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Comparing the accuracy and advantages of transperineal ultrasonography and MRI for anal sphincter dysfunction

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Abstract

Introduction: The pelvic floor muscles assist in both defecation and continence when acting along with the anal sphincter. Hence, the clinical symptoms of anal sphincter dysfunction include faecal incontinence or obstructed defecation. Faecal incontinence refers to the involuntary release of gas, liquid, or solid feces, which is not only a socially uncomfortable issue but also poses a risk to one's health.

Materials and Methods: Between January 2015 to November 2015, at the Department of Radiology, Department of Radiodiagnosis, Madha Medical College, Chennai, Tamil Nadu, India. We treat everyone who has faecal incontinence due to an injury to the anal sphincter. Experiment with a Cross-Sectional Design and Prospective Analysis.

Results: For most people, having a vaginal delivery is the primary cause of faecal incontinence. Postpartum faecal incontinence has a complex aetiology, but the most common cause is damage to the anal sphincters. Postpartum may also result from damage to the anal sphincter complex, the puborectalis muscle, or the pudendal nerve.

Conclusion: These patients choose this non-invasive, inexpensive, and readily available technique. MRI is useful for secondary fistula and supra and extra elevator evaluation. MRI can detect extensions, extent, length, secondary tracks, and perianal abscess. TPUS detects perineal descent and rectocele better than MRI. TPUS and MRI detect sphincter abnormalities equally well.

Keywords: Sphincter, vaginal delivery, MRI, postpartum

Introduction

The pelvic floor and anal sphincter regulate the passage of feces and maintain continence. Anal sphincter dysfunction results in either the inability to control bowel movements (Faecal incontinence) or difficulty in passing stool (Blocked defecation). Faecal incontinence, which refers to the involuntary release of gas, liquid, or solid feces, is a problem that affects both social interactions and personal hygiene. Obstetric anal sphincter injury, often known as OASIS, is responsible for 2% of cases of adult faecal incontinence^[1, 2]. Faecal incontinence can be caused by pelvic injuries and abnormalities of the anal sphincter. Perianal inflammatory conditions encompass perianal abscess, pilonidal sinus, ano-vaginal fistula, recto-urethral fistula, and sinus. Pelvic harm can be caused by postpartum obstetric injury and road traffic accidents. The underlying cause must be systematically evaluated. The evaluation of anal sphincter dysfunction necessitates a thorough investigation of the patient's medical history, a rectal examination, radiological imaging, and physiological tests^[3-5]. Sonography, including transperineal and transvaginal techniques, as well as endoanal sonography using 3D imaging, CT pelvis, and MRI of the anal sphincter (Using external phased array and endoanal methods) can be utilized to evaluate the anatomy of the anal sphincter^[6-8].

These tests assess the functionality of the anal sphincter. Defecogram, electromyography, and anorectal manometry are diagnostic tests used to assess the function and movement of the rectum and anus. Transperineal ultrasonography (TPUS) is a simple, cost-effective, secure, and painless method for assessing the structure of the anorectal region. Transperineal ultrasonography is utilized in the fields of urology, gynaecology, and gastroenterology. Anal sphincter examination in gastroenterology often focuses on obstructed defecation syndrome and inflammatory perianal conditions^[9-11]. It aids in the identification, categorization, and surveillance of inflammatory perianal diseases by assessing these structures during bowel movements. It assists individuals with faecal incontinence in identifying injury to the sphincter. MRI is capable of evaluating abnormalities of the anal sphincter complex. MRI can be used to see the sphincter and assess defecation in order to evaluate muscle integrity^[12, 13].

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External phased MRI is a method used to assess the anal sphincter and pelvic floor without the need for an endoluminal coil. An accurate diagnosis is essential for perianal conditions as it enhances and sustains the quality of life for patients. Magnetic resonance imaging (MRI) and transperineal ultrasonography are effective diagnostic tools for identifying perianal abscesses and fistulas. Prior to undergoing surgery, patients who have experienced trauma must assess the position and extent of any anomalies in the internal and external sphincters.

Materials and Methods

From January 2015 to November 2015, I worked at the Department of Radiology, specifically the Department of Radiodiagnosis, at Madha Medical College in Chennai, Tamil Nadu, and India. We provide care for those experiencing fecal incontinence resulting from damage to the anal sphincter. Conduct an experiment using a cross-sectional design and prospective analysis.

Inclusion criteria

1. Individuals with a prior perineal injury or postpartum anal sphincter dysfunction, who are currently experiencing fecal incontinence or constipation.
2. Individuals with fistulas and perianal conditions such as Crohn's disease.

Exclusion criteria

1. Patients who have an infection of the anal canal mucosa and perianal skin.
2. Disobedient patients.

This prospective study was authorized by our Institutional Ethics Committee, and we adhered to all necessary regulations for obtaining informed consent. This investigation can be best described as a prospective cross-sectional study. Prior to participating in the experiment, all patients were required to provide their written consent. A digital rectal examination was conducted on patients presenting with complaints of fecal incontinence, sphincter tears, or perianal problems. The anal sphincter complex was thoroughly examined utilizing transvaginal ultrasonography in females and transperineal ultrasound in males. Subsequently, magnetic resonance imaging was utilized to analyze the anal sphincter complex of each of these patients. A comparative analysis was conducted between transperineal ultrasonography and magnetic resonance imaging (MRI) to assess their diagnostic accuracy and advantages in studying the anal sphincter complex.

Statistical analysis

The data was characterized using descriptive statistics, which involved conducting frequency analysis and percentage analysis for categorical variables, as well as calculating the mean and Standard Deviation for continuous variables. The unpaired t-test was employed to ascertain whether there was a statistically significant disparity between the bivariate samples of the two distinct groups. The Sensitivity and Specificity were calculated by the utilization of a Receiver Operating Characteristic (ROC) curve study. The Chi-Square test was used to assess statistical significance in 2x2 tables with categorical data, whereas the Fisher's Exact test was applied for tables with expected cell frequencies below 5. The statistical methods outlined above utilize a significance level of 5.

Observation & Results

Age distribution

Patients between the ages of 20 and 40 were found to have a higher prevalence of anal sphincter dysfunction.

Table 1: Mean age range of individuals with anal sphincter dysfunction in study group A and normal adults in group B

	A Group	B Group
Up to 20	8.2%	7.2%
21 to 40	62.8%	84.9%
41 to 60	21.5%	8.9%
61 to 80	8.9%	0.1%

Table 2: Cross-tabulation Mean age of research group A's anal sphincter dysfunction patients and group B's normal adults

Crosstab				
Age in yrs.		Groups		Total
		Group A	Group B	
Up to 20 yrs.	Count	5	3	08
	Groups	12.5%	7.5%	20.0%
21 to 40 yrs.	Count	10%	12	22
	Groups	25%	30%	55.0%
41 to 60 yrs.	Count	04	04	08
	Groups	10%	10%	20.0%
61 to 80 yrs.	Count	1	1	02
	Groups	2.5%	2.5%	5%
Total	Count	20	20	40
	Groups	100.0%	100.0%	100.0%

Gender distribution: In this study of group, A, out of 40 patients, 20 were females and 20 were males.

Table 3: Gender distribution of group A patients with anal sphincter dysfunction and group B normal adults.

Gender		Groups		Total
		A Group	B Group	
Female	Count	18	22	40
	Groups	45%	55%	100.0%
Male	Count	18	22	40
	Groups	45%	55%	100.0%
Total	Count	40	40	40
	Groups	100.0%	100.0%	100.0%

Frequency distribution of abnormalities on imaging

Table 4: Distribution of results by frequency in the research population

Sr. No.	Findings in patients	Frequency
1	Altered spintered thickness	18
2	Fibrosis	07
3	Fistula	03
4	Perineal descent	01
5	Rectocele	03
6	Cystocele	01
7	Enterocoele	02
8	Prolapse	01
9	Normal	04
	Total	40

Table 5: Analysis of USG and MRI in a Randomized Controlled Trial T-test

	Low		Mid		High	
	USG	MRI	USG	MRI	USG	MRI
Group A	4.41	4.01	4.30	4.31	3.20	2.42
Group B	4.20	3.89	4.51	4.24	4.41	4.00

Discussion

The main factor contributing to fecal incontinence in the majority of individuals is vaginal delivery. Postpartum faecal incontinence is mostly caused by anal sphincter injury, however its etiology is multifaceted. Postpartum may also occur because of injury to the anal sphincter complex, the puborectalis muscle, or the pudendal nerve. Women who experience obstetric anal sphincter injury (OASI) are more likely to develop faecal incontinence, even after the initial healing of the sphincter lesion. An account of OASI, similar to an account of FI, can have a harmful effect on sexual function. Women with a history of obstetric anal sphincter injury (OASI) are less inclined to actively plan future pregnancies. Perineal tears are estimated to occur during vaginal births worldwide as a result of difficulties. In 2016, a total of 53,614 births were documented, and among them, there were cases of perineal tears classified as grade III or IV^[14-16].

Endoanal ultrasonography has high sensitivity and specificity and is now considered the most reliable method for identifying sphincter damage. A review research indicates that certain women exhibit indications of hidden structural harm to the anal sphincter after their initial vaginal delivery. Nevertheless, a number of authors have highlighted the constraints of this imaging method, such as its incapacity to assess the external appearance of the anal sphincter, the distortion of the anal sphincter caused by the transducer, and the discomfort experienced by the patient. Therefore, they recommend performing either a transvaginal or transperineal ultrasound, both of which can be done while the patient is lying comfortably on their back^[17,18].

A limited number of studies have compared two-dimensional transperineal/transvaginal ultrasonography to magnetic resonance imaging for the assessment of anal sphincter dysfunction. We conducted our research at a tertiary care teaching hospital in South India, as transperineal ultrasound has proven to be a valuable tool for assessing anal sphincter abnormalities. Out of the total of 40 patients, 12 were classified as "normal." 21 patients had sphincter thickness that was regarded abnormal, 12 had fibrosis, 5 had fistula, 4 had perineal descent, 1 had enterocele, and 2 had rectocele, cystocele, or prolapse^[19].

The PREDICT experiment found that transperineal ultrasonography had a sensitivity of 64% and a specificity of 85% in assessing sphincter atrophy, which is higher than that of endoanal ultrasound. In this study, we conducted a comparison between MRI and ultrasound, with TPUS serving as the reference standard. The sensitivity of magnetic resonance imaging (MRI) in assessing alterations in sphincter thickness, as opposed to transperineal ultrasound (TPUS), was found to be 86.36%, while the specificity was 96.97%. Both 2D/3D ultrasound and MRI can be utilized to assess sphincter anomalies with comparable precision. Although USG is widely considered the most accurate method for assessing anal sphincter thickness, MRI is equally sensitive at moderate and high levels. There was a significant difference in the average thickness of the internal sphincter between moderate and high stress levels^[20].

Meyer *et al.* found that both TPUS and MRI yield favorable and similar results when investigating perianal disorders. Nevertheless, our research demonstrated that MRI had high sensitivity and specificity in detecting fistulas. MRI is a more effective method than TPUS for assessing fistulas due to its ability to accurately identify secondary tracks and determine the full length of the fistula. Two-dimensional imaging has an

inherent limitation in accurately detecting fistulas with a high degree of complexity. Rania A. Marouf discovered that MRI is very responsive in identifying both healing fibrosis and active lesions. In this investigation, we regarded hypoechoic regions or changes in echogenicity observed in ultrasound (USG) as fibrosis. Similarly, we interpreted the presence of T₁ and T₂ hypointensity in MRI as fibrosis.

The results of our investigation indicated that MRI had a sensitivity of just 60% but a specificity of 100% in diagnosing fibrosis. At now, there is a lack of research comparing the precision of ultrasound (USG) and magnetic resonance imaging (MRI) in evaluating perineal decline, enterocele, or rectocele. However, a study conducted by Perniola *et al.* has shown that ultrasound is not effective in detecting rectocele and perineal ultrasound is less reliable than evacuation proctography. Our findings indicate that ultrasonography outperformed MRI in identifying perineal descent with higher accuracy. The MRI's sensitivity in detecting perineal descent was just around 50%. This may have happened due to the dynamic and repetitive use of ultrasound until the patient exerted enough force. Unlike ultrasonography, MRI is a time-consuming procedure, making it impractical to repeat the straining process^[22].

Conclusion

TPUS/TVS should be the main imaging method utilized to assess sphincter anomalies in persons who have given birth or had trauma, or to screen for fistulas in patients with perianal discharge. Magnetic resonance imaging (MRI) is the most effective method for evaluating the secondary track of a fistula and the supra and extra elevator muscles. The MRI scan provided a clear visualization of the precise location, dimensions, length, secondary pathways, and presence of a perianal abscess in the extension. Transvaginal ultrasonography (TPUS) is superior to MRI in detecting perineal descent and rectocele. When assessing sphincter anomalies, both MRI and TPUS exhibit comparable levels of sensitivity.

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