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Original Research Article

CORROBORATION OF TRANSPERINEAL/ TRANSLABIAL ULTRASONOGRAPHY AND DYNAMIC MRI IN EVALUATION OF PELVIC FLOOR DISORDERS

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ABSTRACT

Background: Aim: To collate the pelvic floor measurements during rest and valsalva measured by transperineal/ translabial ultrasonography and dynamic MRI, in patients with pelvic floor dysfunction.

Materials and Methods: This is a hospital-based prospective study performed on 50 patients with various pelvic floor dysfunction referred to radiology department from the gynecology and urology departments of Kurnool Medical College and Government general hospital. They were classified into those with stress incontinence, urge incontinence, fecal incontinence and mass per vagina and were subjected to two-dimensional transperineal ultrasonography (TPU) and dynamic magnetic resonance imaging. The study examined the measurements of bladder base below the pubococcygeal line (PCL), uterus below the pubococcygeal line, and "H" line with two modalities which were compared and analysed independently.

Results: In the present study, the data showed that, for age distribution, the majority (48%) of study group were within the 51-60 years age range. The BMI distribution was divided into three categories, with 52% falling within the 26-30 kg/m² range. The most common parity was 5, accounting for 34% of the group. The study showed that for measurement of bladder base below the PCL line, the findings were consistent between MRI and TPU. The correlation analysis for the bladder base below the PCL line between MRI and TPU measurements shows strong and significant correlations in all conditions. The paired sample t-test for the bladder base below the PCL line reveals significant correlation between MRI and TPU measurements in all conditions. But it was noticed that TPU can underestimate the need for surgical intervention as compared to MRI. For the measurement of uterus below the pubococcygeal line (PCL), both MRI and TPU provided consistent results. For the H-line measurement, MRI and Transperineal Ultrasound (TPU) showed minor variations but with both methods showing consistency in the mean H line measurement across different conditions. The paired sample t-test for the H line shows significant correlation between MRI and TPU measurements in all conditions. The results indicate statistically significant correlation between the two modalities.

Conclusion: The study concluded that transperineal ultrasound can be used as screening tool for evaluation of women with various pelvic floor dysfunction. Overall, the integration of ultrasound and dynamic MRI improves diagnostic precision and aids in the development of more effective management plans for pelvic floor disorders.

Keywords: MRI, PCL, USG, TPU, 'H' Line, Pelvic Floor Disorder.

INTRODUCTION

Pelvic floor failure is a condition that can cause pelvic organ prolapse, urine and fecal incontinence, difficult defecation, and pelvic discomfort, all of which can substantially compromise a woman's quality of life.[1]

The anterior, middle, and posterior compartment defects associated with pelvic floor dysfunction include cystocele, uterine descent, and rectocele.[2]

According to one study on women with Pelvic Floor Disorder (PFD), the lifetime chance of having a single surgical intervention for PFD was estimated to be 11.1%, and in 30% of instances, two or more surgical procedures were needed. The detrimental impact of PFD on the health care system in terms of cost, productivity, and quality of life is significant as life expectancies rise. Therefore, it is necessary to give primary attention to establish effective preventive techniques.[3]

PFD has a variety of causes, some of which are linked to the inefficiency or weakness of support networks.

A number of congenital and acquired risk factors, such as female sex, vaginal delivery, menopause, advanced age, multiparity, hysterectomy, connective tissue disorders, obesity, hypoestrogenism, chronic pulmonary disorders, and conditions linked to elevated abdominal pressure, are linked to pelvic floor failure.[4]

A complex array of muscular and fascial lesions ranging from stretching, insertion detachment, denervation atrophy, and combinations of pelvic floor relaxation to pelvic organ prolapse may manifest in a single patient. To lower the relapse rate, which is reported to be as high as 30%, a thorough preoperative assessment of pelvic floor dysfunction is required.[5]

Dynamic MRI (Magnetic resonance imaging) of the pelvic floor is a two-step procedure which includes analysing anatomical damage on axial fast spin-echo (FSE) T2-weighted images and functional evaluation using sagittal dynamic single-shot T2- weighted sequences during straining and defecation.

Transperineal/translabial ultrasound is gaining more importance recently in imaging of pelvic floor.[6]

The two imaging methods have numerous benefits in common, including no radiation, non-invasiveness and good soft tissue contrast.

Transperineal ultrasound excels in cost-effectiveness, repeatability, and reproducibility of the examination, which may be carried out in an outpatient basis, in addition to the previously listed combined advantages. MRI, however, performs better when imaging a larger volume of pelvis.

Therefore, imaging (MRI and transperineal ultrasound) constitutes a potent tool that helps radiologists to thoroughly assess pelvic anatomical and functional problems, assisting surgeons in treating patients appropriately and avoiding the need for repeat procedures.

Aim and objectives of the study

To collate the pelvic floor measurements during rest and valsalva measured by transperineal/ translabial ultrasonography and dynamic MRI, in patients with dysfunction of pelvic floor.

The following parameters will be compared:

1. Bladder base below PCL line.
2. Uterus below PCL line.
3. H line.

MATERIALS AND METHODS

This is a hospital-based prospective cross-sectional study performed on 50 patients with various pelvic floor dysfunction referred to radiology department from the gynecology and urology departments of Kurnool Medical College and Government general hospital, over a period of 21 months from October 2022 to June 2024

Inclusion Criteria

1. Multiparous women with pelvic organ prolapse, stress incontinence, urge incontinence and fecal incontinence.

Exclusion Criteria

1. Procidentia
2. Cardiac pacemaker
3. Cochlear implants
4. Claustrophobia

Procedure, Equipment and Sequences

- All patients included in the study or their guardians were explained about the procedure and informed consent taken from them.
- All the patients underwent dynamic MRI after ultrasound evaluation.
- The ultrasound was performed using Ultrasound machine (E-Saote MyLab X6), curvilinear probe using a trans labial/transperineal approach. Pelvis was evaluated both during rest and Valsalva.
- Dynamic MRI was performed on 1.5Tesla super conducting magnet, Philips INGENIA machine using torso phased array coil and body coil with sequences including T1 localiser sequence; axial, sagittal and coronal T2 TSE sequence for anatomical evaluation; and sagittal single shot SSH-TSE sequence for dynamic evaluation (Rest, strain, squeeze and defecation phases); after filling the rectum with ultrasound gel.

RESULTS

The study included 50 women with pelvic floor dysfunction who were referred to radiology department from gynaecology and urology departments, GGH, Kurnool and the following observations were made.

All 50 patients were classified based on their symptoms in to those with mass per vagina (MV), stress incontinence (SI), urge incontinence (UI), and fecal incontinence (FI), and they were subjected to

both two-dimensional transperineal ultrasonography and dynamic magnetic resonance imaging.
The following metrics were compared and analysed independently with two modalities.

1. Bladder base below the PCL line.
2. Uterus below the PCL line.
3. "H" line.

Table 1: Distribution of Patients according to their Age

S.NO	Age (Yrs)	Number (%)
1	31-40	3 (6)
2	41-50	15 (30)
3	51-60	24 (48)
4	61-70	8 (16)
	Total	50 (100)
	Mean ± S. D	53.68±7.25

The data (table 1) presents the age distribution of a group of 50 individuals, categorized into four age brackets. The majority of the patients (48%) fall within the 51-60 years age range and least proportion, 6%, in the 31-40 years range. The total number of individuals is 50, with the mean age being 53.68 years and a standard deviation of 7.25 years.

Table 2: Distribution of Patients according to Parity

Parity	Number (%)
3	8 (16)
4	15 (30)
5	17 (34)
6	8 (16)
7	2 (4)
Total	50 (100)

The data (Table 2) presents the parity distribution among a group of 50 patients. The most of the patients belonged to parity 5, accounting for 34% of the group, while least belonged to parity 7 (4%).

Table 3: Distribution of Patients according to Clinical Presentation

Presentation	Number (%)
MV	20
MV, SI	7
MV, SI, UI	6
MV, UI	8
SI, MV, FI	2
UI, SI	7
Total	50(100)

The data (Table 3) shows the distribution of individuals based on different combinations of clinical presentation categories. The most common category is MV (Mass per vagina) alone, with 20 individuals. The combinations of MV and SI; and UI and SI each include 7 individuals. The MV and UI combination has 8 individuals, while MV, SI, and UI together account for 6 individuals. The least common category is combination of SI, MV, and FI with 2 individuals.

BLADDER BASE BELOW PCL LINE

Table 4: Distribution of Patients based on Bladder base below PCL Line

S.NO	Parameter	MRI			Transperineal USG		
		Rest	Valsalva	Normal	Rest	Valsalva	Normal
1	Bladder base below PCL line	6	40	4	6	40	4

The data (Table 4) presents the evaluation of bladder base position relative to the pubococcygeal line (PCL) using MRI and Transperineal ultrasound under different conditions. For both MRI and Transperineal USG, the bladder base is below the PCL line in 6 cases at rest, in 40 cases during the Valsalva maneuver, and is positioned normally in 4 cases.

Table 5: Bladder Base below PCL line: Paired sample Statistics

Parameter	Mean (c.m)	Number	STDEV
MRI Rest	1.6	6	0.08
TPU Rest	1.58	6	0.21
MRI Valsalva	3.37	40	1.08
TPU Valsalva	3.21	40	0.99
MRI Normal	0.73	4	0.13
TPU Normal	0.77	4	0.14

The data (Table 5) presents the mean bladder base position relative to the pubococcygeal line (PCL) under different conditions using MRI and Transperineal Ultrasound (TPU), along with the number of cases and standard deviations (STDEV).
At rest, the mean bladder base position below baseline is 1.6 cm for MRI with 6 cases and a standard deviation of 0.08 cm, while for TPU, it is 1.58 cm with 6 cases and a standard deviation of 0.21 cm. During the Valsalva maneuver, the mean bladder base position below base line is3.37 cm for MRI with 40 cases and a standard deviation of 1.08 cm, and for TPU, it is 3.21 cm with 40 cases and a standard deviation of 0.99cm.For the normal cases, the mean bladder base position is 0.73 cm for MRI with 4 cases and a standard deviation of 0.13 cm, whereas for TPU, it is 0.77 cm with 4 cases and a standard deviation of 0.14 cm.
This indicates that the measurements are consistent between MRI and TPU across different conditions.

Table 6: Bladder base below PCL line during Valsalva

S.NO	Parameter	>2cm	>1 cm to ≤2 cm
1	MRI	35	5
2	TPU	30	10

Patients with bladder base below PCL line >2cm needs surgical intervention. The above data (Table 6) evaluates the position of the bladder base relative to the pubococcygeal line (PCL) using MRI and Transperineal Ultrasound (TPU), specifically focusing on cases where the bladder base is below the PCL line. It shows that among 40 patients who had bladder base below PCL line during valsalva maneuver, 35 of them had value of more than 2cm using MRI thus indicating the need for surgical intervention and 5 patients had value less than 2 cm and more than 1 cm. For the same 40 patients, transperineal USG showed that for 10 patients the value was below 2cm and more than 1cm, thus underestimating the need for surgical intervention. Hence the limited use of transperineal USG, regarding this parameter in selecting the patient for surgery has to be kept in mind.

Table 7: Bladder base below PCL line: Paired sample Correlations

Parameter	Number	Correlation	Significant
MRI rest & TPU rest	6	0.993	0.007
MRI Valsalva & TPU Valsalva	40	0.963	<0.00001
MRI Normal & TPU Normal	4	0.9855	0.002

The correlation analysis for the bladder base below the PCL line between MRI and TPU measurements shows strong and significant correlations in all conditions. Specifically, at Rest, for MRI and TPU, the correlation is 0.993 with a significance of 0.007. At Valsalva, For MRI and TPU, the correlation is 0.963, which is highly significant at less than 0.00001. For MRI and TPU in Normally positioned bladder base, the correlation is 0.9855 with a significance of 0.002. These results indicate a very high consistency between MRI and TPU measurements across all conditions.

Table 8: Bladder base below PCL line: Paired sample T test

Parameter	T test	Df	Significant
MRI Rest & TPU Rest	12.82	5	<0.001
MRI Valsalva & TPU Valsalva	16.54	39	<0.001
MRI Normal & TPU Normal	3.71	3	<0.001

The paired sample t-test for the bladder base below the PCL line reveals significant correlation between MRI and TPU measurements in all conditions. At rest, for MRI and TPU measurements, the T test value is 12.82 with 5 degrees of freedom and a p value of less than 0.001. On Valsalva, for MRI and TPU measurements, the T test value is 16.54 with 39 degrees of freedom and a p value of less than 0.001. For MRI and TPU values in Normal bladder base, the T test value is 3.71 with 3 degrees of freedom and a p value of less than 0.001.

UTERUS BELOW PCL LINE

Table 9: Distribution of Patients based on Uterus below PCL Line

Parameter	MRI			Transperineal USG		
	Rest	Valsalva	Normal	Rest	Valsalva	Normal
Uterus below PCL line	4	38	8	4	38	8

The data (Table 9) presents the evaluation of Uterus below the pubococcygeal line (PCL) using MRI and Transperineal Ultrasound under different conditions. For both MRI and Transperineal USG, the uterus is below the PCL line in 4 cases at rest, in 38 cases during the Valsalva maneuver, and is positioned normally in 8 cases. This indicates consistent findings between MRI and Transperineal USG under both rest and Valsalva conditions.

Table 10: Uterus below PCL line: Paired sample Statistics

Parameter	Mean (c.m)	Number	STDEV
MRI Rest	1.56	4	0.08
TPU Rest	1.48	4	0.20
MRI Valsalva	3.34	38	1.48
TPU Valsalva	3.3	38	0.99
MRI Normal	0.74	8	0.08
TPU Normal	0.78	8	0.13

For the uterus below the PCL line, paired sample statistics show the mean and standard deviation for MRI and TPU measurements. At rest, MRI shows mean of1.56 cm (STDEV 0.08) and TPU shows mean of 1.48 cm (STDEV 0.20). During Valsalva, MRI shows a mean of 3.34 cm (STDEV 1.48) while TPU shows a mean of 3.3 cm (STDEV 0.99). In the normal condition, MRI has a mean of 0.74 cm (STDEV 0.08) and TPU has a mean of 0.78 cm (STDEV 0.13).

Table 11: Uterus below PCL line: Paired samples Correlations

S.NO	Parameter	Number	Correlation	Significant
1	MRI Rest & TPU Rest	4	0.89	0.43
2	MRI Valsalva & TPU Valsalva	38	0.344	0.034
3	MRI Normal & TPU Normal	8	0.82	0.01

The correlation analysis for the uterus below the PCL line shows varying levels of correlation between MRI and TPU. At rest, for MRI and TPU measurements, the correlation is 0.89 but not statistically significant (p- 0.43). For MRI and TPU measurements on valsalva, the correlation is 0.344 with p value of 0.034, indicating a moderate correlation. For MRI and TPU measurements in normally positioned uterus, the correlation is 0.82 with p value of 0.01, indicating a strong and significant correlation.

H LINE

Table 12: Distribution of Patients based on H Line

S.NO	Parameter	MRI			Transperineal USG		
		Rest	Valsalva	Normal	Rest	Valsalva	Normal
1	H Line	25	20	5	25	20	5

The data shows the distribution of patients in reference to the measurement of H line under different conditions as measured by MRI and Transperineal Ultrasound. Both MRI and USG measurements showed abnormal H line in 25 cases at rest, in 20 cases during the Valsalva maneuver, and 5 cases had normal H line. This indicates that both MRI and Transperineal USG provide consistent results in measuring H line.

Table 13: H-Line: Paired samples Correlations

Parameter	Number	Correlation	Significant
MRI Rest & TPU Rest	25	0.65	0.001
MRI Valsalva & TPU Valsalva	20	0.56	0.01
MRI Normal & TPU Normal	5	0.92	0.02

The correlation analysis for the H line shows varying levels of correlation between MRI and TPU. For abnormal H value at rest, the correlation is 0.65 with a significance of 0.001, indicating a moderate and significant correlation. For abnormal H line during the Valsalva maneuver, the correlation is 0.56 with a significance of 0.01, indicating a moderate correlation. For patients with normal H line, the correlation is 0.92 with a significance of 0.02, indicating a very strong and significant correlation

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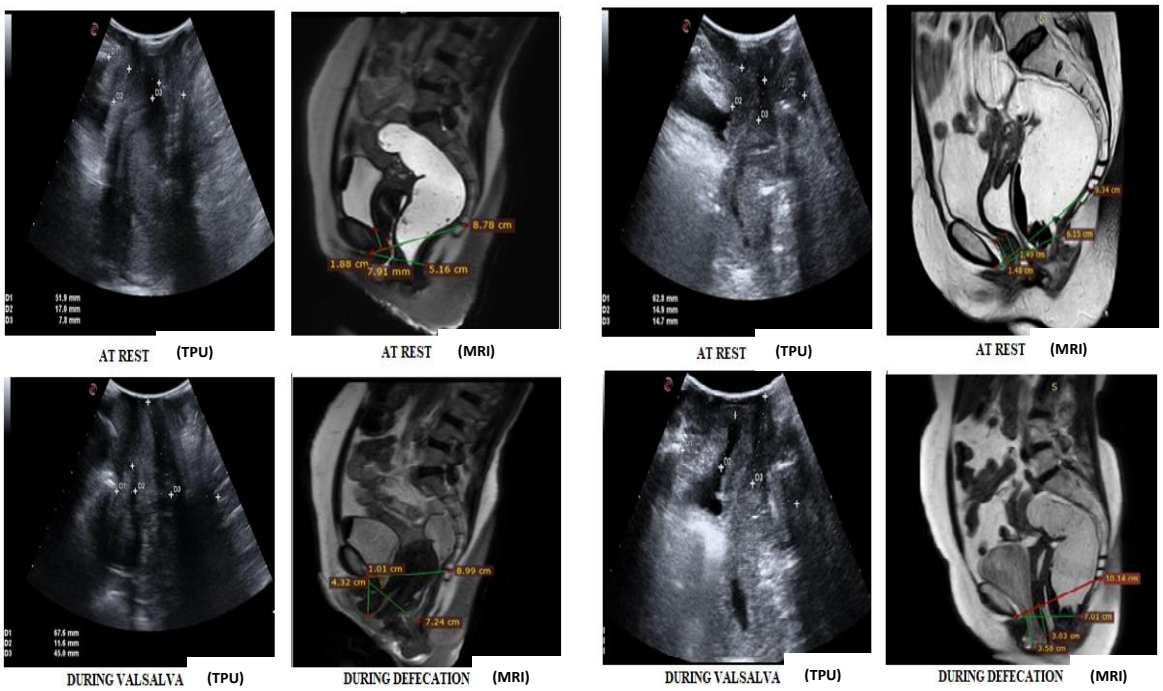
Table 14: H-line: Paired sample test

S.NO	Parameter	T test	Df	Significant
1	MRI Rest & TPU Rest	4.31	24	0.03
2	MRI Valsalva & TPU Valsalva	2.12	19	0.04
3	MRI Normal & TPU Normal	1.36	4	0.01

The paired samples t-test for the H line shows significant correlation between MRI and TPU measurements in all conditions. For abnormal H value at rest, the T test value is 4.31 with 24 degrees of freedom and p value of 0.03. For abnormal H line during the Valsalva maneuver, the T test value is 2.12 with 19 degrees of freedom and p value of 0.04. For patients with normal H line, the T test value is 1.36 with 4 degrees of freedom and p value of 0.01. These results indicate statistically significant correlation between the two methods.

REPRESENTATIVE CASES



CASE 1: Transperineal ultrasound (TPU) and Dynamic MRI images

CASE 2: Transperineal ultrasound (TPU) and Dynamic MRI images

Findings of case 1

	TPU (rest)	TPU (Valsalva)	MRI (rest)	MRI (defecation phase)
Bladder base	1.7 cm above baseline	1.1 cm below baseline	1.8cm above baseline	1.1 cm below baseline
Uterus	0.78 cm above baseline	4.5 cm below baseline	0.79 cm above baseline	4.3 cm below baseline
H line	5.1 cm	6.7 cm	5.1 cm	7.1 cm

Findings of case 2

	TPU (rest)	TPU (Valsalva)	MRI (rest)	MRI (defecation phase)
Bladder base	1.5 cm above baseline	3.3 cm below baseline	1.5 cm above baseline	3.6 cm below baseline
Uterus	1.5 cm above baseline	2.9 cm below baseline	1.5 cm above baseline	3 cm below baseline
H line	6.3 cm	6.9 cm	6.2 cm	7 cm

DISCUSSION

The corroboration of transperineal/translabial ultrasonography (TPUS/TLUS) and dynamic magnetic resonance imaging (MRI) in evaluating pelvic floor disorders (PFD) offers significant insights into diagnostic accuracy and utility.

Both modalities have demonstrated strong correlation in assessing conditions such as levator ani deficiency and other PFD-related abnormalities. Dynamic MRI is often considered the gold standard due to its comprehensive visualization capabilities, allowing detailed assessment of pelvic floor anatomy and functional disorders. However, MRI is resource-intensive, less accessible, and costly, particularly in developing regions.[7]

TPUS/TLUS, on the other hand, presents a practical and widely available alternative. It is non-invasive, relatively inexpensive, and more accessible, making it a valuable tool in settings with limited resources. Studies have shown that TPUS/TLUS can reliably detect and grade LAD, providing comparable results to MRI. This supports the potential of TPUS/TLUS as a frontline diagnostic tool for PFD, with MRI reserved for more complex or inconclusive cases.[8]

Our study included 50 women with pelvic floor dysfunction who presented to gynaecology and urology clinic and were subjected to two-dimensional transperineal ultrasonography and dynamic magnetic resonance imaging. The parameters namely bladder base below PCL, uterus below PCL and H line were

compared between the two modalities and assessed independently:

Age Distribution

The age distribution of the group of 50 individuals was categorized into four age brackets. The majority of the individuals (48%) fell within the 51-60 years age range, followed by 30% in the 41-50 years range, 16% in the 61-70 years range, and a small portion, 6%, in the 31-40 years range. The total number of individuals is 50, with the mean age being 53.68 years and a standard deviation of 7.25 years. Dahlia O El-Haieg reported that 73 women with PFD symptoms were included. Their men age was 41.5yrs.(range23-65yrs.) Sudha et al 9 reported the mean age of the participants is approximately 55.48 years, with a standard deviation of 3.10 years.

Complaints

The distribution of individuals based on different combinations of presentation categories, specifically medical conditions, showed that the most common category was MV (Mas per vagina) alone, with 20 individuals. The combinations of MV and SI (Stress incontinence), and UI (Urinary incontinence) and SI each included 7 individuals. The MV and UI combination had 8 individuals, while MV, SI, and UI together accounted for 6 individuals. The least common category was SI, MV, and FI (Fecal incontinence), with 2 individuals. This is similar to Sudha et al study[9].

Bladder base below the PCL line

The evaluation of the bladder base position relative to the pubococcygeal line (PCL) using MRI and Trans perineal Ultrasound (TPU), specifically focusing on cases where the bladder base was below the PCL line, showed that, for MRI, in 5 cases, the bladder base was between more than 1cm to 2 cm below the PCL line and there were 35 cases where the bladder base was more than 2 cm below the PCL line thus indicating the need for surgery. Whereas for transperineal ultrasound, in 10 cases, the bladder base was between more than1cm to 2 cm below the PCL line and there were 30 cases where the bladder base was more than 2 cm below the PCL line thus underestimating the need for surgery in the patients.

Yang et study showed that the reference values for bladder base position relative to the PCL are as follows: At rest, the bladder base position is -2.3 ± 0.46 cm. During straining (Valsalva maneuver), the bladder base position is 0.81 ± 1.11 cm.[10] In comparison to the reference values, the findings from MRI and Transperineal USG evaluations showed that a significant number of cases had the bladder base positioned below the PCL line, particularly during the Valsalva maneuver.

Uterus below the PCL line

For both TPU and MRI, the uterus is below the PCL line in 4 cases at rest, in 38 cases during the Valsalva maneuver, and is positioned normally in 8 cases. The correlation analysis for the uterus below the PCL line shows varying levels of correlation between MRI and TPU.

H line

Both MRI and USG measurements showed abnormal H line in 25 cases at rest, in 20 cases during the Valsalva maneuver, and 5 cases had the normal H-value. This indicated that both MRI and Trans perineal USG provided consistent results for detecting the abnormal H line across different conditions.

The correlation analysis for the H line shows varying levels of correlation between MRI and TPU. The paired samples t-test for the H line shows significant correlation between MRI and TPU measurements in all conditions.

Our study results were almost in agreement with the conclusions drawn by study done by Sudha et al.[9]

The anterior and middle (apical) compartment prolapse on MRI has been demonstrated to be significantly affected by two variables:

1.The usage of the defecation phase and

2.Distention of the rectum.

Defecation was the only method during which about half of cystoceles and nearly two thirds of uterine/vaginal apex descent were observed in a study of individuals who used upright MR Defecography[11](MRD). Neither strain nor Valsalva were used during this trial. Only with defecation, and not with strain or Valsalva, were roughly forty percent of cystoceles and approximately twenty percent of uterine/vaginal apex descent observed in a closed magnet with left lateral decubitus placement[12]. The findings were comparable, albeit relatively less significant.

According to study done by Khatri G, defecation images on MRD in comparison to pre-defecation Valsalva images produced with rectal gel and post-defecation Valsalva images performed with restricted rectal distention were shown to have a higher prevalence and magnitude of anterior and middle (apical) compartment prolapse[12].This was found to be the case when comparing the two types of images. In addition, the anterior and middle (apical) compartment prolapses were shown to be more numerous and larger on the post-defecation Valsalva pictures in comparison to the pre-defecation Valsalvas[12]. Though this was not the objective of our study similar findings were found in our study.

If the MRD is being performed specifically to confirm the presence of suspected anterior and middle (apical) compartment prolapse, then pre-filling or post-evacuation dynamic MRD and defecation can be considered necessary.

MR Defecography may be of assistance in the process of pre-surgical planning for patients who have anterior and middle (apical) compartment prolapse. This is because it makes it easier to discover cul-de-sac hernias, multicompartment prolapse, and pelvic foor muscle and fascial deficiencies prior to undertaking surgical procedures

CONCLUSION

The study involving 50 patients with pelvic floor dysfunction who were assessed using two-dimensional transperineal ultrasonography and dynamic magnetic resonance imaging demonstrated a high degree of consistency between MRI and ultrasound in detecting bladder base and uterus positions relative to the pubococcygeal line (PCL) and measuring H line across different conditions, confirming both modalities utility.

Both imaging techniques effectively identified pelvic floor abnormalities, though MRI offered more detailed anatomical views, especially useful in complex cases. Correlation analyses revealed strong relationships between MRI and ultrasound measurements, but minor discrepancies suggested the need for cautious interpretation in clinical practice.

The study highlights the complementary nature of these modalities, providing a comprehensive assessment of pelvic floor dysfunction, particularly useful in older women and those with higher BMI. Understanding the relationship between parity and pelvic floor changes further underscores the importance of tailored diagnostic approaches.

The limitation of transperineal ultrasound is measuring the length of bladder base below PCL line, uterus below PCL line, and H line in patients with pelvic floor weakness during valsalva. MRI detects the abnormal length accurately. In treatment point of view the length in centimeter is very important but transperineal ultrasound detects the abnormality but accuracy of length could not be ascertained. So transperineal ultrasound can be used as screening tool for evaluation of women with various pelvic floor dysfunction. Overall, the integration of ultrasound and dynamic MRI improves diagnostic precision and aids in the development of more effective management plans for pelvic floor disorders.

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