Pelvic organ prolapse: anatomical and functional assessment

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Abstract

Pelvic organ prolapse (POP) is a common presenting complaint in gynaecology. In the UK, prolapse accounts for 20% of women on the waiting list for major gynaecological surgery. It is therefore important that clinicians understand how accurately to assess women with prolapse. The aim of this review is to provide a comprehensive description of the assessment required. Anatomical assessment should be made using the standardized Pelvic Organ Prolapse quantification system (POP-Q). The use of POP-Q in women with POP is recommended by the NICE guideline because allows effective communication between clinicians, reproducible evaluation of surgical outcomes, meaningful comparison of published series and comparison of different populations. The main focus of the review is a detailed and practical explanation of the POP-Q.

Keywords anatomy; pelvic organ prolapse POP-Q; quality of life; questionnaires; urogynaecology

Introduction

Pelvic organ prolapse (POP) is common condition in female population especially after menopause. A woman's lifetime risk of a pelvic organ surgery or incontinence is approximately 11−19%. An estimated 13% of these women will require a repeat operation within 5 years, whilst the 29% will undergo a surgery for another compartment prolapse or a related condition.

Appropriate treatment of any condition relies first on accurate diagnosis. Frequently, prolapse has been somewhat crudely diagnosed and treatments were often limited to simple vaginal repairs. Possibly inadequate attention was addressed to vault or uterine descent. The last decade has seen several significant developments within the field of pelvic organ prolapse (POP). Greater understanding of the anatomy of the female pelvic floor has come from magnetic resonance imaging (MRI) and three dimensional ultrasound scanning. Specialist societies, International Urogynaecology Association (IUGA) and the International Continence Society (ICS) have worked together to elaborate standardized terminology to assess prolapse. The use of validated questionnaires to assess symptoms and the impact of symptoms has become more common in both research and clinical practice.

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Anatomy (Figure 1)

The pelvic floor is a highly complex three dimensional structure, the nature of which would challenge the most adept structural engineer. The relative role of connective tissue, muscles and neurovascular tissue in maintaining normal pelvic floor morphology remains controversial.

Some of the anatomy of the pelvic floor is also still controversial however it is now commonly agreed that the main muscular component of the pelvic floor is made up of levator ani and that levator ani has two component parts. These are the pubovisceral muscle and the iliococcygeal muscle. The pubovisceral muscle is composed of pubococcygeus and puborectalis. Pubococcygeus is made up of several component parts puboanal, puboperineal and pubovaginal muscle. The iliococcygeal muscle arises from a fibrous band on the pelvic side wall the arcus tendineus levator ani, which runs from the symphysis pubis to the ischial spine over the obturator foramen.

De Lancey describes three levels of support for the pelvic organs. Level I support, the upper vagina and uterus, is suspensory and is provided by the uterosacral and cardinal ligaments. Level 2, the mid portion of the vagina is attached to the pelvic sidewall long the "white line" which is the arcus tendineus fascia pelvis. This attachment stretches the vagina between the bladder and rectum. Level 3, the distal vagina is directly attached to surrounding structures, the urethra anteriorly, the perineal body posteriorly and the levator muscles laterally. The three dimensional complexity and the three levels of support are demonstrated in Figure 2.

In 1918 Paramore described the support of the pelvic organs using the simple analogy of a ship in a dock. The ship represents the pelvic organs, the water is the levator muscle and the mooring ropes are the ligaments/fascia. If the water level falls enough the ropes will break.

The use of MRI has allowed the structure of the pelvic floor to be studied in greater detail. However, there are many areas of aetiology of prolapse which are still poorly understood.

Definition of prolapse

Currently there is no adequate definition of prolapse. IUGA and ICS published a joint report on terminology for female pelvic floor dysfunction in 2016. The term prolapse derives from the Latin: Prolapsus − "a slipping forth"and describes a falling, slipping or downward displacement of a part or organ, which can be experienced by the woman as a departure from the normal sensation, structure or function in reference to the position of her pelvic organs.

The National Institute of Health (NIH) defines uterine prolapse as the falling or sliding of the uterus from its normal position in the pelvic cavity into the vaginal canal. Despite very poor evidence about normality the NIH defined prolapse as greater than or equal to Stage II on the POP-Q examination. Using this NIH definition studies have shown 40−50% of women have prolapse. This is probably too broad.

Prolapse is a condition which affects women's quality of life, it is not associated with mortality. It is therefore important to

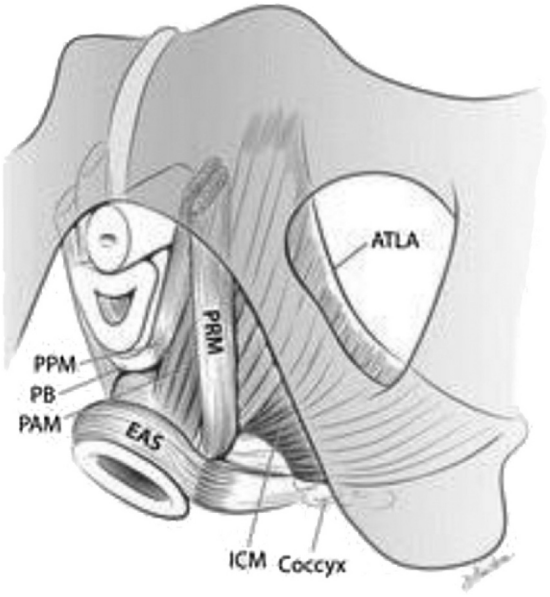

Figure 1 Levator Ani (The levator ani muscles from below after the vulvar structures and perineal membrane have been removed showing the arcus tendineus levatorani (ATLA), external anal sphincter (EAS), puboanal muscle (PAM), perineal body (PB) uniting the two ends of the puboperineal muscle (PPM), iliococcygeal muscle (ICM) and puborectal muscle (PRM). The urethra and vagina have been transacted just above the hymenal ring. (Reproduced with permission from: Kearney R, Sawhney R, De Lancey JO. Levator Ani muscle anatomy evaluated by origin-insertion pairs. Obstet Gynecol 2004; 104: 168–73).

consider symptoms in any definition of prolapse. The only symptom which consistently shows good correlation to the presence of anatomical prolapse is that of vaginal bulge.

Consider Figure 3: how would you describe this prolapse to colleague by telephone? Or interpret a colleague's written notes about this prolapse?

Some clinicians use terms such as small, moderate or large cystocele however it is difficult for another clinician to interpret such statements. (One man's small is another man's large!) Some clinicians would describe it as grade II cystocele. Others would state it was a first degree cystocoele and some may comment that it is a stage 2 anterior wall prolapse. All of these statements are correct depending on the classification system used (Figure 4). However prior to the POP-Q, there was no agreed "gold standard" to assess prolapse.

In 2016 the IUGA and the ICS published a joint report paper on the standardized terminology of female pelvic organ prolapse.

Despite a consensus by specialist societies to use POP-Q, its use in clinical practice remains predominantly with subspecialist urogynaecologists. The reasons stated for not using POP-Q are that it is too time consuming or too confusing. However, once POP-Q is understood it is an easy, quick, comprehensive and reproducible method of examining women with pelvic organ prolapse. It allows effective communication between clinicians, reproducible evaluation of surgical outcomes, meaningful comparison of published series and comparison of different populations.

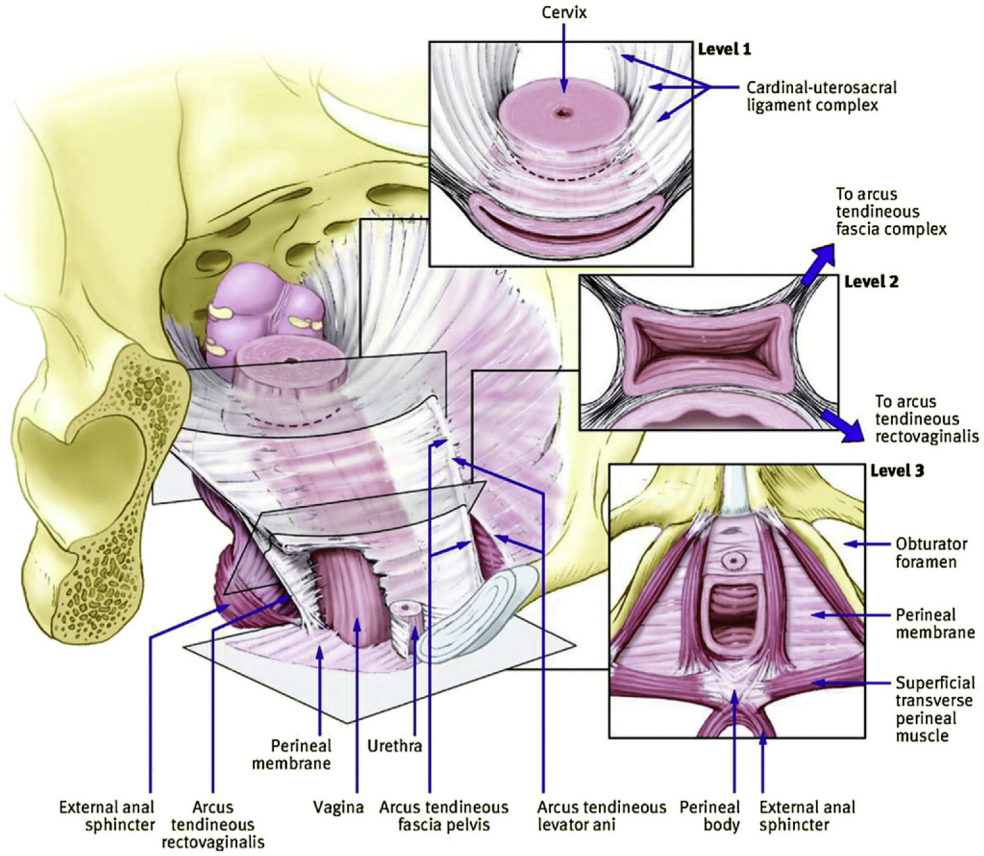

Figure 2 Complex 3D support of pelvic organs. (Reproduced with permission from Barber MD.Contemporary views on female pelvic anatomy. Cleve Clin J Med 2005; 72 (suppl 4):S3-11.).

Figure 3 Anterior vaginal wall prolapse.

Staging of POP-Q

Stage	Definition
0	Points Aa, Ba, Ap,Bp, are all at −3 cm and C and D is at great than or equal to TVL −2 cm
1	The criteria for stage 0 are not met and the leading edge of the prolapse is greater than 1 cm above the hymen
2	The leading edge of the prolapse is between 1 cm above or below the hymen
3	The leading edge is greater than 1 cm beyond the hymen but less than (TVL −2) cm from the hymen
4	The leading edge of the prolapse is greater than or equal to TVL −2 cm beyond the hymenal remnant.

Table 1

The most recent NICE guidance (NG123) has stipulated that POP-Q should be used in the routine clinical assessment of prolapse.

Understanding POP-Q

Ideally POP-Q should be measured after the patient has emptied their bladder and bowel. The examination position should be documented as lithotomy, left lateral or standing. The examiner should also record if maximum extrusion of the prolapse was seen. This is confirmed by the patient, either by them visualising the prolapse with a mirror or by touch. All measurements in POP-Q are expressed in centimetres, to the nearest 0.5 cm.

There are nine measurements in the POP-Q system. These are then translated in to a staging system. The staging is described in Table 1, however there is no evidence that this staging is clinically useful and therefore it will not be explained in detail in this review. Instead POP-Q should be reported as a nine cell grid (Figure 5).

Five of the nine points are easy to understand and measure (GH, PB, C, D, and TVL). There are two points on the anterior wall which require some greater conceptual understanding and thought. These are Aa and Ba. However, once these are understood then the two remaining points on the posterior wall are easy to understand, Ap and Bp. We will therefore focus on the simple five points first (GH, PB, C, D and TVL).

Measurements are all taken at maximum valsava, except TVL which is measured at rest. Disposable measuring sticks are available (Figure 6). Otherwise a clinical POP-Q can be undertaken in a similar manner to that used to estimate cervical dilatation during labour. The examiner first measures their own fingers and uses this measure for future approximation of POP-Q.

Comparison of four common classification systems for POP

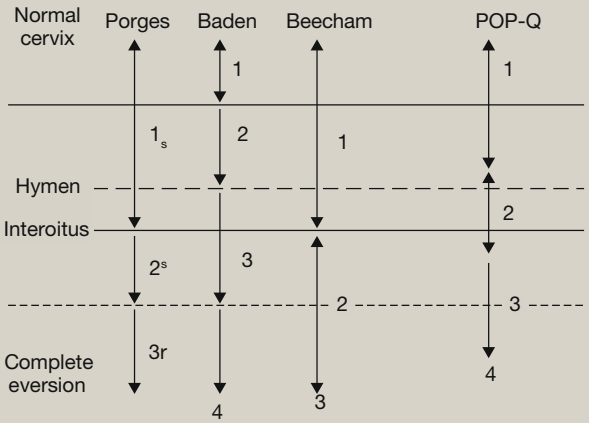

Figure 4

POP-Q Grid

Aa Descent of fixed point on anterior wall	**Ba** The lowest part of the upper anterior vaginal wall	**C** The lowest part of the cervix
GH Genital hiatus	**PB** Perineal body	**TVL** Total vaginal length
Ap Descent of fixed point on posterior wall	**Bp** The lowest part of the upper posterior vaginal wall	**D** Vault or insertion uterosacrals

Figure 5

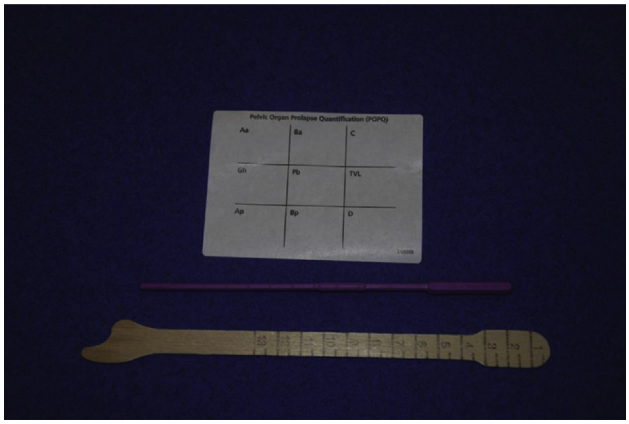

Figure 6 POP-Q grid sticker for medical records and measuring sticks, one commercial and one made from an Ayres spatula.

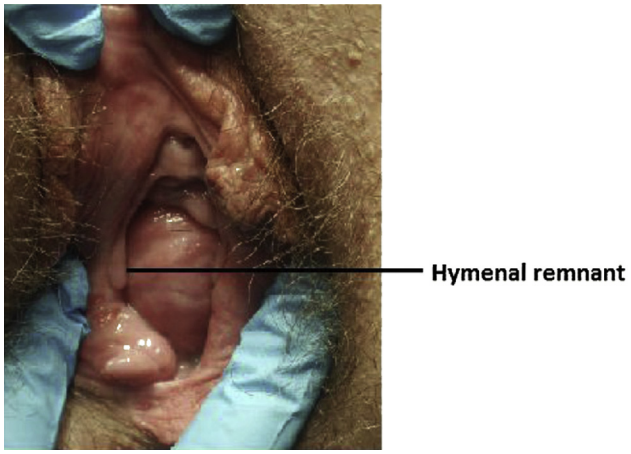

Figure 8 The hymenal remnant.

This estimation is only suitable for clinical practice and is possibly not accurate enough for research.

First measure Genital Hiatus (GH) this is measured from the middle of the external urethral meatus to the posterior aspect of the hymenal remnant. Remember it is measured at maximum valsalva.

Next measure the Perineal Body (PB) this is measured from the posterior aspect of the hymenal remnant to the middle of the anal opening, again at maximum valsava (Figure 7).

Points C is the lowest part of cervix and point D is the insertion of uterosacral ligaments to the cervix. These two points are measured relative to the plane of hymenal remnant. Conceptually the hymen remnant is used in exactly the same manner that the ischial spines are used to determine descent of the fetal head during labour. If the cervix lies below the hymenal remnant it is given a positive distance in centimetres. If it lies above the hymenal remnant it is given a negative distance.

The hymenal remnant is chosen because unlike the introitus it is a clearly defined and easily identified structure. However, often the plane of the hymenal remnant is not perpendicular to the longitudinal axis of the vagina. In this case it is usually best to use the hymenal remnant at 3 or 9 o'clock as the fixed reference point, not the 6 o'clock part of the hymenal remnant (Figure 8).

To measure point C, if the woman has a cervix then insert your index finger and feel the lowest part of the cervix during maximum valsalva. This is not always the os, sometimes it is the anterior lip of the cervix which is lowest. Use the thumb of the same hand to note the level of the hymenal remnant against the edge of your index finger. The distance from the end of your finger to your thumb is point C (Figure 9). This can be estimated or measured depending on the available resources.

If the woman has had a hysterectomy, the vault scar is then point C and there is no D. The vault scar must be visualised because it cannot always be reliably palpated. A Sims speculum should be used to assess the descent of the vault. However it is important not to obstruct the descent of the vault with the Sims. Accurately measuring the vault can be difficult and requires practice. There is currently no research evidence to inform surgeons at what level of vault descent should a vault suspension be included in the prolapse repair. Is it when the vault descends half

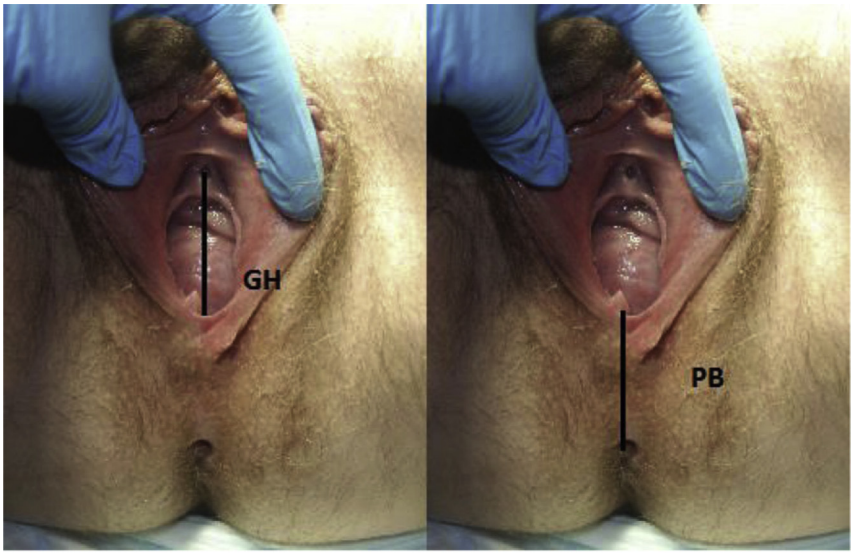

Figure 7 Measuring GH and PB at strain.

Figure 9 Measuring point C.

way down the total vaginal length, two thirds of the way down or to the hymen?

Point D is the point at which the uterosacral ligaments insert into the posterior aspect of the cervix. This is easier to palpate than to visualise. It can be palpated and then measured using the method described to measure point C. However, sometimes when a patient is not anaesthetised or if the uterosacral ligaments are atrophic it can be difficult to palpate their insertion. Point D is then approximated as the posterior fornix.

Total vaginal length (TVL) can be measured next.**TVL is the only point measured at rest.** Any prolapse is reduced but do not over elevate the vagina. TVL again can be measured digitally in the same manner that one does a bi manual examination, placing two fingers into the posterior fornix. Digital examination allows one to assess the amount of tension on the vagina and reduces the chance of over elevation. Occasionally the vagina is too long to measure digitally. TVL is the distance from the hymenal remnant to point D when any prolapse is reduced. Post hysterectomy use point C to estimate TVL.

Hence if TVL is 8 cm and point C is at -2 and point D is at -6 this suggests cervical elongation rather than prolapse.

The more complex points are Aa and Ba and Ap and Bp.

Point Aa

Aa is an arbitrary fixed point on the anterior wall of the vagina. It is 3 cm back from the middle of the external urethral meatus, measured along the vaginal mucosa. An imaginary mark is made on the anterior vaginal skin at this point. Then the patient is asked to strain and the new position of the imaginary mark is then measured relative to the plane hymen. Hence in the absence of prolapse Aa will remain at -3 cm (Figure 10).

At rest the fixed point is marked 3 cm along the length of the anterior vaginal wall (left). Then the patient is asked to strain and the mark is measure in relation to the plane of the hymenal remnant (right). In this case Aa is equal to +2 cm. (In clinical practice an imaginary mark is used).

Point Ba

Point Aa assess the lower anterior vaginal wall. Ba is the lowest part of the upper anterior vaginal. Ba is not a fixed point like Aa. Instead, this point can be anywhere along the vaginal wall above the first 3 cm, i.e. above Aa. Ba is measured at maximum strain relative to the hymenal remnant. In the absence of prolapse Ba is equivalent to Aa and is at -3 cm.

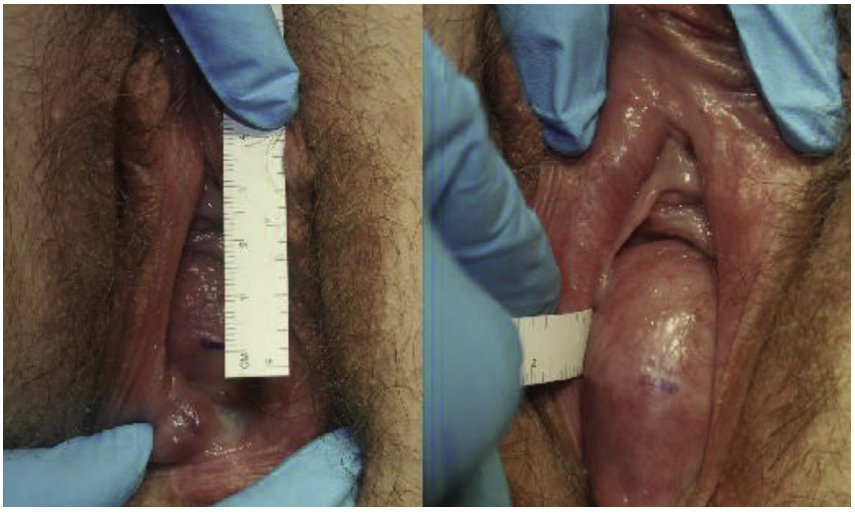

Figure 10 Measuring point Aa.

Ap and Bp are similar points to Aa and Ba; however, Ap and Bp are on the posterior vaginal wall.

Point Ap

Ap is an arbitrary fixed point on the posterior wall of the vagina. It is 3 cm back from the middle of the anal opening, measured along the vaginal mucosa. An imaginary mark is made on the posterior vaginal skin at this point. Then the patient is asked to strain and the new position of the imaginary mark is then measured relative to the plane hymen. Remember to use the hymenal remnant at 3 and 9 o'clock not 6 o'clock.In the absence of prolapse Ap will remain at -3 cm.

Point Bp

Point Ap assess the lower posterior vaginal wall. Bp is the lowest part of the upper posterior vaginal wall. Bp is not a fixed point like Ap. Instead this point can be anywhere long the vaginal wall above the first 3 cm, i.e. above Ap. Bp is measured at maximum strain relative to the hymenal remnant. In the absence of prolapse Bp is equivalent to Ap and is at -3 cm.

Some clinician use a chart to record POP-Q in a visual manner which may help to conceptualise the numbers in the 9 cell grid. Figure 11 shows visual representation of a high anterior wall prolapse following a hysterectomy and colposuspension. The lower part of the anterior wall is over elevated behind the symphysis pubis following the colposuspension hence Aa is at -3 cm. However, the upper portion of the anterior wall is descending to 2 cm beyond the hymen. There is only minimal prolapse of the lower posterior wall Ap and Bp are both at -2 cm above the hymen. There is no point D because of the previous hysterectomy.

Assessment of symptoms of prolapse

Pelvic organ prolapse can affect bladder, bowel and sexual function and it is therefore important that a comprehensive history is taken to assess all the patients' symptoms. These are listed in Table 2.

Vaginal bulge is the only symptom which appears to correlate strongly with prolapse. Although this may not be the patient's main concern, it is useful to prioritise any symptoms.

The clinician should investigate through symptom specific, targeted questions the presence of:

- Vaginal bulging, a lump seen or felt in the vagina
- Pelvic pressure, heaviness or dragging sensation
- Bleeding, discharge, erosion, ulceration or infection
- Lower backache

Similarly the presence of urinary symptoms should be also investigated, such as:

- Frequency of micrurition
- Stress urinary incontinence
- Urgency and urge urinary incontinence

Visualising prolapse by graphic representation of POP-Q (A high cystocele)

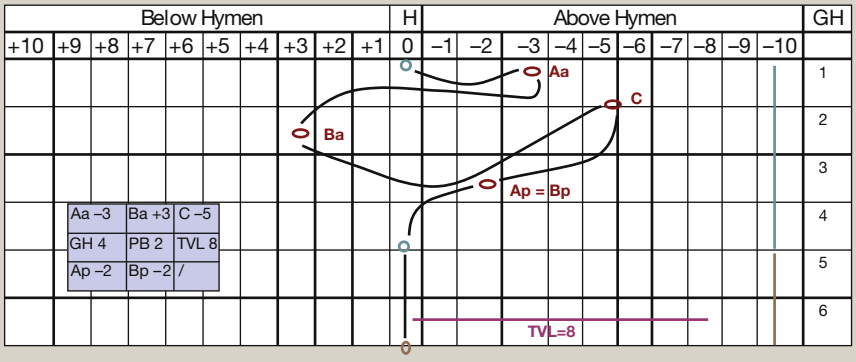

Figure 11

Symptoms of prolapse

Urinary symptoms	Bowel symptoms	Sexual symptoms	Other symptoms
Incomplete emptying	Incomplete emptying	Obstructive	Lump
Digitate to void	Digitate to defecate Anal/vaginal/perineal	Reduced sensation	Bulge
Frequency micturition	Difficult defecation	Reduced libido	Something coming down
Urgency to void	Anal Incontinence	Body image	Dragging
Urinary incontinence		Pain	Backache
? Recurrent UTI			PV Bleeding

Table 2

- Voiding difficulties, hesitancy, straining, slow stream
- Feeling of incomplete emptying, double voiding, post micturition leakage
- Position-dependent micturition
- Manual reduction of prolapse to initiate or complete micturition

Urinary symptoms

There is some evidence that voiding difficulties will improve following prolapse surgery for severe anterior or vault prolapse. There is considerable overlap of the pathophysiological cause of most urinary symptoms. This is summarised in Table 3. Hence patients should be advised that following prolapse surgery the urinary symptoms may improve but could stay the same or even get worse. This is especially true of stress urinary incontinence which may develop de novo following prolapse surgery.

Stress urinary incontinence is a relatively common de novo symptom following prolapse surgery for the anterior wall or vault descent. Many researchers have tried to develop pre operative tests to predict who will develop post operative stress incontinence following prolapse surgery. Unfortunately none of the tests for "occult stress incontinence" have a strong enough positive or negative predictive values to be clinically useful. Some clinicians still perform routine urodynamic testing prior to prolapse surgery however the value of such investigations is currently debatable.

Bowel dysfunction symptoms should likewise investigated, such as:

- Constipation
- Faecal or flatus incontinence
- Urgency
- Obstructive defecation symptoms, straining
- Splinting on the vagina or perineum

Digital evacuation. Although the majority of patients referred with prolapse to gynaecologists usually have symptoms of "something coming down", vaginal lump or bulge they may also have bowel symptoms which have been previously undisclosed due to embarrassment. The commonest symptom is difficult defecation. Many patients have to push on their perineum, posterior vaginal wall or digitate anally to evacuate their bowels. Some of these patients on more detailed questioning may have significant obstructive defecation due to intra anal intussusception. This can be palpated on rectal examination during straining and confirmed on defecating proctogram. These patients should be seen in a joint pelvic floor clinic with a colorectal surgeon and an urogynaecologist.

Finally, sexual quality of life symptoms related to prolapse could involve:

- Dyspareunia
- Decreased sensation
- Reduced self esteem
- Depression

There are several validated prolapse questionnaires available for research or clinical use (Table 4). However, few address all pelvic floor symptoms. EPAQis a comprehensive British electronic validated pelvic floor questionnaire it can be accessed at www.epaq.co.uk.

Treatment

The management of pelvic organ prolapse involves both conservative and operative options.

Conservative management includes observation, pelvic floor muscle exercises, pessary use, lifestyle modification

Overlap of possible pathophysiology of urinary symptoms (Green square = possible factor)

Urinary symptoms	Prolapse	Urothelial factor	Urethral stricture	Detrusor factor
Digitate vagina to void				
Incomplete empty				
Poor stream				
Strain				
Frequency				
DO				
UTI				
Retention				

Table 3

Validated questionnaires to assess prolapse

Questionnaire	Description
Pelvic Floor Distress Inventory & Pelvic Floor Impact Questionnaire (PFDI & PFIQ)	American questionnaire. It is widely used in research. It has a paper and electronic form. There is also a short form of the questionnaire available. Both assess symptoms and QoL of the pelvic floor.
Electronic Pelvic Floor Assessment Questionnaires (ePAQPF)	British questionnaire which is primarily electronic which reduces the burden on patients. It assesses both symptoms and QoL of the pelvic floor.
Prolapse Quality of Life Questionnaire (P-QoL)	British paper questionnaire. It assesses both symptoms and QoL of prolapse.
Pelvic Organ Prolapse Symptom Score (POP eSS)	British paper questionnaire. It assesses both symptoms of prolapse.

Table 4

measurements such as weight loss, treatment of constipation, smoking cessation, and avoidance of high impact exercise.

Some patients are referred with prolapse following a routine examination, for example following a smear test. Their prolapse is often asymptomatic or not bothersome. By definition operating on a patient who is asymptomatic cannot improve their symptoms and could result in side-effects for example dyspareunia or stress incontinence. These patients should be encouraged to have conservative treatment.

Women with symptomatic pelvic organ prolapse who fail or decline conservative management could be eligible for surgery. Surgical treatment could be either reconstructive or obliterative.

Reconstructive surgery aims to restore the prolapse of each compartment, whilst maintaining sexual function and improving symptoms. Surgery could be performed with either an abdominal (open or laparoscopic), e.g. sacrocolpopexy or a vaginal approach, e.g. anterior/posterior colporrhaphy, vaginal hysterectomy, sacrospinous fixation etc. Several techniques have been described with different outcomes, with or without the use of meshes biological or synthetic.

A recently published survey assessing the pelvic organ prolapse clinicians' practice during the last decade in the UK showed that the trends of native tissue surgery remain unchanged. Additionally a decrease of mesh implants and an increase in laparoscopic surgery has been also noted. ◆

FURTHER READING

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