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Original Research Article

Role of magnetic resonance imaging in evaluation of vault prolapse

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ABSTRACT

Background: Vault prolapse usually follows vaginal or abdominal hysterectomy and is usually associated with cystocele, rectocele and enterocele. Diagnosis is made clinically but magnetic resonance imaging can better detect enterocele than clinical finding.
Methods: It was a prospective study over 3 years, so women presenting with vault prolapse, in which grading of vault prolapse was made clinically and by pelvic organ prolapse quantification (POPQ). Magnetic resonance imaging was performed for all cases to quantify prolapse and compare findings of MRI and POPQ with intraoperative findings of prolapse.
Results: Mean age, parity, BMI were 58.4 years, 3.5, 22.71kg/m^2 respectively. Most patients (75%) had vaginal hysterectomy while 25% had abdominal hysterectomy. Symptoms were pressure in lower abdomen and perineum (55%), bulge and feeling of mass descending in perineum (100%) and chronic constipation (60%). The type of prolapse was cystocele (100%), rectocele (100%), vault prolapse (100%) and enterocele (45%). MRI had agreement with intraoperative findings in 65% cases in cystocele, 45% cases in vault prolapse, 50% in rectocele but had much higher agreement of 88.8% for enterocele. While POPQ had higher agreement with intraoperative findings for cystocele (80%), vault prolapse (98%), rectocele (80%) but had poorer agreement for enterocele (66.6%).
Conclusions: This study demonstrated that MRI was inferior in diagnosis of cystocele, rectocele and vault prolapse than POPQ but was superior in identification of enterocele than POPQ.

Keywords: Cystocele, Enterocele, Magnetic resonance imaging, Pelvic organ prolapse quantification, Rectocele, Vault prolapse

INTRODUCTION

Pelvic floor disorder especially pelvic organ prolapse are common, affecting up to 25% of women with 75% of them reporting negative impact of it in their quality of life.[1] Up to 12% of these prolapse cases involve the apical compartment including post hysterectomy vaginal vault prolapse.[2] Incidence of clinically significant post hysterectomy vaginal vault prolapse requiring surgical intervention has been estimated to be 36/10,000 women per year. Similarly the total incidence of post hysterectomy vault prolapse is 1.8% but increases up to 11.6% for women who underwent hysterectomy for uterovaginal prolapse.[1,2] The most frequent symptoms of pelvic organ prolapse includes sensation or something coming or falling out of vagina, urinary incontinence, faecal incontinence, having to push up on the perineum or digitate vagina to micturate or defecate and vaginal discomfort during sexual intercourse.[3] Etiological factors include method of delivery, new-born birth weight and body mass index simply affects the occurrence of prolapse.[3,4]

Diagnosis of pelvic organ prolapse including vault prolapse is made from symptoms and clinical examination. However clinical examination may miss findings. The Baden Walker Halfway grading system is a commonly used physical examination for pelvic organ prolapse by describing prolapse on scale of 0 to 4 in relation to hymen but has limitations.[5] Pelvic Organ Prolapse Quantification (POPQ) is a physical examination technique used to quantify the prolapse. POPQ provides objective, site specific protocol for describing, quantifying and staging the pelvic organ prolapse including vault prolapse.[1] The POPQ system has observed to be reproducible and provides a precise method of communicating physical examination findings of prolapse and has been accepted as a standard for describing prolapse by various gynaecological societies like society of Gynaecological Surgeons, The International Incontinence Society, The International Urogynaecology Society. The POPQ stages prolapse in relation to hymen as anterior, middle and posterior compartment prolapse.[5]

Dynamic pelvic magnetic resonance imaging (MRI) is an objective radiological imaging method used to evaluate the pelvic floor and pelvic organ prolapse especially as a part of preoperative assessment.[1,6] It uses a multiphasic radiological protocol in which multiple MRI images are taken at rest and during straining or Valsalva and can be combined with defecography in which contrast is instilled in vagina and rectum.[1,6] During dynamic MRI and by adding defecography in which evacuation phase uses expulsion of rectal contrast mimicking natural physiological conditions causing POP or prolapse may be observed which is not apparent , when external sphincter is closed and pelvic floor is contracted.[1,6,7] Dynamic MRI hence can detect enterocele which may be missed clinically or by POPQ examination. This may have a bearing on the outcome of POP surgery by adequately operating for the enterocele during surgery for POP giving better results and lesser incidence of post hysterectomy vault prolapse and enterocele.

The present study was conducted to evaluate the role of dynamic MRI in prospective evaluation of post hysterectomy vault prolapse cases as compared to POPQ system with intraoperative finding being taken as gold standard for comparison.

METHODS

It was a prospective study, conducted over 20 patients of vault prolapse following abdominal or vaginal hysterectomy admitted in our tertiary referral hospital- All India Institute of Medical Sciences, New Delhi, India over three year period for surgery for vault prolapse. The study was conducted from January 2015 to December 2017. The inclusion criteria included women with post hysterectomy vault prolapse irrespective of indication and type of hysterectomy between 25-85 years of age, who were willing to participate in the study. The study was approved by institute ethical committee, informed written consent was taken from all participants. The women with general prolapse, nulliparous prolapse, claustrophobic to MRI, obstetric patient, patient with implants, and who were not willing to participate in the study were excluded from the study. Detailed history was taken from all the patients regarding symptoms of prolapse, any urinary complaints (SUI or urge incontinence) any bowel problem like faecal incontinence, detailed obstetric history (mode of delivery, any obstructed or difficult labour), any chronic cough, constipation, and smoking. All women underwent general physical examination, measurement of BMI, chest, abdominal and gynaecological examination including local examination, speculum and vaginal examination to look for prolapse, its grading as per POPQ (Pelvic Organ Prolapse Quantification) as described by Bump et al.[8]

Pelvic muscle function assessment was done and recto-vaginal examination was done to assess basal and contracted tone of anal sphincter complex. POPQ grid charting was made as per Bump et al.[8]

Baseline investigations like complete hemogram, blood sugar (fasting and postprandial), renal and liver function test, urine examination, urine culture were done for all cases. Urodynamic study was done only when women had any urinary incontinence.

All women underwent dynamic magnetic resonance imaging using Siemens Avanto 1.5 Tesla system using body array surface coil free of cost combination of static and dynamic MRI was used. Static section included T2 weighted turbo spin echo sequence of pelvis in axial and sagittal orientation. The dynamic section taken was a T2 weighted single slice true FISP/HASTE sequence. Standard slice orientation included a mid-sagittal and an axial alignment to provide information about urogenital hiatus and contents (enterocele, rectal descent, descending perineum).

During the measurement, patients were asked to relax their pelvic floor, then slowly contract and relax. Then the patients were asked to increase the abdominal pressure by straining and thus levator muscle was also localised for measurement. The prolapse was graded in reference to the ‘H’ line referring to the puborectalis hiatus.

All patients underwent surgery for vault prolapse (vaginal sacrospinous fixation, or abdominal sacropexy as per clinical situation) and grading of vault prolapse and other compartment defects were graded as per intra-operative findings which was considered gold standard for comparison. The grading of pelvic organ prolapse used for MRI was that of Lienemann et al as compared to H line as grade 0 (above H line no prolapse), grade 1 (mild or small, 0-2 cm below H line), grade 2 (moderate, 2-4 cm below H line), grade 3 (severe or large, >4 cm below H line, measurement measured at mid sagittal MR image as taken on maximal strain.[9]

Material and data analysis

Findings were compared using sum of square of means and Chi square test. The degree of changes of levator plate on MRI was correlated with stages of vault prolapse using Pearson's coefficient after Bivariate regression analysis. Assessment of coherence between the clinical evaluation and MRI was done using Alpha new and Kappa coefficient.

RESULTS

The characteristics of patients in the present study and their symptoms and sign are shown in Table 1.

Table 1: Characteristics of symptoms of patients with vault prolapse (n=20).

Characteristics	Number	Percentage
Age (years)		
Range	38-66	
Mean±SD	54.8±9.21	
Parity		
Range	1-6	
Mean±SD	3.5±1.2	
Body mass index (kg/m^2)		
Range	19.2-29.7	
Mean±SD	22.71±2.47	
Socioeconomic status		
Lower	12	60
Moderate	7	35
Upper	1	5
Past surgery	20	100
VH+ACR+PCPR	15	75
Abdominal hysterectomy (AUB)	3	15
Abdominal hysterectomy (fibroid)	2	10
Complaints		
Pressure in lower abdomen and perineum	11	55
Urinary retention	2	10
Stress urinary incontinence	5	25
Sensation of bulge in perineum	20	100
Feeling of mass descending per vaginum	20	100
Dyspareunia	3	15
Bowel dysfunction	3	15
Fecal incontinence	3	15
Incomplete evacuation of stool	8	40
Constipation	12	60
Obstetric features		
Normal vaginal delivery	15	75
Instrumental delivery	3	15
Prolonged labor	2	10
Caesarean section	1	5
Associated features		
Chronic constipation	14	70
COPD	3	15
Chronic smoking	4	20
Obesity (BMI>25 kg/m^2)	2	10
Intraoperative examination findings		
Cystocele	20	100
Rectocele	20	100
Vault prolapse	20	100
Enterocele	9	45

Most patients belonged to lowest moderate socioeconomic status as per Kuppuswamy classification. All patients had hysterectomy before with 15 (75%) vaginal hysterectomy with anterior colporraphy and posterior colpoperineorrhaphy while 5 (25%) had abdominal hysterectomy with 3 (15%) for abnormal uterine bleeding, 2 (10%) for fibroid uterus. Various symptoms of patients were pressure in lower abdomen and perineum in 11 (55%), urinary retention in 2 (10%), stress urinary incontinence in 5 (25%), sensation of bulge in perineum in all 20 (100%), dyspareunia in 3 (11%), sexual dysfunction in 3 (15%), faecal incontinence in 3 (15%), incomplete evacuation of stool in 8 (40%), constipation in 12 (80%) cases. In obstetric history 14 (70%) had vaginal delivery, 3 (15%) had instrumental delivery, 2 (10%) had prolonged labour, only 1 (5%) had caesarean section. Other associated features were chronic constipation in 14 (70%), chronic obstructive pulmonary disease in 3 (15%) cases, chronic smoker in 4 (20%) and obesity in 2 (10%) cases.

The intraoperative examination findings are also shown in Table 1. Thus all 20 (100%) women had vaginal dryness, cystocele, rectocele and vault prolapse, while 9 (45%) women had associated enterocele. Intraoperative findings with which findings of POPQ (pelvic organ prolapse quantification) and MRI were compared.

Table 2: Summary of findings on agreement between different levels of vault prolapse staging.

Cystocele	Level of agreement (%)	P value
POPQ with intraoperative	0.630	0.012
Agreement	16 (80)	
Disagreement	4 (20)	
Over-diagnosis	3 (15)	
Under-diagnosis	2 (10)	
MRI with intraoperative	0.630	0.768
Agreement	13 (65)	
Disagreement	7 (35)	
Over-diagnosis	3 (15)	
Under-diagnosis	2 (10)	
POPQ with MRI	0.638	0.768
Agreement	8 (40)	
Disagreement	12 (60)	
Over-diagnosis	4 (20)	
Under-diagnosis	8 (40)	
Vault prolapse		
POPQ with intraoperative	0.804	0.001
Agreement	18 (90)	
Disagreement	2 (10)	
Over-diagnosis	0 (0)	
Under-diagnosis	2 (10)	
MRI with intraoperative	0.104	0.603
Agreement	9 (45)	
Disagreement	11 (55)	
Over-diagnosis	2 (10)	
Under-diagnosis	9 (45)	
POPQ with MRI	0.118	0.517
(Poor agreement)		
Entereocele (Number-9)		
POPQ with intraoperative	0.412	0.107
Agreement	6/9 (66.66)	
Disagreement	3/9 (33.33)	
Over-diagnosis	0 (0)	
Under-diagnosis	3 (33.33)	
MRI with intraoperative	0.737	0.016
Agreement	8/9 (88.88)	
Disagreement	1/9 (11.11)	
Over-diagnosis	0 (0)	
Under-diagnosis	1 (11.11)	
POPQ with MRI	0.615	0.035

Continued.

Cystocele	Level of agreement (%)	P value
Rectocele		
POPQ with intraoperative	0.459	0.011
Agreement	12 (60)	
Disagreement	8 (40)	
Over-diagnosis	4 (20)	
Under-diagnosis	4 (20)	
MRI with intraoperative	0.306	0.100
Agreement	10 (50)	
Disagreement	10 (50)	
Over-diagnosis	4 (20)	
Under-diagnosis	6 (30)	
POPQ with MRI	0.342	0.045
(Poor agreement)	-	-

Table 2 shows summary of findings on agreement between different methods of vault prolapse staging. For anterior compartment defect (cystocele) POPQ had agreement with intraoperative findings in 16 (80%) cases with over-diagnosis in 3 (15%) and under-diagnosis in 2 (10%) cases, while MRI had agreement with intraoperative findings in 13 (65%) cases, over-diagnosis in 3 (15%) and under-diagnosis in 2 (10%) cases. MRI and POPQ had agreement in only 8 (40%). Using MRI over-diagnosing cystocele in 4 (20%) and under-diagnosing cystocele in 8 (40%) cases. Middle compartment defect (vault prolapse) MRI had agreement with intraoperative findings in only 9 (45%) cases over-diagnosing in 2 (10%) cases but under-diagnosing in 9 (45%) cases. POPQ and MRI had poor agreement with each other. Hence POPQ had better agreement with vault prolapse intraoperative findings as compared to MRI which had poor agreement and had under-diagnosed vault prolapse.

Enterocele was present in 9 cases only. MRI scored over POPQ in enterocele and had agreement in 8 out of 9 (88.8%) cases and under-diagnosed enterocele in only 1 (11.11%) cases. POPQ and MRI had moderate agreement. Hence for enterocele MRI had better results. In rectocele POPQ agreed with 12 (60%) case with intraoperative findings with over-diagnosing in 4 (20%) and under-diagnosing in 4 (20%) cases while MRI had agreement in 10 (50%) cases with intraoperative findings and disagreement in 10 (50%) cases with over-diagnosing 4 (20%) cases and under-diagnosing in 6 (30%) cases. MRI and POPQ had poor agreement.

MRI findings with vault apex from PCL line on TRUFISP image of patient at rest is shown in Figure 1. Figure 2 shows TRUFISP image of patients at straining showing descent from PCL line in a case of vault prolapse. Figure 3 shows TRUFISP image of patients with vault prolapse at rest showing 'H', 'M', and PCL line while Figure 4 shows TRUFISP image of patient with vault prolapse at straining the 'H', 'M', and PCL lines.

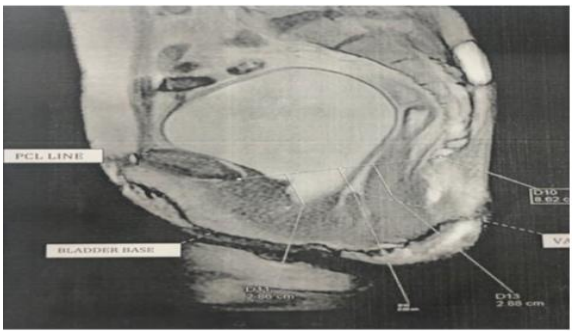

Figure 1: TRUFISP of patient at rest showing descent from PCL line.

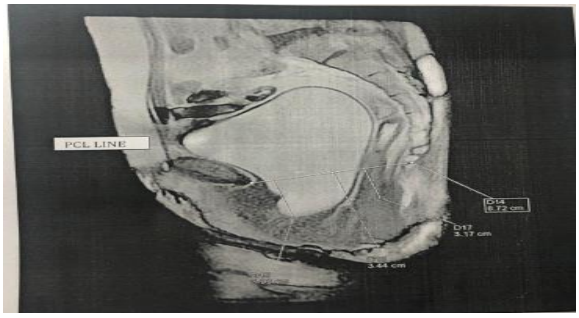

Figure 2: TRUFISP of patient at straining showing descent from PCL line.

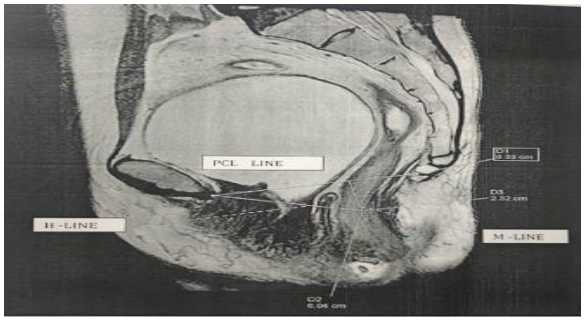

Figure 3: TRUFISP of patient at rest showing 'H', 'M' and 'PCL' lines.

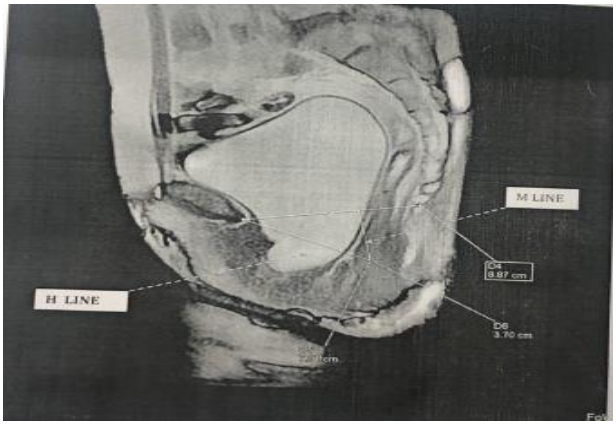

Figure 4: TRUFISP of patient at straining showing 'H', 'M' and 'PCL' lines.

Hence MRI was inferior to POPQ and intraoperative findings in cystocele, vault prolapse and rectocele but was superior to POPQ in detection of enterocele.

DISCUSSION

Pelvic Organ Prolapse (POP) has been defined by the International Urogynaecological Association/International Continence Society (IUGA/ICS) as departure from normal sensation, structure or function experienced by the women in reference to her pelvic organs.[10] The pelvic floor is complex functional and anatomical system being composed of active and passive support system.[11] It is topographically divided in three main functional and anatomical compartments; the anterior 9 supporting bladder and urethra); the middle (supporting vagina and uterus) and the posterior or anorectal compartment.[12] Traditionally diagnosis of POP has been made by clinical examination.[1,2] Many clinicians use the simple Baden Walker halfway grading system to describe prolapse by using 0 to 4 scales in relation to hymen but is not very accurate.[1] POPQ system is objective, site specific system for describing, quantifying and staging POP by using six defined points in vagina measured during maximum straining in relation to hymen.[5] It provides a standardised tool for recording and communicating results and to compare results of one centre with the other with proven interobserver and intra-observer reliabilities.[1,5] It has now been accepted by rest urogynaecological society of the world as a standard method to quantify POP and to report results.[1,5] However, clinical staging including POPQ may lead to misdiagnosis of enterocele and may not quantify all the prolapse completely especially enterocele.[1] Imaging of female pelvic floor is of rising interest for pelvic floor dysfunction and POP.[13] Imaging techniques are being developed to support therapy, planning and management. Trans labial ultrasound is used with limited acceptance. Trans labial ultrasound is done with 4-8 MHz transducer in lithotomy position to visualise and measure grading of prolapse but is less accurate than MRI and is operator dependent.[14,15]

The female pelvic floor particularly combines high resolution images with an excellent soft tissue contrast and provides the information about POP objectively and noninvasively in one examination.[12] There is general agreement amongst radiologist that MRI of pelvic floor should use both static and dynamic MRI images as static MRI images visualises pelvic floor anatomy and defects of supporting structures better while the dynamic MRI visualises pelvic organ motility, pelvic floor weakness, pelvic organ prolapse and associated compartmental defects better.[12,13] MRI may diagnose unexpected masked functional abnormalities with different spectrum of pelvic floor disorders in up to 42.9% cases and may influence surgical techniques.[12,13] For best results it is recommended to use standardised MRI procedure and a systemic approach to report the MRI findings.[11] Out of various lines used in MRI to quantify POP like pubococcygeal (PCL) (line drawn between inferior borders of pubic symphysis to the last coccygeal joint) is recommended as the reference line to measure POP by various international societies like European Society of Urogenital Radiology (ESUR) and European Society of Gastrointestinal and Abdominal Radiology (ESGAR) in the joint recommendation of their moving groups.[12] The degree of POP can be graded based on depth of descent below PCL (mild < 3 cm, moderate 3-6 cm, severe >6 cm).[13-15] Other authors also recommend MRI and PCL for quantifying prolapse.[16,19] In the present study we took PCL as the standard line for quantification of prolapse. The other lines are 'H' line (between inferior border of pubic symphysis and anterior wall of rectum at anorectal junction) and 'M' line (perpendicular to PCL and intersecting the inferior part of H line) can also be used for levator hiatus and pelvic muscle weakness. However the results of present study do not show superior rate of dynamic and static MRI in diagnosis of POP than POPQ staging. Also POPQ staging is free of cost while MRI is very expensive, though it was done free of cost for the patients in present study. In fact POPQ agreed more with intraoperative findings in cystocele, rectocele and vault prolapse while MRI tried to under diagnose these prolapses. Other authors also do not find MRI to be superior to POPQ.[20-23] Gross et al, also observed underestimation of POP in supine straining position based on magnetic resonance imaging findings.[22] However, in the present study, MRI could pick up more cases of enterocele as compared to POPQ classification which is an important finding as enterocele can then be surgically operated during POP surgery to prevent future vault prolapse and enterocele.

CONCLUSION

The present study proves that both static and dynamic MRI are inferior to carefully performed POPQ classification and are routinely not recommended in clinical practice with only exception of enterocele. However, large multicentre studies are recommended to prove or disprove role of MRI in POP as present study was done only on 20 patients.

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