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ORIGINAL ARTICLE

Defining normal apical vaginal support: a relook at the POSST study

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Abstract

Introduction and hypothesis The purpose of this study is to reanalyze data from the original 2005 Pelvic Organ Support Study (POSST) data set to define normal values for apical Pelvic Organ Prolapse Quantification (POP-Q) points C and D and total vaginal length (TVL) in an asymptomatic population of women.

Methods In this retrospective observational data-set review, patient were >18 years presenting for annual gynecologic exams to six centers in the United States. Data included demographics, questions about prolapse symptoms, and POP-Q points. Means and standard deviations were determined for each POP-Q point in the total population.

Results The data set comprised 1011 women; 59 were excluded because they met criteria for having POP or were missing data. This left 948 for study. Mean age of our study population was 42 ± 14 years, and 45.6% were white, 25.1% black, and 25.2% Hispanic. One hundred fifty-six had a prior hysterectomy. Mean values with standard deviations (SD) for POP-Q values are as following: point C (vaginal cuff) −7.3 ± 1.5 cm, point C (cervix) −5.9 ± 1.5, point D −8.7 cm ± 1.5 cm, TVL (no hysterectomy) 9.8 cm ± 1.3 cm, and TVL (hysterectomy) 8.9 cm ± 1.5 cm.

Conclusions This data suggests normal values for POP-Q apical points in a population of patient with annual gynecological exams.

Keywords Apical support · Pelvic organ prolapse support

Introduction

Pelvic organ prolapse (POP) is a common condition affecting between 3 and 50% of adult women depending on how the condition is defined [1]. The wide range in estimates comes from the lack of an explicit definition of the disease state of POP. POP manifests with bothersome symptoms and a vaginal bulge. Therefore, its definition should include the presence of bother symptomatology and physical examination description. The first data-driven definition of POP suggested the disease be defined as: (1) presence of bothersome POP symptoms, and (2) physical exam finding of one or more Pelvic Organ Prolapse Quantification system (POP-Q) points ≥ 0 cm [2]. In other words, patients in whom all POP-Q A, B, C, or D point values are above the hymen represent normal support and patient with symptoms of prolapse and any POP-Q A, B, C, or D point values at or beyond the hymen have POP [3]. This definition was developed after multiple studies on general gynecologic clinic populations that identified normal pelvic organ support using POP-Q values combined with studies on how symptoms of prolapse correspond with physical exam findings and studies on patient satisfaction with surgical outcomes [1]. The confounder for this definition is that it does not adequately address patient with all POP-Q point values above the hymen who have bothersome prolapse symptoms. In symptomatic patients, the hymen seems to be a good boundary for defining prolapse of the anterior and posterior vaginal walls (POP-Q points A and B) but may not accurately reflect presence or absence of apical vaginal support defects. This can lead to over or underdiagnosis of apical support defects which can make management decisions on when and how to best correct apical vaginal support defects difficult. While there is a developing consensus on what is normal support for the anterior and posterior vaginal walls, there is no agreement on what represents normal apical support. A recent systematic review of the various definitions of successful treatment

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of apical support defects following surgery highlights this dilemma [2, 4].

The Pelvic Organ Support Study (POSST) evaluated 1011 women presenting for a routine annual gynecologic examination who were asked to complete a prolapse symptom questionnaire and underwent a POP-Q examination [5]. At the time of the original study publication in 2005, data were analyzed on the group as a whole, regardless of symptomatology, and demonstrated a bell-shaped distribution of pelvic organ support. Overall values for all POP-Q points were reported in the first publication, but differences between point C for cuff versus point C for cervix and means with standard deviations were not determined. The purpose of this study was to reanalyze data from the original 2005 POSST data set with the aim of better defining normal values for point C (vaginal cuff), point C (cervix), point D, and total vaginal length (TVL).

Methods

This is a reanalysis of a retrospective observational review of women using the original Pelvic Organ Support Study (POSST) study data set. The POSST study was a multicenter observational study of patient presenting for an annual gynecologic exam at six centers around the United States between September 1999 and March 2002 [5]. Data from the original study was stored in a locked office with one of the primary investigators (SS) in paper format. Data was reentered into electronic form using a spreadsheet format. Each data set was then cross-referenced to others to make sure there were no duplicates. Every ten data entries were compared with the paper set to ensure that data was accurately copied from the paper forms. All data had been deidentified prior to the start of this study without any way to connect data back to individuals. After discussing with members of the IRB at the Medical University of South Carolina, no IRB approval was deemed necessary.

Data collected included general demographic information, results of a pelvic exam including a POP-Q exam measured in half-centimeter increments, a questionnaire in which patients were asked a series of questions about pelvic floor symptoms, two of which regarded prolapse symptoms and bother: (1) Do you have a sense of something falling out of your vagina? Does it bother you? and (2) Can you feel with your hand or see something bulging out of your vagina? Does it bother you? Responses were either yes or no.

To best define asymptomatic patients, we identified those with POP defined by the International Urogynecology Association/International Continence Society (IUGA/ICS) terminology document, which defines POP as patients with bothersome prolapse symptoms and descent of the cervix, anterior, posterior, or vaginal vault most commonly at or past the hymen. Therefore, we excluded all patients who responded yes for either of the above-mentioned symptoms and yes to "Does it bother you?" and who had any POP-Q point A, B, C, or D at or beyond the hymen (≥0 cm). Means and standard deviations (SD) were determined for each POP-Q point in the population of patients that did not meet criteria for POP. In the original data set, there were many POP-Q integers recorded in 0.5-cm increments. This made data abnormally distributed because of the relatively few values recorded in 0.5-cm increments (i.e., there were many more POP-Q point C values of −5 cm vs −5.5 cm). Therefore, since most clinical practice is to record POP-Q values in whole integers, we rounded all half integers up. This left us with normally distributed data and is more consistent with clinical practice.

Data analysis was performed with IBM SPSS Statistics Version 22.0 (Chicago, IL, USA). Continuous variables were analyzed using the Student's *t* test or Mann-Whitney *U* test, and categorical variables were analyzed using $\chi 2$ or Fisher's exact tests, when appropriate. All terminology conforms to the IUGA/ICS standards of terminology [3].

Results

The data set comprised 1011 women, of whom 54 (5.3%) complained of POP and had a POP-Q point A, B, C, or D ≥0 cm; these women were excluded. That left 957 asymptomatic patients for this report. Of this group, nine were missing either a POP-Q point or an answer to the question about bother, and thus, 948 were available to study. Table 1 lists their demographics. Of note, 3% (29) of patients had a prior POP surgery, and 16% (156) had a prior hysterectomy.

Mean POP-Q point values for 948 patients are shown in Table 2. In addition, POP-Q point values were compared between those who did and did not have a hysterectomy, which revealed mean point C (vaginal cuff) values of -7.3 ± 1.5 cm versus mean point D value of -8.6 ± 1.5 cm; $p < 0.05$. In comparing cervical POP-Q point C values in those who had a uterus with those who had undergone a hysterectomy, there

Table 1 Demographics for this population

Variable	Mean (SD) or count (%) $n = 948$
Age	42 years (14)
Race	
White	432 (45.6%)
Hispanic	239 (25.2%)
Black	238 (25.1%)
BMI	29.1 kg/m^2 (7.2)
Parity	2 (0–12)
Surgery	
Prolapse surgery	29 (3%)
Prior hysterectomy	156 (16%)

BMI body mass index, *SD* standard deviation

Table 2 Mean Pelvic Organ Prolapse Quantification (POP-Q) system points with standard deviation (SD) for asymptomatic patients°

POP-Q exam Mean ± SD	Total, cm ($n = 948$)
Stage	1.0 ± .76
Total vaginal length	9.7 ± 1.4
Hysterectomy	8.9 ± 1.5 ($n = 156$)
No hysterectomy	9.8 ± 1.3 ($n = 787$)
Aa	−1.8 ± 1.0
Ba	−1.8 ± 1.0
Ap	−2.4 ± 1.0
Bp	−2.5 ± 1.0
C	−6.1 ± 1.5
C (cuff)	−7.3 ± 1.5 ($n = 156$)
C (cervix)	−5.9 ± 1.5 ($n = 787$)
D	−8.7 ± 1.5 ($n = 787$)
GH	2.9 ± 1.4
Pb	3.7 ± 1.4

were differences in mean values: point C (cervix) −5.9 cm ± 1.5 and point C (vaginal cuff) −7.3 ± 1.5 cm; $p < 0.05$. When comparing TVL, the mean was 8.9 ± 1.5 cm in those who had undergone a hysterectomy and 9.8 cm ± 1.3 in those who had not; $p < 0.05$.

Figures 1, 2 and 3 demonstrate the distribution of all apical POP-Q point values (C (cervix), C (vaginal cuff) and D.

There were 183 (18%) patient with the complaint of bother, either with or without POP-Q point A, B, C, or D ≥ 0 cm. Table 3 lists means and compares them with the complaint of bother to those without. Statistically significant differences were noted between anterior and posterior POP-Q points and the D point, but not the C point.

Discussion

Agreement on normal values for pelvic organ support has been difficult despite almost 15 years of study. This makes it challenging to define what is "normal" and to counsel patient regarding recommendations about surgical repair, particularly in reference to apical support. Swift et al., in 2003, showed that bother correlated with prolapse beyond the hymeneal remnants, which has led to this anatomic structure being used in conjunction with bothersome symptoms to define presence or absence of POP [6]. This definition was to some extent codified with the publication of the IUGA/ICS joint reports on terminology for female POP [3, 7]. In those documents, POP is defined as: "The descent of one or more of the anterior vaginal wall, posterior vaginal wall, the uterus (cervix) or the apex of the vagina (vaginal vault or cuff scar after hysterectomy). The presence of any such sign should be correlated with relevant POP symptoms. More commonly, this correlation would occur at the level of the hymen or beyond" [7]. The qualifying statement; "…more commonly this correlation would occur at the level of the hymen or beyond," allows for some discretion in interpretation. This is appropriate, because while this definition seems adequate for the anterior and posterior vaginal walls, it may not describe what is or is not prolapse for the apical vaginal segment. A recent systematic review identified several different definitions for surgical success following apical defect repair but noted that there was no agreement on what represents successful apical repair or restoration of normal [4]. Therefore, we felt delineating normal POP-Q values for the vaginal apex is the first step to better understand what is and is not normal apical vaginal support.

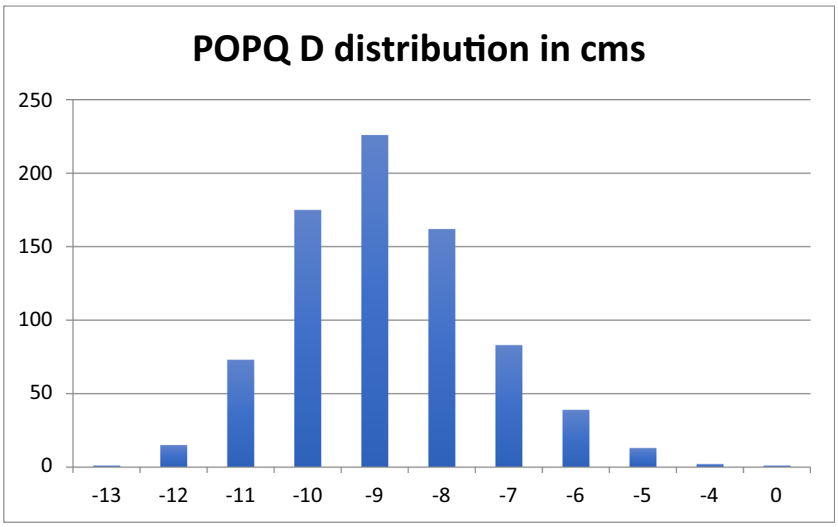

Fig. 1 Pelvic Organ Prolapse Quantification (POP-Q) system point D distribution

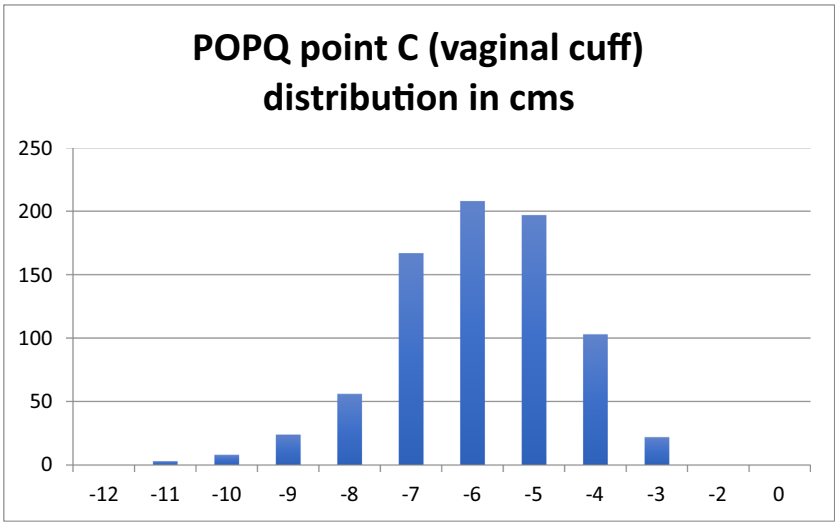

Fig. 2 Pelvic Organ Prolapse Quantification (POP-Q) system point C (vaginal cuff) distribution

Our results for the anterior and posterior vaginal POP-Q points Aa, Ba, Ap, and Bp in are consistent with current definitions. The normal values for point D suggest that it can vary between −7 and −10 cm if we round up the values obtained (−8.7 ± 1.2 cm). For cervical support, a normal POP-Q point C (cervix) value could vary between −4 and −7 cm if rounded to whole integers (−5.9 ± 1.5 cm). In patients who have had a hysterectomy, the normal apical POP-Q point C (vaginal cuff) value can range between −6 and −9 cm (−7.3 ± 1.5 cm). These numbers are similar to a study from southwest Michigan [8]. This suggests that in reporting surgical outcomes, restoring the cervix to at least −4 cm or the cuff to −6 cm brings them to a normal level. Alternatively, this may also suggest that once the cervix descends to ≥ −3 cm or within 3 cm of the hymen or vaginal cuff to ≥ −4 cm or within 4 cm of the hymen, an apical suspension should be considered. Before recommending these as cutoffs for apical vaginal prolapse or using these values for surgical recommendations, more data should be obtained from other studies, particularly those involving apical surgical procedures and correlating apical POP-Q points with patient-reported outcomes of success.

In comparing TVL in those who have and have not had a hysterectomy, we found a 1-cm difference in length, suggesting that hysterectomy does slightly shorten the vagina. Our data supports those of other studies, that hysterectomy does play a role in reducing vaginal length [8].

With regard to bother, there were statistically significant differences between anterior and posterior POP-Q points, though these differences are minute and not clinically significant. Of note, patients with the complaint of bother still had values above the hymen, with the lowest point being the anterior wall: Aa −1.5 ± 1.2 and Ba −1.5 ± 1.2. This is limited by the small number in the bothered group.

Limitations of this study include that the studied population does not accurately reflect the current US population. However, given that there is limited data on the correlation of race and prolapse, data can still be more widely applied. Of note, in reviewing the data, our total population totalled 1011,

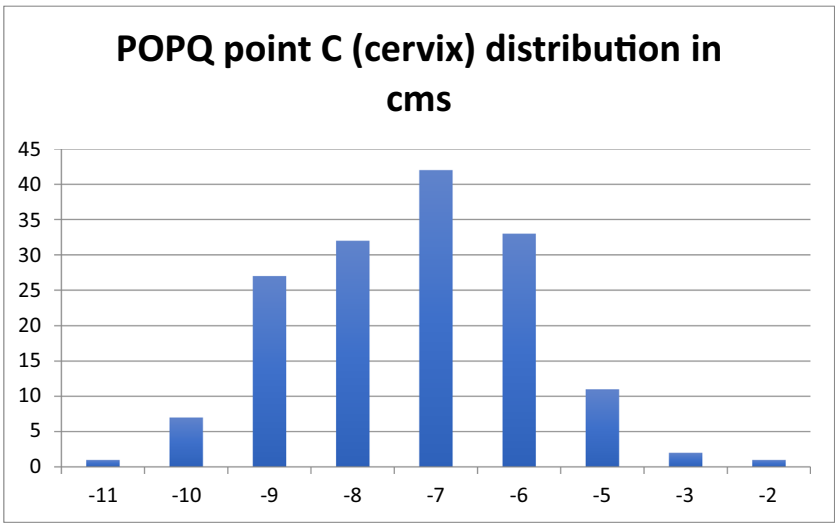

Fig. 3 Pelvic Organ Prolapse Quantification (POP-Q) system point C (cervix) distribution

Table 3 Mean Pelvic Organ Prolapse Quantification (POP-Q) system points with standard deviation (SD) for all patients separated by complaint of bother

POP-Q exam Mean (± SD)	Total ($N = 1011$)	No Bother ($N = 828$)	Bother ($N = 183$)	P value*
Stage	1 (0.8)	1.1 (0.8)	1.3 (0.8)	**.001**
TVL	9.6 (1.5)	9.6 (1.4)	9.5 (1.8)	.194
Aa	−1.7 (1.1)	−1.8 (1.0)	−1.5 (1.2)	**.000**
Ba	−1.7 (1.1)	−1.8 (1.0)	−1.5 (1.2)	**.000**
Ap	−2.3 (1.1)	−2.3 (1.0)	−2.1 (1.4)	**.038**
Bp	−2.3 (1.1)	−2.3 (1.0)	−2.1 (1.4)	.090
C	−6.1 (1.7)	−6.1 (1.6)	−5.9 (1.8)	.171
D	−8.5 (1.9)	−8.6 (1.7))	−8.0 (2.4)	**.035**

Bolded data indicate statistically significant

*Student's t test

as opposed to the 1004 discussed in the original paper. This could be for several reasons: either certain individuals were not included in the original, or data collection continued after analysis began. We carefully checked for repeat entries and thus used the total number of patients found. Finally, questions used in the original study to evaluate bother were not validated. However, data was collected prior to common use of validated questionnaires, like the Epidemiology of Prolapse and Incontinence Questionnaire or the Pelvic Floor Distress Inventory [9, 10]. Regardless, questions used are remarkably similar to those in the PFDI, incorporating both presence of the symptom and whether the symptoms was a bother, indicating the questions probably do have validity in this context.

In conclusion, normal apical support seems to be when the cervix remains at least 4 cm above the hymen during POP-Q exam or when the cuff remains at least 6 cm above the hymen during POP-Q exam. How these values correlate with surgical success in procedures that restore apical support needs further study.

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Compliance with ethical standards

Conflicts of interest None.

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