ORIGINAL ARTICLE

Total vaginal length: Does it matter for assessing uterine prolapse?

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Abstract

Introduction and hypothesis Using the International Continence Society Pelvic Organ Prolapse Quantification (ICS POP-Q) system, uterine prolapse staging requires measurement of total vaginal length (TVL). The aim of this study was to determine whether TVT is a confounder of the relationship between uterine descent and POP symptoms.

Methods This is a retrospective study on 721 patients seen in a tertiary urogynaecological unit. All patients had undergone a standardised, in-house, physician-led questionnaire and digital POP-Q examination. Patients with a history of hysterectomy or with a dominant prolapse in the anterior ± posterior compartment were excluded from analysis, leaving 393 complete data sets for analysis. Association between prolapse symptoms (lump/drag) and station of cervix (i.e. C) were tested. Age, body mass index (BMI), menopausal status and vaginal parity were tested as potential confounders. Variables that were significant on binary logistic regression ($P < 0.05$) were included in a model for receiver operting characteristic (ROC) statistical analysis. This was repeated after adding TVL to the model. Likelihood ratio test was performed to compare models.

Results On binary logistic regression, prolapse symptoms were significantly associated with C, menopausal status and TVL (all $P < 0.03$). ROC analysis yielded an area under the curve (AUC) of 0.75 with menopausal status and C in the model. Adding TVL yielded an AUC of 0.773. The difference is statistically significant on the likelihood ratio test ($P < 0.001$).

Conclusions Adding TVL improved the performance of cervical station in predicting prolapse symptoms, validating the practice of using TVL in staging uterine prolapse.

Keywords Pelvic organ prolapse · POP-Q · Uterine prolapse · Vaginal length

Introduction

Pelvic organ prolapse (POP) is a common gynaecological condition for women, with a lifetime risk of POP surgery estimated at up to 20%. [1, 2]. Over the years a number of staging systems have been developed to quantify POP to help patient management, including those of Porges in 1963 [3], Baden and Walker in 1972 [4] and Beecham in 1980 [5]. The number of grading systems makes comparisons of findings difficult in surgical audit and research and has hindered communication between clinicians.

In 1996 the International Continence Society (ICS) introduced the Pelvic Organ Prolapse Quantification (POP-Q) staging system [6] aiming at standardising clinical assessment and staging. This system is now widely used [7] and has good inter- and intra-observer reproducibility, but validation has been incomplete. To stage central compartment descent, total vaginal length (TVL) is used, with stage I descent defined as C (≥ 2 cm). This definition is, however, arbitary and not based on scientific data. Furthermore, normality of pelvic organ descent has, to date, not been considered in this staging system. As POP is a relative indication for surgery, it is important to determine whether a certain degree of descent is relevant, whether symptoms reported by the patient are sufficiently explained by the examination findings and determine which compartment is most likely to be responsible for the patient's symptoms. As far as uterine prolapse is concerned, a recently published study using receiver operating characteristic (ROC) statistics showed that C at −5, i.e. a cervix at 5 cm above the hymen, has optimal sensitivity and specificity to predict symptoms of POP [8]. However, it is uncertain whether

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TVL is a confounder of this relationship. Using cervical station alone without measuring TVL to stage apical prolapse has the potential to simplify the assessment. This project was designed to study this research question. The null hypothesis is that TVL is not a confounder of the relationship between C and prolapse symptoms.

Materials and methods

This was a retrospective observational cross-sectional study on data obtained in a tertiary urogynaecological unit between March 2014 and November 2015. Patients were referred for POP and /or lower urinary tract symptoms (LUTS). All patients underwent a standardised physician-led questionnaire and digital POP-Q examination. Symptoms of prolapse were ascertained using standardised wording querying a "sensation of a lump or bulge" and/or a "dragging sensation in the vagina". Symptom bother was assessed using the visual analogue scale (VAS). Prolapse assessment was performed after bladder emptying, and care was taken to ensure Valsalva maneuvres lasting for at least 5–6 s to avoid false-negative findings [9].

Analysis was performed after excluding women with a history of hysterectomy and/or surgery for incontinence (except for a suburethral sling) or surgery for POP. To control for multi-compartment prolapse, women with a dominant prolapse in other compartments (defined as ICS POP-Q two stages higher than uterine prolapse in anterior or posterior compartments) were also excluded from analysis. This was based on findings showing that a stage 1 uterine prolapse is equally significant in predicting prolapse symptoms as stage 2 anterior/posterior-compartment prolapse on ICS POP-Q, concurring with imaging data in the literature [8, 10, 11].

Statistical analysis was carried out using SPSS v20. Binary logistic regression was performed to determine the association between prolapse symptoms and station of cervix (i.e. C). Age, body mass index (BMI), menopausal status and vaginal parity were tested as potential confounders. Variables significant on binary logistic regression ($P < 0.05$) were included in a model for ROC statistical analysis to test for an association between symptoms of prolapse, i.e. vaginal bulge or dragging sensation, and station of the cervix, i.e. C. This was repeated after adding TVL to the model. Likelihood ratio test was performed to determine whether the difference in performance between the two models was statistically significant. This study was approved by the local ethics committee HREC (LNR/15/LPOOL/250).

Results

In total, 727 patients were seen during the study period. Eight were excluded because of missing data, and 275 were excluded because of previous hysterectomy, prolapse repairs or anti-incontinence surgery apart from a suburethral sling, leaving 444. To control for multi-compartment prolapse, another 51 cases were excluded because of a dominant prolapse in the anterior and/or posterior compartment, leaving 393 complete data sets for analysis. Mean age was 52 years [standard deviation (SD) 13]. One hundred and eighty-one patients (46%) were menopausal, mean BMI was 29 kg/m^2 (SD 7.2), median parity was 2 (range 0–8) and 301 were vaginally parous (77%). Median vaginal parity was 2 (0–8), and 80 women (20%) had at least one forceps delivery. One hundred and seventy-seven patients (45%) reported prolapse symptoms. Median bother score on the VAS was 0 (range 0–10). Table 1 shows the prevalence of symptoms of other forms of pelvic floor dysfunction and the corresponding VAS bother score.

Mean Ba was −0.8 cm (range −3 to +4.5; SD 1.7), C −4 cm (range −9 to +7; SD 2.8), Bp −1.4 cm (range −3 to +3; SD 1.3). Mean TVL was 9 cm (range 5–12; SD 1.2). Mean Gh + Pb on Valsalva was 7.8 cm (range 3.5–12.5). On univariate analysis, age, menopausal status, vaginal parity, station of the cervix (C) and TVL were all significantly associated with symptoms of POP (all $P < 0.05$). On binary logistic regression, only menopausal status ($P < 0.03$), C ($P < 0.001$) and TVL ($P = 0.001$) remained significant. ROC curves were prepared for the relationship between symptoms of prolapse and C, controlling for confounders identified on binary logistic regression analysis. Areas under the ROC curve (AUC) were calculated as a measure of predictive performance, and cutoffs were determined. An ROC curve with C and menopausal status in the model yielded an AUC of 0.75 [(95% confidence intervlal (CI) 0.701–0.799]. ROC statistics was repeated including TVL in the model, which yielded an AUC of 0.773 (95% CI 0.727–0.82) (Fig. 1). On the likelihood ratio test, the model including TVL performed significantly better than the one without ($P < 0.001$).

Discussion

The ICS POP-Q system introduced >20 years ago is now widely used by urogyaecologists [7]. It has facilitated research in the field and was shown to be the staging system used in

Table 1 Prevalence of various symptoms of pelvic floor dysfunction and the corresponding visual analogue bother score (VAS)

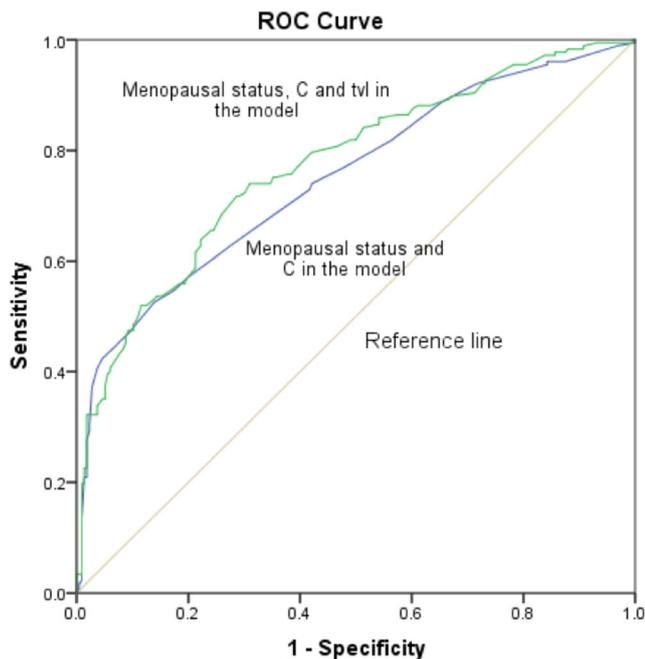| Symptoms	No. patients (%)	Median VAS (range)
Prolapse	177 (45%)	0 (0–10)
Stress urinary incontinence	298 (75%)	5 (0–10)
Urge incontinence	278 (71%)	4 (0–10)
Voiding dysfunction	119 (30%)	Not available
Obstructed defecation	226 (58%)	1 (0–10)

Fig. 1 Receiver operating characteristic (ROC) curves with menopausal status, station of cervix (C) ± total vaginal length (TVL) in the model for prediction of symptoms of pelvic organ prolapse (POP) ($n = 393$)

82% of articles published on POP [12] in a recent review. Twenty years on, the shortcomings and limitations of the quantification system have become apparent, and there is a need to revise the staging system [13]. One limitation is its arbitrary nature and lack of validation. The issue of inclusion of TVL in staging central compartment prolapse is an example [6]. To stage central compartment descent, TVL is used, with stage 1 central compartment descent defined as C (≥ 2 cm). This formula in staging central compartment prolapse was not derived from scientific data but consensus opinion. Furthermore, it was uncertain whether descent of C to a given level is equally symptomatic in women with and without a uterus until recently [14].

While assessment of TVL seems to have implications in the management of POP, its diagnostic value is unclear. Vaginal length is a predictor for successful pessary placement for women with POP and stress urinary incontinence (SUI) [15–17]. A shorter vaginal length is associated with a higher chance of unsuccessful pessary fitting. In addition, measurement of vaginal length is considered important when vaginal surgery for apical suspension is contemplated. Insufficient vaginal length may mean that apical fixation may be difficult or even impossible if the apex does not reach the sacrospinous ligament [18]. Shortened vaginal length following vaginal reconstructive surgery is a known risk factor for dyspareunia, and it is advised that patients with a shorter TVL be counselled about the risk of vaginal shortening and dyspareunia after prolapse repair. Furthermore, measurement of TVL is useful for assessing

the efficacy of central compartment support, i.e. point C, following surgery.

As regards central compartment prolapse assessment, it has recently been shown that a cervical station at −5 cm was the optimal cutoff to predict symptoms of POP for the central compartment [8, 14]. It is unknown, however, whether TVL is a confounder of the relationship between C and prolapse symptoms. Using cervical station alone without measuring TVL to stage apical prolapse would simplify the assessment. On the other hand, using TVL may potentially over-diagnose uterine prolapse. Women with a TVL of 10 and a cervix at −7 cm would be diagnosed as stage 1 uterine prolapse using the POP-Q staging system, which appears excessive. In view of a lack of evidence on the use of TVL in diagnosing central compartment prolapse, we undertook the study reported here. We found that adding TVL to a model including C and menopausal status improved performance in predicting POP symptoms, and this difference is significant on likelihood ratio test. This implies that TVL is a confounder of the relationship between C and POP symptoms, suggesting that staging uterine prolapse should be performed with reference to TVL. It does, however, remain questionable whether the current POP-Q formula (≥ 2 cm) is optimal for predicting symptoms of POP. Our group intends to perform another study to follow-up on this research question.

As far as we are aware, this is the first attempt at validating the use of TVL in uterine prolapse staging. The large sample size is a strength of the study. Women with potential confounders, e.g. a history of pelvic surgery other than a suburethral sling and a dominant prolapse in the anterior/posterior compartment, were excluded from analysis. It is, however, acknowledged that most of the study population was Caucasian, which may limit the generalizability of results. Furthermore, it is acknowledged that digital examination was used for ICS POP-Q coordinates and TVL assessment in this study. Although good agreement between the two assessment techniques for TVL has been shown ($\kappa = 0.67$) [19], it may be claimed that digital assessment lacks precision and reproducibility relative to the use of a ruler. Finally, using the ICS POP-Q staging system, central compartment descent was staged similarly for uterine prolapse secondary to poor uterine support and for low cervical station due to an elongated cervix. Future studies should explore whether point D is a confounder for the relationship between C and prolapse symptoms.

In conclusion, TVL seems to be a confounder in the relationship between cervical station and prolapse symptoms. This validates the practice of using TVL in the staging of uterine prolapse.

Compliance with ethical standards

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