GYNECOLOGY

Structural, functional, and symptomatic differences between women with rectocele versus cystocele and normal support

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BACKGROUND: Prolapse of the anterior and posterior vaginal walls has been generally associated with apical descent and levator ani muscle defects. However, the relative contributions of these factors to the pathophysiology of descent in the different vaginal compartments is not well understood. Furthermore, symptoms uniquely associated with prolapse in these compartments have not been well characterized.

OBJECTIVES: The objectives of the study were to compare the associations between the following: (1) apical support, (2) levator ani muscles, and (3) pelvic floor symptoms in women with posterior-predominant prolapse, anterior-predominant prolapse, and normal support.

STUDY DESIGN: This is a cross-sectional study with 2 case arms: 60 women with posterior prolapse, 90 with anterior prolapse, and a referent control arm with 103 asymptomatic subjects with normal support, determined from pelvic organ prolapse quantification examinations. Levator muscle defects were graded from magnetic resonance imaging. Vaginal closure forces above resting were measured with an instrumented speculum during maximal contraction. Pelvic floor symptoms were measured via the Pelvic Floor Distress Inventory—Short Form.

RESULTS: Mean point C location in controls was −6.9 cm [1.5] (mean [standard deviation]); and was higher in posterior prolapse (−4.7 cm [2.7], 2.2 cm below controls) than the anterior prolapse group (−1.2 cm [4.1]; 5.6 cm below controls, $P < .001$ for all comparisons). Normal-appearing muscles (ie, muscle without a visible defect) occurred at similar frequencies in posterior prolapse (45%) and controls (51%, $P = .43$) but less often in anterior prolapse (28%, $P \leq .03$ for pairwise comparisons). Major levator ani defects occurred at similar rates in women with posterior (33%) and anterior prolapse (42%, $P = .27$) but less often in controls (16%, $P \leq .012$ for both pairwise comparisons). Similarly, there were significant differences in generated vaginal closure forces across the 3 groups, with the prolapse groups generating weaker closure forces than the control group ($P = .004$), but the differences between the 2 prolapse groups were not significant after controlling for prolapse size ($P = .43$). Pelvic floor symptoms were more severe for the posterior (mean Pelvic Floor Distress Inventory score, 129) and anterior prolapse groups (score, 128) than the controls (score, 40.2, $P < .001$ for both comparisons); the difference between the 2 prolapse groups was not significant ($P = .83$).

CONCLUSION: Posterior-predominant prolapse involves an almost 3-fold less apical descent below normal than anterior-predominant vaginal prolapse. Levator ani defects and muscle impairment also have a lower impact. Pelvic floor symptoms reflect the presence and size of prolapse more than the predominant lax vaginal compartment.

Key words: anterior and posterior vaginal walls, apical descent, levator ani muscle defect, prolapse

Pelvic organ prolapse imposes significant quality-of-life and economic burdens.[1,2] Of the 225,000 surgical operations performed annually in the United States for prolapse,[3-5] posterior colporrhaphy is performed in 87%.[6]

Despite the prevalence and obvious clinical importance of rectocele,[6,7] evidence-based understanding of anatomical and physiological factors specific to this form of prolapse are lacking. Recent reviews have documented significant progress in understanding causal mechanisms of prolapse in general and anterior vaginal wall prolapse in particular,[8,9] but our mechanistic understanding of the posterior compartment remains poor.[10] Because surgeons often base their choice of operation on a theory of causation, function, and pathophysiology, evidence-based mechanistic studies are needed to decide between competing theories.

Despite a long history of innovation and investigation, pelvic organ prolapse surgery continues to have an unacceptably high failure rate. Two large, randomized trials by expert surgeons revealed anatomical failure with prolapse beyond the hymen in 25% of subjects.[11,12]

Attempts to improve this using synthetic mesh grafts have met with blunted enthusiasm because of significant complication rates. Surgeons continue to select treatments empirically, based on training, experience, and patient demographics. Ideally, surgery would be tailored to objective anatomic and physiological patient-specific factors, as is done in selecting cardiac treatment based on echocardiography findings. Improving our understanding of the pathophysiology relevant to different types of prolapse will allow evidence-based, patient-tailored treatments to become viable.

Two causal factors common to anterior and posterior prolapse include the following: (1) apical descent[13,14] and (2) levator ani muscle damage.[15,16] However, the contributions of these components to posterior wall prolapse are poorly understood.

In this analysis, we sought to compare apical support in women with posterior and anterior compartment prolapse, as well as in controls with normal support,

Cite this article as: Berger MB, Kolenic GE, Fenner DE, et al. Structural, functional, and symptomatic differences between women with rectocele versus cystocele and normal support. Am J Obstet Gynecol 2018;xxx:xx-xx.

0002-9378/$36.00

https://doi.org/10.1016/j.ajog.2018.01.033

with the null hypothesis that apical support is similarly compromised in the 2 prolapse groups. Our secondary aim was to assess levator ani appearance and function in these 3 groups, with the null hypothesis that women with posterior and anterior prolapse have similar muscles. Finally, we aimed to compare associations between prolapse and pelvic floor symptoms.

Materials and Methods

This is a cross-sectional study involving 2 case arms, women with posterior-predominant and anterior-predominant pelvic organ prolapse along with a control arm of women with normal vaginal support. The data represent the primary analysis of a University of Michigan Institutional Review Board–approved (IRBMED number HUM00012823) case-control study of women with posterior pelvic organ prolapse and controls with normal pelvic support (National Institutes of Health grant P50 HD044406).

After the study was planned and underway, it became evident that insights from comparing data between women with posterior compartment prolapse with women with normal support would be greatly enhanced by also making comparisons with women with anterior compartment prolapse. Therefore, similar mechanistic data from a contemporaneous study of the biomechanics of anterior vaginal wall support (National Institutes of Health grant R01 HD035665) that had similar goals to the posterior compartment prolapse project were included as well (IRBMED number HUM00043445).

The 2 studies had identical recruitment strategies and testing protocols and were carried out in the same unit by the same personnel. Stress 3-dimensional magnetic resonance imaging (MRI) findings from a subset of this study (National Institutes of Health grant R01 HD035665) have been published,[17] so the current data represent a secondary analysis of a larger group of individuals.

Written informed consent was obtained from all patients in the original studies. Exclusion criteria for both studies included prior pelvic floor surgery, hysterectomy within the year before enrollment, genital anomalies, or a history of radiation therapy or other factors that would pose a risk for MRI or pelvic floor testing such as metal implants, recurrent urinary tract infections, or immunosuppression.

Subject selection and testing

The women with anterior or posterior predominant vaginal wall prolapse were recruited from urogynecology clinics. Controls were recruited by advertisement and institutional pools of research volunteers. The control subjects were selected to be demographically similar as a group in age, race, and parity to the 2 prolapse groups.

All subjects underwent a pelvic organ prolapse quantification (POP-Q) examination[18] in a semirecumbent lithotomy position, which was used to determine eligibility and group assignment. To be included in the 2 prolapse groups, women were selected to represent anterior predominant or posterior predominant prolapse. To be in either group, the location of the contralateral vaginal wall could not be abnormal[19] and had to be at least 1 cm higher than the predominant prolapse.

These groups were based on the women's POP-Q examinations as follows: subjects in the posterior wall prolapse group were those who had distal posterior wall prolapse, with POP-Q point Bp 1 cm or more beyond the hymen ($\geq+1$) with no anterior or apical compartment point below the hymen and in whom this was the predominant element of the prolapse (the most dependent point of the POP-Q measurements).

Similarly, the anterior wall prolapse group was comprised of subjects in whom POP-Q point Ba descended at least 1 cm beyond the hymen ($\geq+1$ cm) with no posterior or apical points below the hymen. Controls had all vaginal POP-Q points at least 1 cm above the hymen (≤-1 cm) and were asymptomatic.

The level of the hymen as a criterion for prolapse was chosen because it represents subjects who are outside the normal range for vaginal support as seen in population-based studies of asymptomatic women,[19] and it is the level at which women become symptomatic from their prolapse.[20-22]

Subjects with similar anterior and posterior wall support in whom Bp and Ba descended the same amount (Bp = Ba), in whom the cervix was the lowest part of the prolapse, or in whom complete vaginal eversion was detected (POP-Q point C = total vaginal length) were excluded.

Pelvic floor imaging

All subjects underwent MRI in the axial, coronal, and sagittal planes using a fast-spin proton density technique (echo time, 15–30 milliseconds; repetition time, 2100–4000 milliseconds) in the supine position. Scans were obtained using a 1.5 T superconducting magnet (Signa; General Electric Medical Systems, Milwaukee, WI) or a 3 T system (Philips Medical Systems, Best, The Netherlands). Slice thickness was 4 mm, with 5 mm total image spacing. Full details of our imaging technique are described elsewhere.[23]

Levator ani muscle defects were graded on magnetic resonance scans by 2 independent examiners blinded to group assignment using a system and its interrater reliability as previously described.[24,25] Briefly, the left and right muscles were scored independently, with scores from 0 to 3 assigned to each muscle. A score of 0 was assigned if there was no visible muscle damage to the pubococcygeal muscle, 1 if less than half the muscle bulk was missing, 2 if more than half was missing, and 3 if no significant muscle could be seen in its normal location. If the 2 reviewers differed on their score assignments, they reviewed the scans together to determine a final score.

The scores from both sides were totaled to provide a final defect score ranging from 0 to 6. These scores were used to categorize the levator defects because they relate to risk association with prolapse,[26] as follows: 0, no defects; 1–3, minor defects that involve less than 50% of the expected muscle bulk; 4–6, or a unilateral grade 3, major defects involving more than 50% of expected muscle bulk.