Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com/sjams/

OPEN ACCESS

Radio Diagnosis

Transperineal Sonography in Evaluation of Female Pelvic Organ Prolapse

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DOI: 10.36347/sjams.2020.v08i02.039 | **Received:** 10.02.2020 | **Accepted:** 17.02.2020 | **Published:** 20.02.2020

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Abstract **Original Research Article**

Introduction: Pelvic organ prolapse is abnormal descent of pelvic organ through the hiatus beneath it and may affects bladder (cystocele), vagina (vaginal prolapse), uterus (uterine prolapse), mesenteric fat (peritoneocele), small intestine, or sigmoid colon (sigmoidocele). The non-invasiveness, rapidity and absence of ionizing radiation, sonography of the pelvic floor by the transperineal approach, has been successfully employed in number of pelvic floor conditions. ***Objective:*** To identify the sonomorphological features and biometric parameters of pelvic floor in patients with pelvic organ prolapse and comparison of biometric parameters of pelvic organ prolapse with age-matched control group at rest and valsalva. ***Methodology:*** In a prospective case control study, 25 subjects with prolapse group and 25 subjects with control group were assessed. Bladder symphyseal distance (BSD), angle of urethral inclination, bladder neck descent, retrovesical angle, bladder wall thickness and quantification of prolapse were measured on rest and valsalva maneuver on 2D ultrasound. ***Results:*** 2D ultrasound may be reliably used for determining the pelvic floor morphology and biometry. Bladder symphyseal distance (BSD) was significantly lower in prolapse group compared to the control group (p=0.0000), while bladder wall thickness was significantly higher in prolapse group than controls (p=0.0055). ***Conclusion:*** Bladder symphyseal distance, bladder neck descent, and bladder wall thickness were most consistent parameters, while angle of urethral inclination and rectovesical angle yielded the most varied and less reliable measurements.

Keywords: Pelvic organ prolapse, Transperineal ultrasound, Bladder symphyseal distance, Bladder neck descent, Bladder wall thickness, Angle of urethral inclination, Rectovesical angle.

INTRODUCTION

The pelvic organs are maintained in their position by a combination of connective tissue, smooth and striated muscle. Complex interactions between these elements are responsible for normal support. Damage to any of them may contribute to pelvic organ prolapse and pelvic floor dysfunction [2].

Pelvic floor dysfunction leads to structural alterations in all compartments of the female pelvis [1]. Such disorders include urinary and fecal incontinence, obstructed defecation and pelvic organ prolapse. Due to non-invasiveness, absence of ionizing radiation, and rapidity, ultrasonography of the pelvic floor by the transperineal approach has been successfully employed in a number of conditions. Currently, it is examination of choice for urinary incontinence [3-12].

A standardized system for assessing and documenting pelvic organ prolapse with a physical examination, the pelvic organ prolapse quantification (POP-Q) system [13,14], was proposed by the International Continence Society in 1996 . In this system, the descent of each compartment is measured by using the vaginal hymen as a reference line while the patient is in the lithotomy position and performing the Valsalva maneuver.

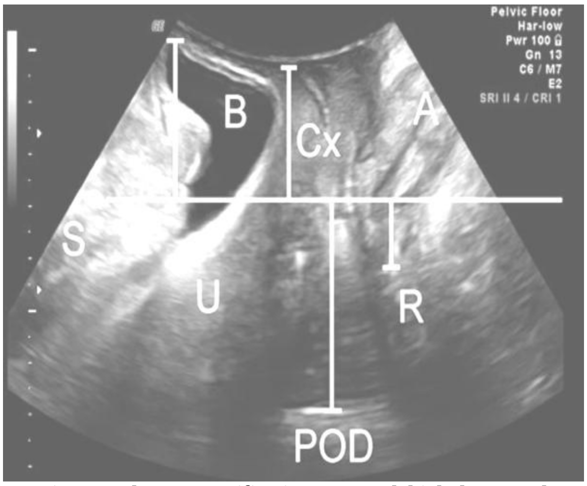

Fig-1: Prolapse quantification on translabial ultrasound (valsalva). The reference line is placed through the inferior margin of symphysis pubis (S) Vertical lines indicate maximal descent of bladder (B), uterine cervix (Cx), pouch of Douglas (POD) and rectal ampulla (R) relative to the symphysis pubis. There is cystocele and uterine prolapse [15]

METHODS AND MATERIALS

This prospective case control study of female pelvic organ prolapse by transperineal approach was carried out over period of 18 month in Department of Radiodiagnosis at Index Medical College Hospital and research centre Indore. Total 50 patients of 40-80 years of age were included in our study, 25 controls and 25 prolapse patients.

In Prolapse group, Patients having pelvic organ prolapse, using Pelvic Organ Prolapse Quantification system (POP-Q) [16] and prolapse which can be manually reduced were included while Patients with prolapse which cannot be manually reduced and pregnant women were excluded from our study. While in Control group, Patients with no clinical evidence of prolapse were included while Patients with pelvic organ prolapse were excluded.

Scan Technique [17]

Consent was obtained and lithotomy position was given. Ultrasound was done by Siemens' Acuson X 300 machine using 5-10 MHz probe; placed between vaginal labia minor for desired anatomy (bladder base, urethra, vaginal vault and anorectal junction).

The examination starts with transducer oriented anteriorly and upward in sagittal plane (position one) for anterior compartment. The consistent position of inferior border of symphysis pubis on left lower side of screen makes it a good landmark. Then transducer moved in backward direction to a point where the uterovesical junction was seen (position two). This was obtained by slowly sweeping the beam posteriorly for visualizing cervix,vaginal vault, Douglas pouch and the perineal body. Then, moving the transducer even more posteriorly (position three) the probe held vertically just inside the hymenal ring for proper identification of anorectal region and post-anal space.

Measurements

The following quantitative parameters were recorded both at rest and Valsalva, to focus on the position of the bladder neck and proximal urethra [18]. Our protocol includes following:

a) Bladder-neck symphyseal distance (BSD)- distance between inferoposterior margin of symphysis pubis and bladder neck. The difference at rest and valsalva will determine neck descent.
b) Angle of urethral inclination- angle between proximal urethra and a fixed axis, measures extent of rotation of proximal urethra.
c) Retrovesical angle- angle between proximal urethra and bladder trigone.
d) Bladder wall thickness- measured at three points: anterior wall, trigone, and bladder dome and mean thickness obtained.
e) Quantification of prolapse- at rest and Valsalva, images were taken and maximal descent of the bladder, uterus, cul de sac, and rectum were measured relative to inferoposterior margin of symphysis pubis.

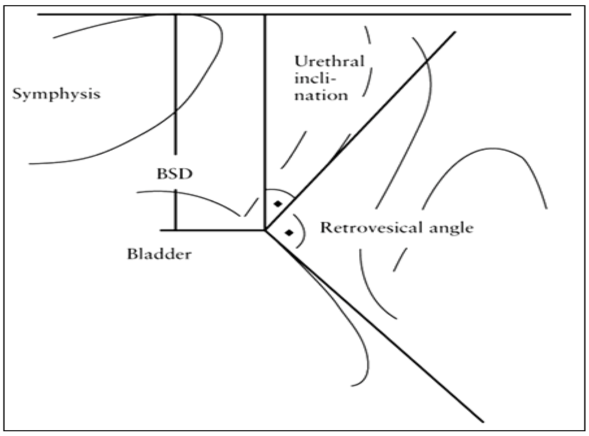

Fig-2: BSD (bladder neck-symphyseal distance) Courtesy-Dietz HP [19]

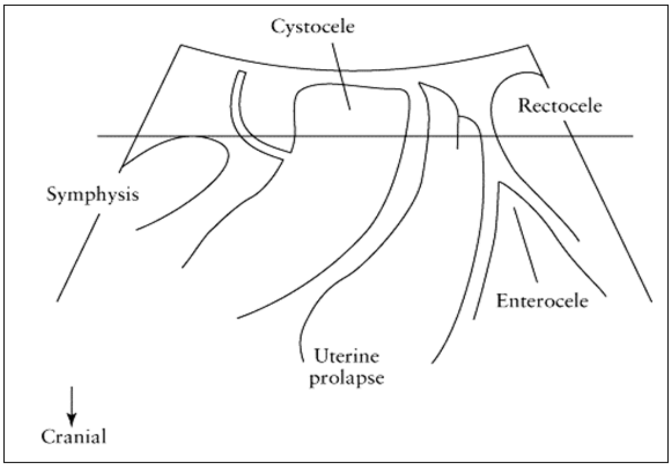

Fig-3: Quantification of uterovaginal prolapse.Reference line at the inferior margin of the symphysis pubis courtesy-Dietz HP [20]

STASTITICAL ANALYSIS

All Data for pelvic floor biometry for both pelvic organ prolapse and control groups were tabulated and encoded in the appropriate Excel tables. The summary measures that were computed are the proportion for the categorical data, while the median and range for the continuous data. The measurements from the two groups were compared using Unpaired t-test. p-value was also computed to determine which characteristics were different for the two groups, value of $p<0.05$ was considered significant. The study protocol was submitted and approved by the Research Ethics Board of institution.

RESULTS

In this study, following biometric parameters were measured on 2D ultrasound: bladder symphyseal distance (BSD), bladder neck descent, angle of urethral inclination, retrovesical angle, and bladder wall thickness at rest and valsalva, which determined position and mobility of bladder neck and proximal urethra.

Table-1: 2D transperineal ultrasound measurements in control group

2D Measurements	Rest (Mean)	Valsalva(Mean)
BSD	1.6-2.8cm (2.1)	2.2-3.0cm (2.6)
Bladder neck descent	0.2-1.3cm(0.5)	
Angle of urethral Inclination	36-81 ° (62.6)	55-100 ° (81.9)
Retrovesical Angle	95-185 ° (151.4)	140-200 ° (177.6)
Bladder wall thickness	0.2-0.6cm(0.4)	

Table-2: 2D transperineal ultrasound measurements in prolapse group

2D Measurements	Rest (Mean)	Valsalva(Mean)
BSD	0.7-2.1cm (1.3)	1-2.4cm (2.0)
Bladder neck descent	0.2-1.4cm (0.6)	
Angle of urethral Inclination	15-45° (30.3)	27-60 ° (47.1)
Retrovesical Angle	90-168 ° (129.3)	120-185 ° (157.1)
Bladder wall thickness	0.4-0.1cm(0.6)	

Table-3: Comparison between 2D transperineal ultrasound measurements of the control and prolapse groups

2D measurement	Control Group Mean / (SD)	Prolapse Group Mean / (SD)	Difference
Rest			
BSD (cm)	2.1 / 0.37	1.3 / 0.48	0.0000
Bladder neck descent (cm)	0.5 /0 .26	0.7 / 0.31	0.0170
Angle of urethral inclination (°)	62.6 / 13.22	30.32 / 8.47	0.0000
Retrovesical angle (°)	151.4 / 25.52	129.3 / 21.66	0.0018
Bladder wall thickness (cm)	0.4 / 0.15	0.6 / 0.23	0.0055
Valsalva			
BSD (cm)	2.6 / 0.27	2.0 / 0.38	0.0000
Angle of urethral inclination (°)	81.9 / 13.20	47.1 /9.52	0.0000
Retrovesical angle (°)	177.6 / 19.66	157.1 /19.7	0.0005

In our study, we observed that Bladder symphyseal distance (BSD) was significantly lower in prolapse group compared to the control group (p=0.0000), while bladder wall thickness was significantly higher in prolapse group than controls (p=0.0055). Our study suggests that Bladder symphyseal distance, Bladder neck descent, and Bladder wall thickness were most consistent parameters, while angle of urethral inclination and rectovesical angle yielded the most varied and less reliable measurements (Table-3). Although there was no significant difference in bladder neck descent between the control and prolapse group, this parameter may be significant in patients diagnosed with stress incontinence as proposed in previous literature [18].

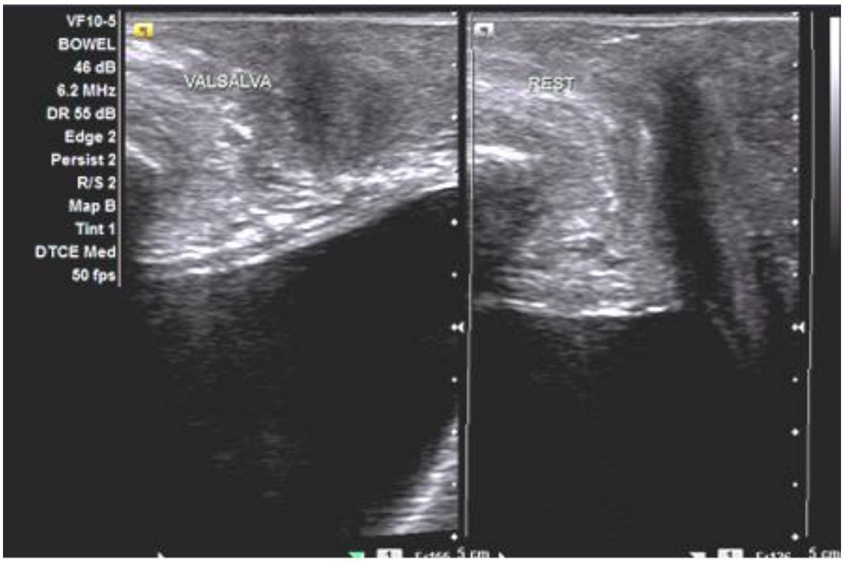

Fig-4: Two-dimensional transperineal ultrasound of a patient with pelvic organ prolapse (cystocoele) at rest and valsalva

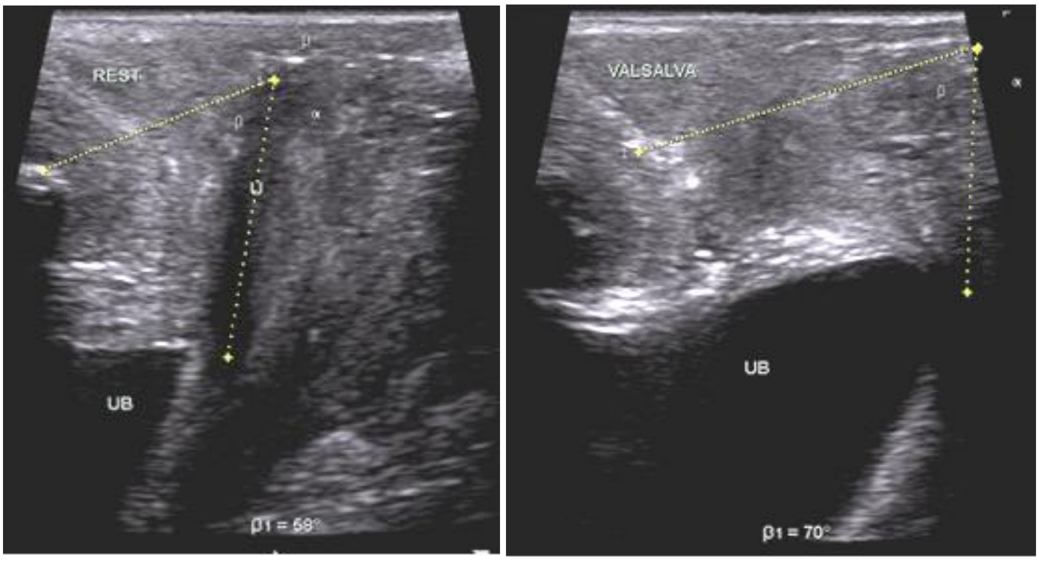

Fig-5(A & B): 2D transperineal ultrasound of patient with pelvic organ prolapse Angle of urethral inclination at rest[β-58°] and valsalva[β-70°]

DISCUSSION

The Aim was assessing clinical presentation and ultrasound findings of pelvic floor dysfunction. The earliest parameter examined by transperineal ultrasound is bladder neck mobility. Bladder neck position and mobility can be assessed with degree of reliability. A reference line is drawn down wards from the inferior pubic symphysis. The bladder neck is identified and a perpendicular line is drawn to join reference line.

In study, BSD of control and prolapse group; mean of 2.6 cm and 2.0cm at valsalva respectively i.e. BSD in prolapse group was lower as compared to control group, our results were compared with previous [18] published literature reference data were 1.6-3.7cm at rest and 1.1-3.0cm at valsalva in control group and 0.7-3.0 cm at rest and 0.8-2.4cm at valsalva in prolapse group, which was also comparable with our result.

Bladder neck descent of control and prolapse group, mean of 0.5 and 0.6cm respectively this clearly showed that bladder neck descent was more in prolapse group as compare to control group. This value was comparable to the bladder neck descent reference value published in literature 0.51-0.53cm in control group and 0.1-3.0cm in prolapse group, Our value was also coming within range of their study [19]. There is still no definition of normal value for bladder neck descent although cutoff of 2.5cm been proposed to define hypermobility [20]. This could be explained by fact that bladder neck descent has been proposed to have strongest association with stress incontinence. The etiology of increased bladder neck descent is likely to be multifactorial.

The angle of urethral inclination in control and prolapse group was 55-100°and 27-60° on valsalva respectively i.e angle of urethral inclination in prolapse group was significantly lower than control group, supporting the theory of hypermobility [20] of proximal urethra, causing a smaller angle of inclination on valsalva maneuver in patients with pelvic organ prolapse. There was no significantly difference from the values of urethral inclination of the control group on valsalva. Previous study [18], published reference range at rest and valsava was 7-85° and 2-100° in control group respectively and 5-45° and 27-60° at rest and valsalva respectively in prolapse group, which was also comparable with our result.

The rectovesical angle in control and prolapse group was 140-200° and 120-185° on valsalva respectively. There was no significant difference of rectovesical angle between control and prolapse group, both at rest and valsalva. Among the parameters, this appeared to be least reliable due to the wide variation in measurement. Our results was comparable with published data which shows that the retrovesical angle opens up to 160-180° from a normal value of 90-120° [22]. This parameter was variable when compared with other studies [18] because of methodological differences such as patient positioning, bladder filling during the exam, and the quality of the Valsalva maneuver may account for the above discrepancies.

Bladder wall thickness in control group and prolapse group was 0.4cm and 0.6cm respectively which was significantly higher than in the control group ($p=0.0055$). This was consistent with the cut-off 4mm published in literature for asymptomatic patients [18]. Bladder wall thickness of >0.5cm associated with detrusor instability according to Khullar *et al.*, [21] in 1996.

Conclusion

Our study was able to demonstrate that 2D transperineal ultrasound reliably used for determining the pelvic floor morphology and biometry and is non invasive and cost effective diagnostic tool for evaluation of various gynaecological and nongynaecological conditions. With regards to the use of 2D ultrasound measurements, our data was comparable with previous published studies. Our study suggests that Bladder symphyseal distance, Bladder neck descent, and Bladder wall thickness were most consistent parameters, while angle of urethral inclination and rectovesical angle yielded the most varied and less reliable measurements.

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