



PELVIC FLOOR DYSFUNCTION IN MALE PATIENTS WITH FISTULA-IN-ANO: AN OBSERVATIONAL STUDY

Dr. Vrinda^{1*}

^{1*}University-GSVM medical college, Atal Bihari Vajpayee Medical University (UPMCI) Mail id- vrindapaliwal@gmail.com

Abstract

Perianal fistula is a perpetual inflammatory disease that is accompanied by broken communication between the canal and perianal skin. Proper preoperative evaluation is essential to reduce the recurrence and maintain the continence. A clear assessment of fistulous tracts and the pelvic floor structures can be found by MRI. This observational study was an analytical observational one and was performed in Pt. B. D. Sharma PGIMS, Rohtak and involved eighty men patients whose fistula-in-ano was clinically diagnosed. A 3 Tesla MRI scanner was used to assess the imaging of H-line, M-line, anorectal angle, and levator plate angle with the use of both static and dynamic sequences and correlate them to fistula grade, activity, and complexity. Fistulas were categorised with reference to the St. James MRI grading system. Results showed hiatal enlargement in 43.7, pelvic floor descent in 37.5, abnormal anorectal angle and 30 and abnormal levator plate angle and 6.2 respectively. The severity of dysfunction was positively related to better grades, activity, and complexity, which was most likely to be observed in Grade V lesions. The defecation phase dynamic MRI was found to be better in the detection of functional abnormalities. The research confirms that MRI is essential to complete assessment of structural and functional changes in fistula-in-ano that enhances preoperative planning and prognostic evaluation.

Keywords: Perianal fistula, MRI defecography, pelvic floor dysfunction, anorectal angle, dynamic MRI

Introduction

Fistula in ano or perianal fistula is a long-term inflammatory disorder that results in anomalous communication between the anal canal and the perianal skin, and which causes permanent discharge, pain, and significant morbidity in individuals with the condition. It is more common in young adult males, and it is most commonly associated with the third and fourth decades of life and has a high recurrence rate, though proper surgical intervention is provided¹. The recurrence of the disease is not uncommonly considered to be caused by the missed secondary tracts or other abnormalities in the pelvic floor, which are not noticed before surgery².

In the past, perianal fistulas have been assessed using imaging modalities that include contrast fistulography and endoanal ultrasound and multidetector computed tomography (MDCT). Fistulography, despite being the first of its kind, was unreliable in demarcating secondary tracts or their association with the sphincter complex because contrast filling may be either incomplete or deceptive³. Similarly, MDCT, though it has the capacity of delivering multiplanar images, has insufficient soft-tissue resolution and is unable to distinguish fibrotic tracts and active infections⁴. Endoanal ultrasonography has been inhibited by low penetration depths and lacks in measuring supralevator extensions⁵. The current preoperative assessment of fistula-in-ano has consequently

taken the form of magnetic resonance imaging (MRI), which has better soft-tissue contrast as well as multiplanar capability⁶. With the help of MRI, the fistulous tract, the abscesses, and their connection with the anal sphincter complex can be clearly visualised⁶. Research has indicated that MRI has a sensitivity of 100 per cent and specificity of 86 per cent in identifying fistulas⁷. Its results are highly related to intraoperative anatomy and make a great impact on planning a surgery⁸.

Proper classification of perianal fistulas is needed in the process of predicting prognosis and surgical management. This is the gold standard of describing primary tracts in terms of the sphincter complex, which is defined by Parks' classification, suggesting the following types: inter-sphincteric, trans-sphincteric, suprasphincteric, and extrasphincteric⁹. St James's University Hospital MRI classification further classified radiologic staging of fistula-in-ano into five grades¹⁰, i.e. Grade 1- simple linear intersphincteric fistula; Grade 2- intersphincteric fistula with abscess or secondary tract; Grade 3- trans-sphincteric fistula; Grade 4- trans-sphincteric fistula with abscess or secondary tract in the ischioanal or ischiorectal fossa; and Grade 5- sup Grades 1-2 fistulas are the ones that have positive results in the cases of simple surgery but Grades 3-5 tend to demand more severe operations that can lead to postoperative incontinence¹¹. These grades can be identified by MRI and this offers a precise road map of surgical management, which prevents recurrence and lowers the functional impairment.

MRI has become the standard in assessing fistulous anatomy; its ability to measure pelvic floor dysfunction introduces a dimension into assessment before the operation. The pelvic floor is a complex of muscles and fascial layers that help provide organ support and continence, and its malfunction can be expressed in the lowering, broadening of the hiatus, or changing anorectal angles during defecation¹². The functional approach of dynamic MR defecography measures four parameters that constitute essential measurements H-line (hiatal length) which is the anteroposterior dimension of the levator hiatus and is slated at less than 6 cm; M-line (pelvic floor descent) which is the perpendicular distance between the pubococcygeal line and H-line which is usually less than 2 cm; anorectal angle (ARA), being the angle between the anal canal and the rectum, should be 90° to 110° at rest and increase more than 15° on straining suggesting laxity; and the levator plate angle (LPA), which represents the deviation of the levator plate from the pubococcygeal line, with values greater than 10° indicating downward rotation¹³. Goh et al. (2000) studies showed that at straining normative values of the M-line is about 1.2 cm in the male and 1.1 cm in the female, with little descent at rest, and the deviation of these norms is an indication of laxity in the pelvic floor¹⁴. Bitti et al. and Colaiacomo et al. observed that supporting fascia injury or weakness causes the hiatus to widen, and the levator plate to be displaced downward and predisposing to prolapse and related dysfunction^{13,15}. Dynamic MRI has also been shown to be a non-invasive and comprehensive modality capable of assessing both structural and functional changes of the pelvic floor simultaneously, and Darwish et al. (2014) showed that it is a useful imaging test in isolating cystocele, rectocele, enteroceles, and paradoxical contraction of the puborectalis muscle, making it a one-stop imaging test in the assessment of the pelvic floor¹⁶.

In past studies, fistula characterization or pelvic floor dysfunction has been studied more. Nevertheless, the relationship between fistula-in-ano and the pelvic floor mechanism is poorly comprehended¹⁷. Persistent inflammatory changes, frequent infection, and surgical trauma could also be a factor in pelvic muscle fatigue, changed anorectal angulation and hiatal widening, which may result in incomplete healing and chronic symptoms. Moreover, levator ani complex functional impairments could also have an effect on the outcome of continence after fistula repair. MRI is the only technique with which one can assess these co-morbidities in a single test by combining the ability to produce static anatomic images with the dynamic measurement of functions¹⁸. The assessment of the H-line, M-line, anorectal angle, and levator plate angle during rest, straining, and evacuation can help to determine the level of the pelvic floor deficiency in the presence of different fistula grades.

Objectives

The objectives of the present analytical work were to determine anatomical and functional alterations in the pelvic floor of patients with fistula-in-ano using 3T MRI, to assess the correlation between the

grading of perianal fistula (St. James classification) and the parameters of dysfunction of the pelvic floor, and to increase the importance of the preoperative examination and surgical planning based on the role of the pelvic floor in the pathophysiology of perianal fistulas.

Materials and Methods

Study Design and Setting

It was an analytical observational study that was done in the Department of Radiodiagnosis, Pt. B. D. Sharma Postgraduate Institute of Medical Sciences (PGIMS), Rohtak. The study included a total of eighty consecutive patients who had a clinical diagnosis of perianal fistula. Written informed consent was taken, and the institutional ethics committee approved the study before it was started. Informed written consent was taken before the inclusion of all participants.

Participants

All patients who had been referred to MRI examination because of a clinical diagnosis of perianal fistula were included. The inclusion criteria included having undergone prior fistula surgeries or incomplete surgeries, having contraindications to MRI (pacemakers or metallic implants), and patients who were experiencing urogenital issues that would disrupt the functioning of the pelvic floor. Incomplete data of patients and low image quality were also not included. In the end, 80 fully evaluable cases were analysed in the study that had undergone the application of these criteria.

Imaging Protocol

A 3T GE MR 750W scanner was used on the supine patient using a pelvic coil. Axial, coronal and sagittal T1- and T2-weighted, STIR and fat-suppressed scans were performed in the form of static ones and post-contrast ones were performed in a few cases. Dynamic imaging at rest, straining, and defecation with rectal instillation of 120-150mL gel as steady-state free precession balanced sequences in the midsagittal plane to determine pelvic floor motion. All the parameters (TR, TE, slice thickness, FOV, matrix) were followed by the standard MR defecography protocol.

Image Analysis

The St. James MRI classification (Grades 1 -5) was used to grade fistulas (active with T2 hyperintensity, peripheral enhancement and inactive with hypointensity without enhancement). The secondary tracts or abscesses defined complexity; the absence of which defined simplicity; the presence of which, complexity. Parameters of the pelvic floor (H-line 6 cm, M-line 2 cm, anorectal angle 90 -110, at rest/straining/defecation) were measured, and mean values of the parameters were recorded.

Outcomes

The major study findings were to establish the prevalence of the pelvic floor abnormalities in patients with fistula-in-ano that were measured as abnormal H-line (>6 cm), M-line (>2 cm), anorectal angle change (>15°) and levator plate angle (>10°). The secondary outcomes were to determine the relationships between these parameters of the pelvic floor and (a) the St. James MRI grade of the fistula, (b) the activity status (active vs. inactive), and (c) the complexity (simple vs. complex).

Statistical Analysis

All the data were summarised and analysed with the help of the SPSS software version 22 (IBM Corp., Armonk, NY). H-line, M-line, anorectal angle, and levator plate angle were continuous variables whose mean and standard deviation were given. The variables like grade, activity, and complexity were categorical and therefore represented the frequencies and percentages. The Chi-square test of categorical data and the independent t-test or ANOVA of continuous data were used to compare groups. A p-value less than 0.05 was a statistically significant value. The analytical procedures were based on the STROBE methodology of observational studies in the pursuit of methodological rigour and transparency in reporting.

Results

Cohort Characteristics

A total of 3 T MRI was used to assess patients with clinically diagnosed perianal fistula (n=80). There were 75 males (93.7%) and 5 females (6.3%) in the cohort, with an average age of 38.77 with a standard deviation of 12.53 years (Table 1).

TABLE 1. NUMBER OF CASES IN VARIOUS GRADES OF FISTULA

GRADE OF FISTULA (N=80)	NO. OF CASES (PERCENTAGE)
I	24(30%)
II	15(19%)
III	4(5%)
IV	8(10%)
V	29(36%)

Fistula Characterization

According to the St. James MRI system, the following distribution was achieved: Grade I = 24 (30%), Grade II = 15 (18.8%), Grade III = 4 (5%), Grade IV = 8 (10%), and Grade V = 29 (36.2%). As far as activity is concerned, 53 cases (66.2%) were active and 27 (33.8%) were not. In the case of complexity, 47(58.8%) were complex and 33(41.2%) simple. As can be seen in Table 2, more prevalent were higher-grade lesions and active lesions. In the resting phase of the hiatal enlargement process, 6, in the straining phase, 17 and in the defecation phase, 30 patients had mild and moderate hiatal enlargement, respectively.

TABLE 2. COMPARISON OF HIATAL ENLARGEMENT, i.e. H LINE (cm) IN DIFFERENT PHASES

GRADE (N=80)	REST PHASE	STRAINING PHASE	DEFECATION PHASE
NORMAL (<6cm)	74	63	47
MILD (6-8cm)	6(7.5%)	17(21.25%)	30(37.5%)
MODERATE (8-10cm)	-	-	3(3.75%)
SEVERE (>10cm)	-	-	-

*Data represents the number of patients with pelvic hiatal enlargement

Pelvic Floor Metrics

The variation in hiatal dimensions, as well as anorectal alignment, was measured using dynamic MRI at various phases of functionality. Table 3 shows the degree of pelvic floor descent (M-line) at various stages of the MRI research. At rest, all 80 cases were within normal limits. Mild descent was noted in 8 patients (10%), during straining and in 29 patients (36.25%), during defecation, whereas moderate descent (4-6 cm) was observed in 3 patients (3.75%), only during defecation. No big fall (>6 cm) was observed. These findings show that there are significantly greater descents of the pelvic floor during the defecation stage than during the rest and straining stages.

TABLE 3. COMPARISON OF PELVIC FLOOR DESCENT, i.e. M LINE (cm) IN DIFFERENT PHASES

GRADE (N=80)	REST PHASE	STRAINING PHASE	DEFECATION PHASE
NORMAL (<2cm)	80	72	48
MILD (2-4cm)	-	8(10%)	29(36.25%)
MODERATE (4-6cm)	-	-	3(3.75%)
SEVERE (>6cm)	-	-	-

*Data represents the number of patients with pelvic floor descent

Table 4 demonstrated that hiatal enlargement was observed in 6, 17, and 32 patients, respectively, at the resting stage, straining, and defecation. The highest number of cases was observed in Grade V fistulas enlarged in 4, 8 and 13 patients in the various phases, which showed gradual widening of the hiatal with an increase in fistula grades and levels of strain.

TABLE 4. COMPARISON OF HIATAL ENLARGEMENT, i.e. H LINE (cm) IN DIFFERENT GRADES OF FISTULA

GRADE OF FISTULA	REST PHASE	STRAINING PHASE	DEFECATION PHASE
I(N=24)	-	4(16.66%)	10(41.66%)
II(N=15)	2(13.33%)	3(20%)	5(33.33%)
III(N=4)	-	1(25%)	2(50%)
IV(N=8)	-	1(12.5%)	3(37.5%)
V(N=29)	4(13.79%)	8(27.58%)	13(44.82%)
TOTAL(N=80)	6(7.5%)	17(21.25%)	32(40%)

*Data represents the number of patients with elongated pelvic hiatus H line (>6cm)

Associations with Fistula Grade, Activity, and Complexity

Greater-grade fistulas experienced an equivalent increment in pelvic floor dysfunctions. Grade V cases had larger hiatal enlargement and decreased pelvic descent, followed by Grade IV, whereas I–II had almost regular measurements. Active, complex fistulas had more deviations of H-line and M-line than inactive or simple fistulas, indicating the presence of more pelvic-floor involvement in inflammatory and extensive tracts. The trend was similar in all parameters, but because of the sample size, statistical significance was low. Table 5 displays the finding that 8 patients and 32 patients experienced pelvic floor descent during the defecation and straining phase, respectively. The mean number of descents during the straining was the highest in Grade V fistulas (4 cases), and the greatest number of descents during defecation was Grade I (13 cases), indicating that the greater the physiological stress, the greater the severity of the descent.

TABLE 5. COMPARISON OF PELVIC FLOOR DESCENT, i.e. M LINE (cm) IN DIFFERENT GRADES OF FISTULA

GRADE OF FISTULA	REST PHASE	STRAINING PHASE	DEFECATION PHASE
I(N=24)	-	2(8.33%)	13(54.16%)
II(N=15)	-	1(6.66%)	5(33.33%)
III(N=4)	-	-	2(50%)
IV(N=8)	-	1(12.5%)	3(37.5%)
V(N=29)	-	4(13.79%)	9(31.03%)
TOTAL(N=80)	-	8(10%)	32(40%)

*Data represents the number of patients with pelvic descent, i.e. M line (>2cm)

Table 6 showed that one patient (1.25%) had an abnormal levator plate angle (> 10°) at the straining stage and in five patients (6.25%) at the defecation stage. The Grade IV fistulas had the highest incidence of the type, with one during the straining phase and two during defecation, which represented mild levels of elevated levator plates with fistulous complexity being advanced.

TABLE 6. COMPARISON OF LEVATOR PLATE ANGLE IN DIFFERENT GRADES OF FISTULA

GRADE OF FISTULA	REST PHASE	STRAINING PHASE	DEFECATION PHASE
I(N=24)	-	-	1(4.16%)
II(N=15)	-	-	1(6.66%)
III(N=4)	-	-	-
IV(N=8)	-	1(12.5%)	2(25%)
V(N=29)	-	-	1(3.44%)
TOTAL(N=80)	-	1(1.25%)	5(6.25%)

*Data represents the number of patients with levator plate angle > 10 degrees

Illustrative MRI Cases

The scale of fistula grades and the resultant changes of the pelvic floor are demonstrated on a representative dynamic MRI. Figure 1 reveals a simple intersphincteric fistula with normal H-line and M-line values, which can be described as a low-grade lesion that is located in the intersphincteric space only.

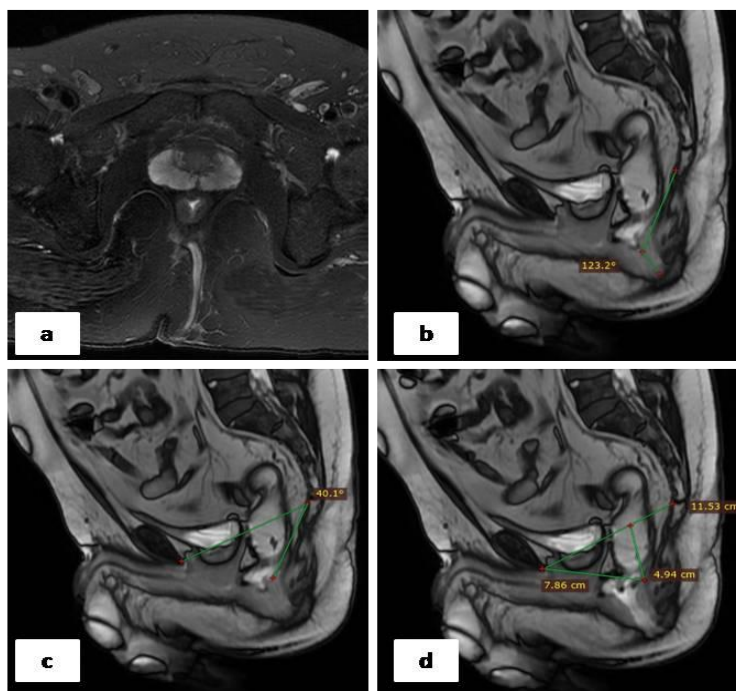


Figure 1: Grade 1 intersphincteric fistula—linear tract confined to the intersphincteric plane, normal H-line and M-line

Figure 2 presents a Grade II intersphincteric fistula that has a horseshoe extension. Inter-sphincteric tract appears hyperintense in axial and coronal T2-weighted images and spreads circumferentially, with each side bilaterally ischioanal-involved. The sagittal section has mild hiatal widening and an intact sphincter. The image after contrast is also showing peripheral intensity, and it represents active inflammation that does not go beyond the intersphincteric and perianal planes.

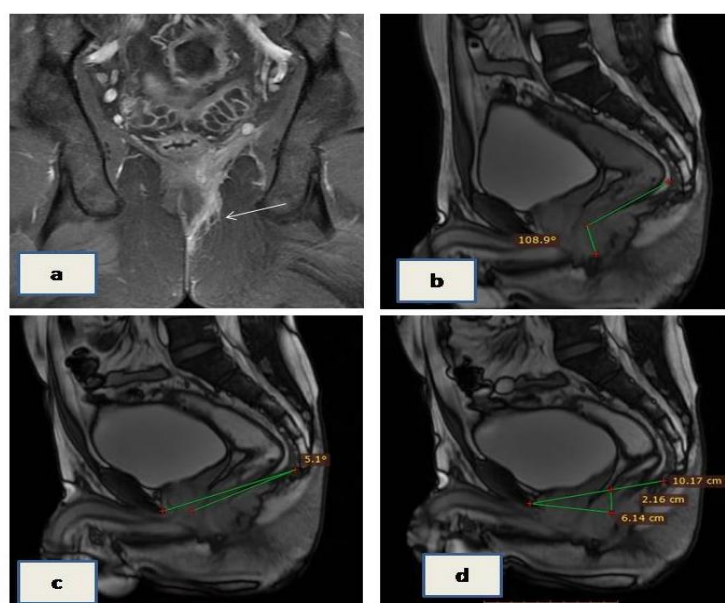


Figure 2: Grade 2 intersphincteric fistula with horseshoe extension and mild hiatal widening A trans-sphincteric track with related dysfunction of the pelvic floor consisting of hiatal widening, levator descent, and anorectal functional changes can be illustrated in Figure 3.

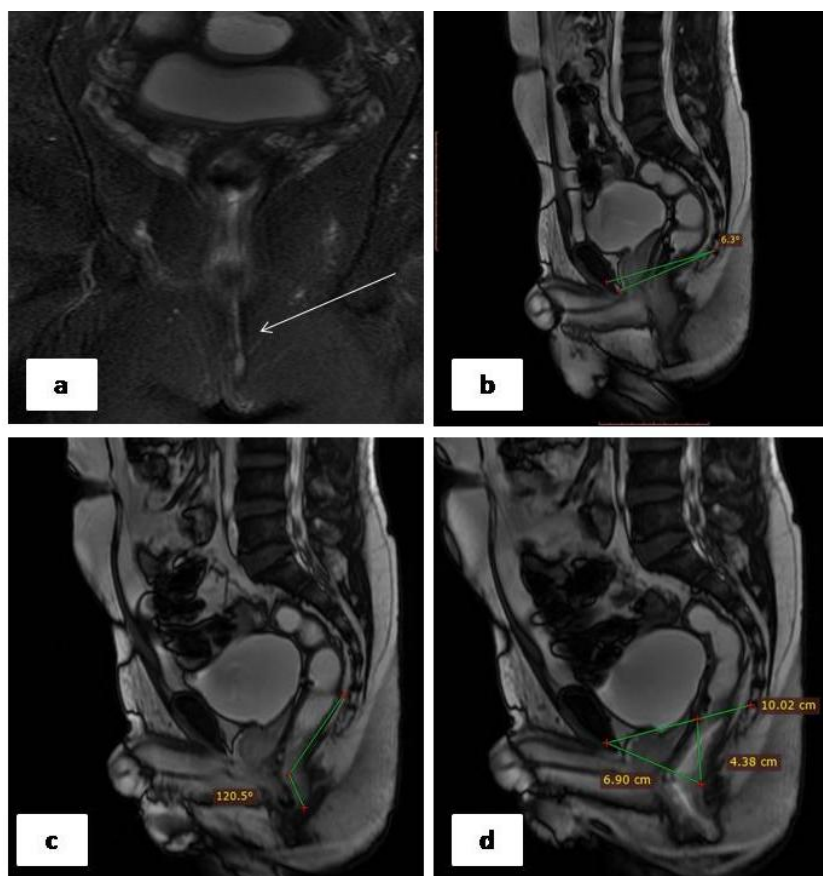


Figure 3: Grade 3 trans-sphincteric fistula showing external sphincter penetration with increased anorectal angle and levator plate rotation

Figure 4 shows a high fistula, complex with the mild involvement of the pelvic floor and intact structural integrity and continence mechanism.

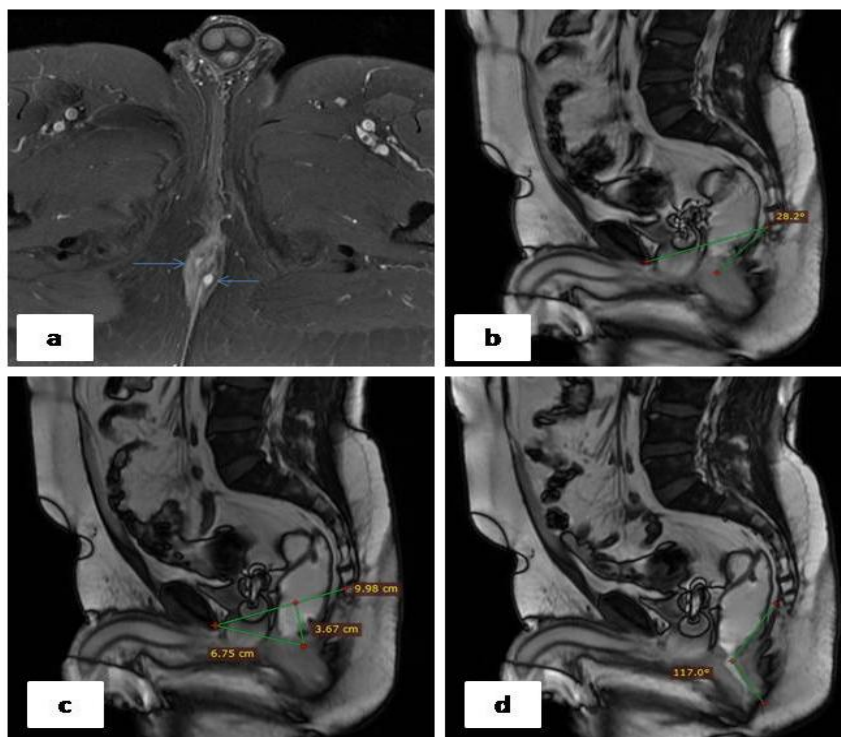


Figure 4: Grade 5 supralelevator/translevator extension demonstrating marked hiatal enlargement and pelvic floor descent

Statistical Highlights

There was a gradual increase in mean H-line and M-line with St. James grades ($p < 0.05$). There was no notable difference in levator plate angle among grades, but a positive correlation was found between activity and grade. SPSS 22 was used to analyse quantitative data, and the significance is determined at $p < 0.05$. Table 7 reveals that in straining, 8 patients exhibited an increase in anorectal angle ($= 15$) and one patient had a paradoxical finding of a decrease. The 24 patients experienced more angles and 5 fewer angles during defecation. Grade I and Grade V fistulas had the highest angular changes, which implies that the dynamic anorectal angle changes are associated with the fistula grade and pelvic-floor stress.

TABLE 7: COMPARISON OF ANORECTAL ANGLE IN DIFFERENT GRADES OF FISTULA

GRADE OF FISTULA	REST PHASE	STRAINING PHASE	DEFECATION PHASE
I(N=24)	-	3↑ (12.5%)	10↑+ 3↓ (54.16%)
II(N=15)	-	1↑ (6.66%)	3↑ (20%)
III(N=4)	-	-	1↑+ 1↓ (50%)
IV(N=8)	-	1↑+ 1↓ (25%)	3↑ (37.5%)
V(N=29)	-	3↑ (10.34%)	7↑+ 1↓ (27.58%)
TOTAL(N=80)	-	8↑+1↓=9 (11.25%)	24↑+5↓=29 (36.25%)

Discussion

It is analytical research that assessed the pelvic floor workings of patients with fistula-in-ano by means of 3 T MRI and assessed their relation with fistula grade, activity, and complexity. The findings were interesting that a large percentage of patients had pelvic floor dysfunction, which included hiatal enlargement, pelvic floor descent, and altered anorectal angle or levator plate angle. The abnormalities were more common in the high-grade and active, as well as complex fistulas, which indicates that the advanced perianal disease is usually accompanied by the functional impairment of the pelvic floor.

In 43.7% (hiatal enlargement), 37.5% (pelvic-floor descent), 30% (abnormal anorectal angle), and 6.2% (levator-plate angle $> 10^\circ$) cases, dynamic MRI showed hiatal enlargement (H-line > 6 cm), pelvic-floor descent (M-line > 2 cm), abnormal anorectal angle, and levator-plate angle, respectively. The results were comparable to the gradual rising dysfunction with the severity of the disease, reaching the Grade V fistulas, then the Grade IV, early grade fistulas did not vary much. These findings highlight the fact that dynamic pelvic floor measurements have some extrinsic diagnostic and prognostic information as compared to the previous fistula characterization. The use of MRI has been previously determined as the gold standard in the assessment of perianal fistulas, as it offers better soft-tissue contrast and multiplanar image^{2,6}. Nevertheless, the majority of the literature has been on the basis of the morphology of the tracts and the classification of fistulas based on St James University Hospital classification¹⁰. The current work builds on this model by incorporating the method of dynamic pelvic floor evaluation, which provides a more detailed description of underlying functional pathology. The current frequency of hiatal and anorectal abnormalities is indicative of the fact that chronic inflammatory processes and recurrent infections could induce the weakening of the levator ani complex. Old-time sepsis or surgery may result in fibrosis, scarring, and muscle exhaustion, and this damages the stability of the pelvis. The H- and M-lines differences between this cohort and the prior MRI studies of the pelvic floor dysfunction indicate that chronic pelvic inflammation is linked to the widening of the hiatal and levator descent^{12,13}.

The current findings are in line with what Darwish et al. (2014) found when they employed dynamic MRI to assess patients with pelvic floor dysfunction and found that the hiatal dimension and pelvic descent improved significantly during straining and defecation¹⁶. Their study population was also etiologically different, but the comparable ranges of quantitative H-line and M-line indicate that the patterns of functional impairment are similar to all pelvic floor disorders. Normal M-line values were determined by Goh et al. (2000) and have been established as around 1.2 cm in men and 1.1 cm in

women with little descent thereby straining¹⁴. Contrastingly, the average M-line in defecation in the present study was more than 4 cm in more than one occasion, which indicates the presence of abnormal pelvic motility and support loss. Likewise, the abnormal anorectal angle (ARA) variations ($> 15^\circ$) were observed in 29 cases and it has been found that excessive angulation is considered to be a sign of puborectalis relaxation and levator weakness. The fact that hiatal enlargement and descent during defecation is more frequent than on rest or during straining indicates the value of having a complete evacuation phase as part of MRI defecography. Research by El Sayed et al. (2008) and Colaiacono et al. (2014) also stated that dynamic pelvic behaviour is best illustrated with real-time assessment during evacuation. This is confirmed by the current results, since numerous functional abnormalities could be observed only at the defecation stage^{18,15}. Moreover, the fact that fistula grade and the metrics of the pelvic floor are associated demonstrates that fistulas are not only localised perianal diseases but can be related to the overall pelvic floor injuries. Complex or active tracts and high-grade (Grades IV-V) tracts had more deviations in H-line and M-line compared to low-grade lesions. This tendency can be used in accordance with the findings of Chaudhari et al. (2015), who observed that multifaceted and recurrent fistulas are likely to accompany perianal soft-tissue distortion and muscular involvement¹⁷.

A dynamic 3 T MRI was used to give a comprehensive imaging of the fistula anatomy and pelvic floor dynamics with one scan. The multiplanar nature of it was able to evaluate the integrity of the sphincter, extensions, abscesses, and levator mobility concurrently. This structural and functional correlation helps the surgeons in planning the right intervention, i.e. fistulotomy when the tract is simple to seton or advancement flap when the lesions are complex and with consideration of the resultant continence. MRI had clear advantages compared to the traditional methods, e.g. fistulography or endoanal ultrasound. Fistulography is not good at identifying secondary tracts, and endoanal ultrasound has a field of view and operator dependence^{3,5}. MRI, especially 3 T, offers a better spatial resolution, tissue contrast, and the possibility to map both active and inactive tracts using the intensity of signals and enhancement patterns⁷. The research also showed that high abnormal pelvic floor measures were common in active (66.2) and complex fistulas (58.8). This indicates that continued inflammation and abscess development can result in muscle spasm or fatigue of the pelvis, which changes the defecation mechanisms. The findings also support previous findings by Halligan et al. (2006) and Spencer et al. (1996), who reported the augmentation of the sphincter and levator in active diseases conditions^{2,8}.

The H-line is mirroring inference of the anteroposterior diameter of the levator hiatus that contains urethra, vagina (in women), and rectum. Its lengthening shows the expansion of hiatus, which is typically a result of the stretching of levator ani. The M-line is the length of the distance of the levator plate beneath the pubococcygeal line; elevated M-line indicates the downward movement of the pelvic floor. In the present study, both parameters gradually grew during rest to defecation, as well as in accordance with the biomechanical chain of evacuation but overstated in diseased conditions. Anorectal angle is an important functional index of puborectalis act. The angle generally gets slightly more during straining with the relaxation of puborectalis. The progressive extreme ($> 15^\circ$) or the paradoxical decline means dyssynergic activity. This cohort had 29 cases of abnormal angular change, which was in line with previous studies by Bitti et al. (2014) and Lalwani et al. (2013) that levator dysfunction and fascia weakness are contributing factors to the abnormal angular change^{13,12}. The angle of the levator plate, which was not commonly abnormal showed slight rotation downwards in higher grades. Similar results were found by a study carried out by Darwish et al. (2014), which reported a high levator plate angle in patients with pelvic floor weakness¹⁶. The combination of these measurements depicts the multifactorial derangement of the pelvic support structures in chronic perianal disease.

These findings have two clinical implications. To begin with, the presence of pelvic floor dysfunction with fistula-in-ano might be a cause of complications during the postoperative period like incontinence or recurrence, when not addressed effectively in the preoperative period. Diagnosis of hiatal widening or levator descent could assist the surgeon to modify the process to help preserve the sphincter¹⁹. Second, active or complex tracts identified by active or dynamic MRI can help in the

determination of chronicity and inflammatory activity of the disease and can be used to inform the medical treatment and the timing of the surgical procedure. MRI results are also used in the prediction of the results after various surgical procedures. The fistulas of lower grade containing pelvic support often respond to the traditional fistulotomy whereas high grade with severe dysfunction of the pelvic floor would be better treated by staged or sphincter-sparing procedures²⁰. Dynamic MRI, therefore, plays a role in diagnostic accuracy and prognosis of functions.

The pattern of changes in the pelvic floor as was observed in this study is similar to the past studies conducted on patients with pelvic floor dysfunction due to other etiologies. Here, the percentage of hiatal widening detected by MR defecography was 47.0% in all women with pelvic organ prolapse, which is almost equivalent to the present study in fistula patients¹³. There is variation in the populations although this similarity is an indication that chronic strain and inflammatory stress have parallel biomechanical influences on the levator complex. According to Darwish et al. (2014), MR characteristics of cystocele, rectocele, and enterocele were explained as fascial weakness¹⁶. In the current generation, unusual organ prolapse was not common, but gentle pelvic descent and angular alteration were common, supporting the idea that the pelvic floor is a unitary entity, which is at risk of damage due to chronic stress. Moreover, an abnormal position of H- and M-lines in the majority of cases during the act of defecation also supports the necessity of full dynamic assessment. El Sayed et al. (2008) focused on the fact that partial protocols that are restricted to the resting and straining phases underestimate the dysfunction severity¹⁸. The protocol that will be employed in this case is 3-phase which matches international recommendation and provides complete visualisation of physician movement. The main advantages of this study are the application of 3 Tesla MRI that has a better resolution and signal-to-noise ratio than lower-field systems. The research used a standardised imaging protocol both in the static and dynamic stages of the research, which provided a reproducibility of measurements. The imaging parameters (TR, TE, slice thickness, FOV) were maintained in accordance with the latest MR defecography guidelines, and the preparation of patients was the same, which improved the reliability of the data. The two-fold assessment morphological classification of the fistula and quantitative assessment of the parameters of the pelvic floor provided an opportunity to understand the disease behaviour in a multidimensional way. In addition, the combination of the two measures of activity and complexity provided an insight into the impact of inflammatory burden and architecture of the tract on pelvic mechanics.

Limitations

There are a number of limitations that have to be admitted. First, dynamic MRI was carried out in the supine position which is not physiological as compared to sitting position that is commonly used during defecation. This is standard in MRI but this could underestimate some levels of pelvic descent. Second, the population of the study was dominated with males (93.7%) and thus the findings cannot be generalised to females whose pelvic floor biomechanics is different. Third, the data were presented in the absolute form instead of being adjusted to the body size or the intra-observer reliability, which may have slightly affected the accuracy. Lastly, intra operative correlation of functional parameters was not done because of the ethical and logistical factors, although morphological correlation with surgical findings was implied by the pre-existing classification systems.

Future Implications

The future research can combine real-time defecography by MRI in the sitting position with open or tilt scans to offer a more physiologic evaluation. Diffusion-weighted sequences and contrast-enhanced sequences can be further included to help in better differentiating between active inflammation and fibrosis. Moreover, the association to the clinical outcome, including the level of continuity, postoperative recovery, and the rate of recurrence would assist in the determination of the prognostic worth of dynamic MRI parameters in the management of fistulas. The incorporation of the quantitative assessment of the pelvic floor into the routine MRI protocols would also benefit the preoperative examination of the all patients with perianal fistula that do not only detect the tracts but

also forecast the functioning results. It is a strategy that in favor of total MRI-based stratification in which anatomical and biomechanical information all contribute to personalised therapy.

Conclusion

A dynamic 3 Tesla MRI was used to give a thorough evaluation of the anatomical and functional elements of fistula-in-ano, with high levels of correlation between severity of the disease and pelvic floor dysfunction. The research showed that patients with higher grades especially Grade IV and V, had a strong hiatal enlargement, descent of the pelvic floor and changed anorectal and levator plate angles. Such results imply that fistula-in-ano is not confined to the localised perianal area it involves, but involves a prolonged impact on the entire system of pelvic support. The relationship between dynamic parameters and fistula activity or complexity is an indication of the importance of continuing inflammation and structural loss in weakening the pelvic floor. The defecation stage of MRI was the most effective in visualising functional derangements and therefore it is important to incorporate this stage in the standard procedures. The visualisation of sphincter integrity, the track activity, and the levator movement in a single examination enables specific mapping of the surgical site activities that reduce the number of postoperative complications and relapse. The measurable MRI parameters, including H-line, M-line, anorectal angle, and levator plate angle are the dependable parameters to measure dysfunction and intervention. Functional pelvic floor evaluation is important to clinical decision making and diagnostic accuracy by incorporating it into standard MRI reporting. Dynamic MRI is presented to be a better, non-invasive imaging modality with better capability of characterising fistula-in-ano effectively and comprehensively, with both structural and functional information that is vital in managing it and maintenance of long-term continence.

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