sphincter disruption.[7] Therefore, ultrasound detected sphincter disruption alone does not explain fecal incontinence remote from delivery.

Conversely, some women who develop fecal incontinence did not sustain sphincter laceration. Faltin, et al.,

evaluated women 18 years after delivery. 13.1% of women who sustained anal sphincter laceration at delivery compared to 7.8% of women who did not reported fecal incontinence. The authors concluded that only a small fraction of incontinence could be attributed to anal sphincter laceration, although none of the women involved in the study had been assessed by ultrasound after delivery.[8]

Clearly, both obstetric injury and aging influences the development of fecal incontinence. However, the influence of an obstetric injury that has occurred remote from disease onset *vs* the influence of normal aging is not currently understood. Large and long-term observational studies are needed to fully understand this relationship. Additional causes of fecal incontinence include poor functional status, prior surgery or radiation, nonobstetric trauma, neurogenic, fecal impaction, congenital abnormalities, rectal prolapse, fistula, tumor, and inflammatory bowel diseases.[1]

PHYSIOLOGY AND ANATOMY OF THE ANAL SPHINCTER COMPLEX

The anal canal is 2.5 to 4.0 cm in length. It consists of an inner, circular smooth muscle layer (the internal sphincter) and an external, striated muscle layer (the external sphincter). The internal sphincter is responsible for 70% of fecal continence and is under involuntary control. The external sphincter is under voluntary control and relaxes during anticipated defecation. The puborectalis muscle appears to influence defecatory function as well. The muscle forms a sling under the rectum by attaching to the pubis on either side and is responsible for the anterior angulation present at the anorectal junction.

EVALUATION

A comprehensive history is the first step to determining the etiology of fecal incontinence as well as the overall impact on the patient's quality of life. Understanding the impact on quality of life continues to be a key factor in determining treatment. Standardized questionnaires such as the Fecal Incontinence Symptom Index (FISI) and the Fecal Incontinence Quality of Life Index (FIQL) are now available to assist with history taking.[9,10] Patients should be asked about the frequency and duration of their symptoms as well as whether they are incontinent of flatus, liquid, and/or solid stool.

The past history should focus on prior surgeries or obstetric interventions the patient may have had. Some patients are aware they sustained an injury at delivery; further evaluation should be directed at determining whether or not this is a factor. Unfortunately, some women may have sustained an undiagnosed sphincter laceration. The absence of injury in the patient's history does not rule it out. Patients who underwent an episiotomy and/or operative vaginal delivery, for example, are now known to have been at increased risk for sphincter laceration.[11,12]

The physical examination should focus on the anatomy and function of the anal sphincter complex. Looking for fecal soiling and inspecting the perineum for scarring, infection, and/or inflammation are important first steps. Movement of the anus should be inspected with the patient straining and squeezing. The anal canal should then be digitally examined to assess movement during straining and squeezing as well as continuity of the sphincter. Sphincter disruption that results from obstetric injury is usually in the anterior portion of the sphincter. Attention should be paid to the quality of stool during the examination as well as whether fecal impaction is present.

Historically, needle electromyography was used to evaluate the striated muscle of the anal canal. This evaluation has been replaced by ultrasound, which is more accurate at differentiating between muscle and scar tissue and therefore more reliable at detecting sphincter defects. Ultrasound is useful in addition to functional studies to evaluate patients with fecal incontinence and will be discussed below.

Additional diagnostic testing modalities include endoanal MRI, fluoroscopy, defecography, barium enema, pudendal nerve terminal motor latency, anal/rectal manometry, evaluation of rectal sensation, proctoscopy, sigmoidoscopy, and colonic motility studies. Endoanal MRI is the closest imaging modality to ultrasound for the detection of sphincter defects, however its increased cost has limited its application.

ULTRASOUND TECHNIQUE AND CURRENT APPLICATIONS

Current ultrasound techniques include the use of two- (2D) and three-dimensional (3D) imaging as well as endoanal, transperineal, and transvaginal approaches. Three hundred sixty degree ultrasound transducers, capable of 2D and 3D with frequency up to 16 MHz are used for endoanal ultrasonography and are currently marketed worldwide. Recently, the intra- and interobserver agreement for assessing anal sphincter defects with 3D endoanal ultrasound has been demonstrated.[13]

Conventional curvilinear vaginal transducers can accomplish similar image recording and resolution with the exception of 360° imaging. Additionally, these transducers can be used with a transperineal approach.[14,15] The transperineal approach appears to be utilized most where the anal sphincter and puborectalis muscle are to be evaluated. After review of the literature, the transvaginal approach appears to be utilized less frequently but may be most appropriate in cases where imaging cephalad to the anal sphincter is necessary, such as evaluation of rectovaginal fistula or perianal abscess.

A key difference between endoanal and vaginal transducers is their availability: vaginal transducers are offered by several manufacturers and available with most ultrasound platforms compared to the less ubiquitous endoanal transducer. Another difference is that vaginal transducers can be utilized for a more diverse set of gynecologic applications compared to endoanal transducers. Finally, a transperineal approach with a vaginal transducer may have a potential advantage over endoanal sonography since the approach does not distort the anal canal or mucosa during examination. Figures 1 to 3 demonstrate endoanal and transperineal approaches as well as normal and abnormal findings.

PREVENTION

Reduction of fecal incontinence due to obstetrical anal sphincter laceration has been the subject of intense research. There are three major areas identified that may improve outcome with respect to OASI: reduction of the injury, improved and early detection of the injury, and optimization of the repair. A discussion of reduction of the injury itself is beyond the scope of this review. The use of pelvic floor ultrasound primarily relates to improved identification of OASI as early detection of the injury and immediate repair have been shown to reduce fecal incontinence.

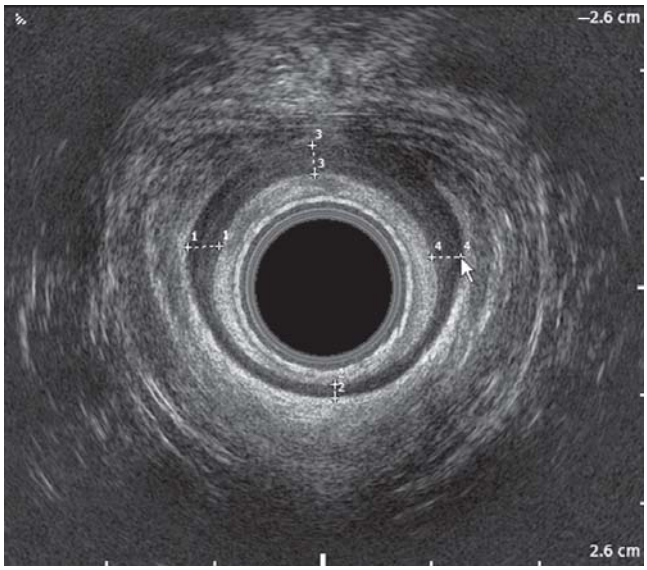

Figure 1: Endoanal ultrasound of the middle anal canal demonstrating internal and external anal sphincters in a healthy asymptomatic female

Figure 2: Transperineal ultrasound demonstrating an intact internal anal sphincter and an intact external anal sphincter with muscular atrophy in a 75-year-old female with fecal incontinence

Figure 3: Transperineal ultrasound demonstrating anal fistula

Faltin, et al., randomized women to receive endoanal ultrasound immediately postpartum or no intervention. 5.6% of women assessed with ultrasound had a full thickness anal sphincter tear that was not diagnosed by clinical examination. Immediate repair in these women was

associated with a significant reduction in severe incontinence compared to women who had no intervention. Ultrasound was needed in 29 women to prevent 1 case of severe fecal incontinence.[16]

Optimization of repair has also become the subject of intense scrutiny. After primary repair, persistent sphincter defects and fecal incontinence occur in 40 to 85% and 20 to 50%, respectively.[3, 17] Concern for optimal repair has fostered increased scholarship aimed at training physicians in appropriate repair as well as determining the optimal mode of repair. Recently, ultrasound has been employed in research studies as a means to evaluate repairs prospectively.[18]

FUTURE DIRECTIONS

Increased use of ultrasound in pelvic floor evaluation has led to several advances. Enhanced understanding of pelvic floor anatomy has been made possible through the correlation of ultrasound findings with function.[19-21] Internal anal sphincter function, for example, is better understood through correlation with ultrasound images and analrectal manometry.[20,21] Patients with strong contraction of the puborectalis muscle have better functional outcomes after sphincterplasty compared to those with poor contraction.[19]

Treatment of fecal incontinence ranges from conservative to surgical: Behavioral modification, diet, biofeedback, physical therapy, pharmacologic, surgical reconstruction, and sacral neuromodulation are all potential therapies. Ultrasound has become an established and significant component of a thorough evaluation in order to determine whether surgical reconstruction of the anal sphincter is appropriate.

CONCLUSION

Ultrasound is a useful diagnostic modality for assessing the anatomy of the anal sphincter complex as well as puborectalis function. It has increasingly been utilized in studies to evaluate risk of injury as well as to quantify types of injury resulting from obstetric trauma. The use of ultrasound to evaluate the outcome of sphincter repair is also increasing. Due to the abundance of vaginal transducers in most clinician offices, alternative approaches to endoanal sonography may be utilized. Direct comparison between endoanal, transperineal, and transvaginal anal ultrasound is underway.

REFERENCES

1. Whitehead WE, Borrud L, Goode PS, et al. Fecal incontinence in US adults: Epidemiology and risk factors. Gastroenterol 2009;137(2):512-17.
2. Sultan AH, Kamm MA, Hudson CN, Thomas JM, Bartran CI. Anal-sphincter disruption during vaginal delivery. N Engl J Med 1993;329:1905-11.
3. Sultan AH. Anal incontinence after childbirth. Curr Opin Obstet Gynecol 1997;9:320-24.
4. Zetterstrom J, Mellgren A, Jensen LL, et al. Effect of delivery on anal sphincter morphology and function. Dis Colon Rectum 1999;42:1253-60.
5. Varma A, Gunn J, Gardiner A, et al. Obstetric anal sphincter injury: Prospective evaluation of incidence. Dis Colon Rectum 1999;42:1537-43.
6. Fynes M, Donnelly V, Behan M, et al. Effect of second vaginal delivery on anorectal physiology and fecal incontinence: A prospective study. Lancet 1999;353:983-86.
7. Frudinger A, Ballon M, Taylor SA, Halligan S. The natural history of clinically unrecognized anal sphincter tears over 10 years after the first vaginal delivery. Obstet Gynecol 2008;111(5):1058-64.
8. Faltin DL, Otero M, Petignat P, et al. Women's health 18 years after rupture of the anal sphincter during childbirth: I. Fecal incontinence. Am J Obstet Gynecol 2006;194:1255-59.
9. Rockwood TH, Church JM, Fleshman JW, et al. Patient and surgeon ranking of the severity of symptoms associated with fecal incontinence: The fecal incontinence severity index. Dis Colon Rectum 1999;42:1525.
10. Rockwood TH, Church JM, Fleshman JW, et al. Fecal incontinence quality of life scale: Quality of life instrument for patients with fecal incontinence. Dis Colon Rectum 2000;43:49.
11. Handa VL, Danielsen BH, Gilbert WM. Obstetrical anal sphincter lacerations. Obstet Gynecol 2001;98:225-30.
12. Minaglia S, Ozel B, Gatto NM, et al. Decrease rate of obstetrical anal sphincter laceration is associated with change in obstetric practice. Int Urogynecol J 2007;18:1399-404.
13. Norderval S, Dehli T, Vonen B. Three-dimensional endoanal ultrasonography: Intraobserver and interobserver agreement using scoring systems for classification of anal sphincter defects. Ultrasound Obstet Gynecol 2009;33:337-43.
14. Timor-Tritsch IE, Monteagudo A, Smilen SW, et al. Simple ultrasound evaluation of the anal sphincter in female patients using a transvaginal transducer. Ultrasound Obstet Gynecol 2005;25(2):177-83.
15. Weinstein MM, Pretorius DH, Jung SA, et al. Transperineal three-dimensional ultrasound imaging for detection of anatomic defects in the anal sphincter complex muscles. Clin Gastroenterol Hepatol 2009;7(2):205-11.
16. Faltin DL, Boulvain M, Floris LA, Irion O. Diagnosis of anal sphincter tears to prevent fecal incontinence. Obstet Gynecol 2005;106:6-13.
17. Sultan AH, Kamm MA, Hudson CN, Bartram CI. Third-degree obstetric anal sphincter tears: Risk factors and outcome of primary repair. BMJ 1994;308:887-91.
18. Pronk P, Van Leeuwen E, Albicher C, et al. Temporal endosonographic evaluation of anal sphincter integrity after primary repair for obstetric ruptures: A case for specific training of obstetricians. Colorectal Dis 2009; Apr 16. [Epub ahead of print]
19. Zufferey G, Perneger T, Robert-Yap J, et al. Puborectal sling as a predictor of successful sphincter repair in the treatment of anal incontinence. Dis Colon Rectum 2009;52:704-10.
20. Lewicky-Gaupp C, Hamilton Q, Ashton-Miller J, et al. Anal sphincter structure and function relationships in aging and fecal incontinence. Am J Obstet Gynecol 2009;200(5):559.
21. Reddymasu SC, Singh S, Waheed S, et al. Comparison of anorectal manometry to endoanal ultrasound in the evaluation of fecal incontinence. Am J Med Sci 2009;337(5):336-39.