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# Total hysterectomy and anterior vaginal wall suspension for concurrent uterine and bladder prolapses: Long-term anatomical results of additional vault and/or posterior compartment prolapse repair

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## ARTICLE INFO

## ABSTRACT

*Objective:* To review the long-term results of an intraoperative decision to repair or not repair associated vault and posterior compartment defects after total hysterectomy (TH) and anterior vaginal wall suspension (AVWS) for uterine and bladder prolapses.
*Methods:* After gaining Institutional Review Board approval, the operative records of women receiving TH and AVWS concurrently with a minimum follow-up period of 6 months were reviewed. Two groups were identified: Group 1 (G1) underwent TH + AVWS and intraoperative apical and/or posterior repairs, and Group 2 (G2) had TH + AVWS alone. The definition of prolapse recurrence was Pelvic Organ Prolapse—Quantification ≥ Stage 2 and/or any reoperation for prolapse.
*Results:* From 1998 to 2009, a total of 94 women were evaluated. At the mean 3 years follow-up, the rates of overall prolapse recurrence following initial surgeries between G1 and G2 were 30% and 24%, respectively. Additional operative repair for G1 and G2 was 18.5% and 16%, respectively. The progression rate for both groups was < 8%. The overall success for G1 and G2 was 70% and 76%, respectively.
*Conclusion:* At long-term follow-up, nearly one in five apical recurrences in these two surgical groups was observed with stable results in the anterior compartment. The posterior compartment required the least surgical intervention.
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## 1. Introduction

The association of bladder prolapse with uterine descent has long been recognized.[1] However, with office clinical examinations, the dominant prolapse may mask additional compartmental defects. A large cystocele component may compete with the uterus to be the "dominant" defect or vice versa when the uterus prolapses more. Most often, these undifferentiated prolapses are only conclusively staged intraoperatively under anesthesia, and data are lacking on the management of an intraoperative examination that differs from the office examination with differences in management from the literature.[2,3]

An even more perplexing situation develops when the planned hysterectomy and the anterior compartment have been completed, but the prolapse of apex and/or posterior compartments now becomes significant. In this situation, when a new diagnostic situation arises, is there an indication to change treatment and perform a concurrent prophylactic repair, or should one defer repair only when they become clinically significant? These decisions are not based on published evidence from the International Consultation on Incontinence or national guidelines owing to a paucity of data regarding long-term outcomes after prolapse repair with and without concomitant hysterectomy and/or an apical procedure.

Over the past decade, our team has encountered two types of situations intraoperatively in which (1) the degree of residual prolapse was major that additional apical and/or posterior repair was performed, or (2) prolapse was either absent or of low stage and no additional repair was performed. We reviewed the clinical outcomes of these two groups to determine if the intraoperative decision to withhold or pursue additional repairs resulted in adequate prolapse correction and/or prevented future need for additional repairs.

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## 2. Materials and methods

After obtaining approval from the Institutional Review Board of UT Southwestern Medical Center, we reviewed consecutive women who underwent concurrent total hysterectomy (TH) and primary cystocele repair with an anterior vaginal wall suspension (AVWS) technique in the Urology and Gynecology departments of our institution for symptomatic bladder and uterine prolapses. Inclusion criteria included age > 18 years with a minimum follow-up period of 6 months. Data were extracted from a prospective prolapse database and reviewed by a third party investigator (DL) who was a nonparticipant in these surgeries. Exclusion criteria included lack of follow-up data > 6 months. Pelvic organ prolapse was defined as per the consensus-based terminology issued jointly by the International Urogynecological Association/International Continence Society.[4]

Both surgical teams assessed patients at baseline for vaginal prolapse using the Pelvic Organ Prolapse—Quantification (POP-Q) classification[5] and a standing voiding cystourethrogram (VCUG) to objectively document urethral hypermobility and cystocele height.[6] Indications for surgery included: (1) bothersome symptoms and (2) POP-Q examination on valsalva with clinically significant apical prolapse (defined as point C ≥ −3) and cystocele stage ≥2 (defined as point Ba ≥ −1), and/or (3) cystocele Grades 2–3 on VCUG. Preoperative pelvic ultrasound was used to evaluate for uterine and/or adnexal pathology prior to determining the route of TH. Both operating surgeons were high-volume physicians with at least 20 years of clinical experience. All surgical procedures were performed in the same order, with hysterectomy being performed first, and the vaginal repair for the anterior compartment repair following. The hysterectomy approach (vaginal vs. open or laparoscopy) was dictated by uterine size, associated fibroids, decision to remove or preserve the ovaries, and patient as well as surgeon's preference.

### 2.1. Surgical technique

TH was performed by K.B. via one of three approaches: total abdominal hysterectomy (TAH), total vaginal hysterectomy (TVH), or laparoscopic vaginal hysterectomy (LAVH). All subsequent prolapse surgeries were performed vaginally by P.Z. With TAH, the modified Richardson technique of intrafascial hysterectomy was used.[7] For both TVH and TAH, the cardinal and uterosacral ligaments were plicated across the midline to obliterate the cul-de-sac.

For primary cystocele repair, the AVWS technique[8] using broad anchoring nonabsorbable sutures placed in a helical fashion beneath the anterior vaginal wall along the anterior vaginal wall from vaginal apex to bladder neck was utilized. These supporting sutures were then transferred suprapubically under finger guidance by a ligature carrier. Following cystoscopy with intravenous (IV) indigo carmine confirming no suture entry into the bladder or ureteric injury, these suspension sutures were tied over the tendinous portion of the rectus muscle, posterior to the pubic bone.

### 2.2. Intraoperative decision

Additional primary prolapse repairs with autologous tissue were performed following the intraoperative assessment of the lax vaginal compartments when the residual prolapse exceeded ≥ −1 cm from vaginal introitus and/or presence of an enterocele > 3 cm depth at time of LAVH measured with a ruler from the vaginal cuff to the trough of the defect. Depending on the approach to the hysterectomy, the apical repair was performed either (1) vaginally with a high midline levator myorrhaphy[9,10] and enterocele closure with Moschowitz purse string technique using a nonabsorbable suture, or (2) abdominally with uterosacral ligament midline plication and enterocele closure with Halban technique. In both approaches, the vaginal vault was anchored to the repair with absorbable sutures using Mayo needle. Cystoscopy after the IV administration of IV indigo carmine was systematically performed after enterocele repairs to confirm ureteric integrity. Rectocele was repaired using standard vaginal posterior colporrhaphy technique via a midline vaginal incision.

### 2.3. Postoperative assessment

Clinical reassessment with POP-Q staging and standing VCUG was undertaken at 6 months postoperatively, and clinical examination yearly thereafter. For determination of prolapse recurrence and progression, data points at the last available clinical visit (postoperative) were compared with baseline (preoperative) information. We defined anatomical success as prolapse stage ≤ 1 based on VCUG (for anterior compartment) at 6 months postoperatively, and/or latest clinical examination. Standardized terminology on POP outcomes reporting issued jointly by the International Urogynecological Association/International Continence Society consensus, subdivided into primary prolapse surgery/different site, repeat surgery (i.e., repeat operation for prolapse arising from the same site), and surgery for complications, was used in this clinical audit.[11] Definition of prolapse recurrence was POP-Q ≥ Stage 2 and/or any reoperation for prolapse. Progression was defined as an increase in POP-Q classification of one or more stages in any uncorrected vaginal wall compartments compared to the baseline. Descriptive statistics were used for analysis of demographics and indications.

## 3. Results

Between 1998 and 2009, a total of 94 of 107 consecutive women had available data for analysis. Thirteen women (12%) were excluded from the study for lack of sufficient clinical data and/or inadequate duration of follow-up. Two surgical groups were identified. Group 1 (G1, $n = 27$) included patients who had additional primary prolapse repairs concurrent with the TH + AVWS procedure. Group 2 (G2, $n = 67$) underwent TH + AVWS alone. The mean
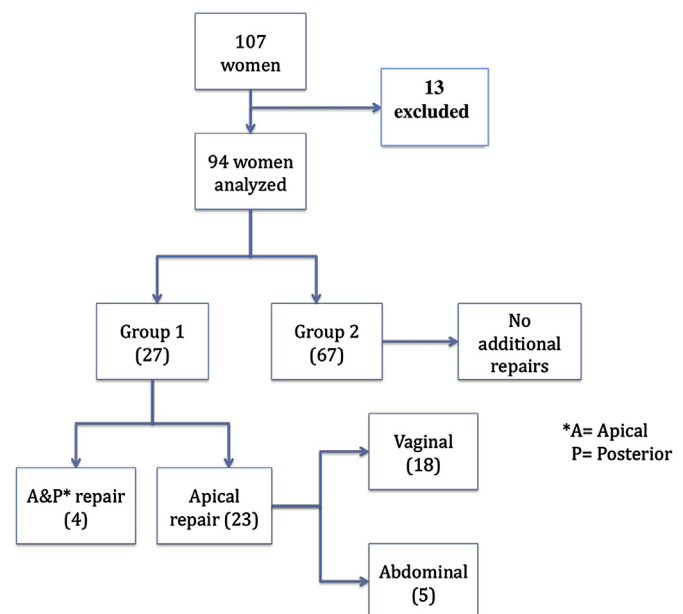


**Fig. 1.** Flowchart of two subgroup populations identified.

patient age was 67 years and 60.5 years for G1 and G2, respectively (range 35–85 years), with a mean duration of follow-up respectively at 39 months and 38 months (range 6–157 months; Fig. 1). No significant differences in baseline demographic characteristics were identified between the two groups as summarized in Table 1.

Baseline POP-Q staging for Groups 1 and 2 were as follows: (1) anterior compartment stage ≥ 2, G1 = 93% and G2 = 90%, respectively, or Grade ≥ 2 cystocele based on VCUG criteria; (2) apical compartment (uterine prolapse) stage ≤ 1, G1 = 93% and G2 = 91%; and (3) posterior compartment stage ≤ 2, G1 = 74% and G2 = 90%, respectively.

The patients in Group 1 received additional primary prolapse repair based on intraoperative findings of more advanced compartment prolapses than initially appreciated. Of the 27 patients, 23 underwent additional apical repairs, of which 18 were performed vaginally and five abdominally, whereas four women received both apical and posterior repairs vaginally (3) or abdominally (1). Table 2 highlights the POP-Q staging before and after the surgical intervention.

The anatomical outcomes following repair were categorized according to each treated compartment and are detailed in the following subsections.

### 3.1. Anterior compartment

In both surgical groups, the majority of women had a significant stage of anterior prolapse at baseline with POP-Q stage 2 (37% and 55% in G1/G2) and stage 3 (48% and 34% in G1/G2), respectively. Based on our definition of success, there was a significant global leftward shift in POP-Q stage following AVWS repair with 93% in G1, 100% in G2, and an overall 98% achieving anatomical success. Two failures were reported with mean time to recurrence of 27 months (range 11–43 months). Both patients were asymptomatic and had hysterectomy performed vaginally (TVH and LAVH). There was a significant apical descent associated with these anterior compartment recurrences with both patients proceeding with apical repair using mesh sacrocolpopexy (SCP).

### 3.2. Apical compartment

The overall apical compartment (vault descent and/or enterocele) failure rate was 18% between the two groups. In G1, there were six (22%) recurrent apical prolapses, with five patients proceeding with operative repair using mesh SCP (3 robot-assisted and 2 open), whereas one patient was managed conservatively without surgical intervention. The mean time to reoperation was 17 months (range 9–36 months). Similarly, in G2, 13 patients (19%) developed primary apical prolapse/different site, with 11 of these patients proceeding with apical repair (9 robotic, 1 open SCP, and 1 vaginal),

whereas two patients were managed conservatively. The mean time to reoperation for this group was 36 months (range 10–101 months).

The majority of apical failures in both groups (16/19 patients or 84%) proceeded to have mesh SCP, with no major perioperative complications such as ureteric or bladder injuries, infection, or bleeding, and a mean time to repair of 31 months (range 10–101 months). There was no *de novo* prolapse or reoperation observed following SCP repair.

### 3.3. Posterior compartment

The posterior compartment (excluding enterocele) was the most stable on POP-Q assessment. The overall incidence was 6.4% (6 patients) with one patient (4%) in G1 and five patients (7.5%) in G2, respectively. Minimal surgical intervention was required, with only

**Table 1**
Baseline demographics.

| Mean | G1 (n = 27) | G2 (n = 67) | Range |
|---|---|---|---|
| Age (y) | 67 | 61 | 35–84 |
| Parity | 3 | 2.7 | 0–7 |
| Body mass index | 24.3 | 25.9 | 17.2–41.3 |
| Menopausal status | | | |
| Pre | 2 | 8 | |
| Post | 25 | 59 | |
| | | | Total (%) |
| Hysterectomy | | | |
| Abdominal | 6 | 18 | 24 |
| Vaginal | | | |
| Total | 15 | 6 | 21 |
| Laparoscopic assisted | 6 | 43 | 49 |

**Table 2**
POP-Q staging between Groups 1 and 2 at baseline and last clinic visit.

| | G1 (intraoperative repair group; n = 27) | | | | |
|---|---|---|---|---|---|
| Preoperative POP-Q | Stage 0 | Stage 1 | Stage 2 | Stage 3 | Stage 4 |
| Anterior | — | 2 | 10 | 13 | 2 |
| Apical | — | 25 | 2 | — | — |
| Posterior | 8 | 12 | 7 | — | — |
| Postoperative POP-Q | | | | | |
| Anterior | 17 | 8 | 1 | 1 | — |
| Apical | — | 5 | 1 | — | — |
| Posterior | 15 | 7 | 4 | 1 | — |
| | G2 (no additional repair group; n = 67) | | | | |
| Preoperative POP Q | Stage 0 | Stage 1 | Stage 2 | Stage 3 | Stage 4 |
| Anterior | — | 7 | 37 | 23 | — |
| Apical | — | 61 | 6 | — | — |
| Posterior | 33 | 27 | 6 | 1 | — |
| Postoperative POP-Q | | | | | |
| Anterior | 60 | 7 | — | — | — |
| Apical | 54 | 12 | 1 | — | — |
| Posterior | 39 | 20 | 8 | — | — |

POP-Q = Pelvic Organ Prolapse—Quantification.

**Table 3**
Clinical outcomes.

| | G1 (n = 27)[a] | G2 (n = 67)[b] | Range |
|---|---|---|---|
| Follow-up (mean), mo | 39 | 39 | 6–157 |
| Time to reoperation (mean), mo | 17 | 36 | 10–101 |
| Primary prolapse repair | | | |
| Anterior | 27 | 67 | |
| Apical | 23 | — | |
| Apical and posterior | 4 | — | |
| Primary prolapse repair (different site) | | | |
| Anterior | 0 | 0 | |
| Apical | 0 | 10 | |
| Apicoposterior | 0 | 1 | |
| Repeat surgery (same site) | | | |
| Anterior | 0 | 0 | |
| Apical | 5 | 0 | |
| Posterior | 0 | 0 | |
| Progression (posterior compartment) | | | |
| No | 1 | 18 | |
| Yes | 2 | 2 | |

SCP = sacrocolpopexy.
[a] Intraoperative repair group, five SCP.
[b] No intraoperative repair group, 10 SCP; one rectocele, vault suspension, enterocele repair.

one patient from G2 requiring a primary repair/different site. Posterior compartment defects were often either unchanged (G1 = 33% and G2 = 58%) or improved (G1 = 48% and G2 = 26%). Only a few cases progressed (G1 = 7.5% and G2 = 3%), with the majority of cases managed conservatively. Table 3 summarizes the postoperative outcomes.

Of the 94 patients with hysterectomy, 70 had vaginal hysterectomy and 24 had abdominal hysterectomy. There was a statistical difference between the vaginal and abdominal hysterectomy groups with respect to follow-up duration (27 months vs. 81 months; $p < 0.0001$) and time to secondary surgeries (20 months vs. 63 months; $p < 0.002$). There was no statistically significant difference between these two populations in terms of age, gravida, parity, and pre- and postoperative POP-Q staging.

In summary, the overall prolapse recurrence-free rate (in any compartment) for G1 and G2 was 70% and 76%, respectively, with < 20% requiring apical or posterior compartment repairs for both groups.

## 4. Discussion

Prolapse staging by POP-Q remains challenging, in part because the procedure is generally performed with the patient in the supine position and typically with a fairly empty bladder.[5] Under anesthesia, we have noted a relative unmasking of apical and posterior compartment defects, especially after the completion of hysterectomy and anterior compartment prolapse repair in some patients (Fig. 2A–D). Therefore, we evaluated the long-term results of intraoperative assessment of apical/posterior significant prolapse, whether or not they may be corrected, following planned hysterectomy and anterior compartment prolapse repair.

Surgical planning with respect to hysterectomy and apical suspension is often contingent upon the intraoperative location of point C with traction. A study by Vierhout et al[2] using spring-scale 0.5 kg traction on each compartment intraoperatively during 108 consecutive repairs confirmed more pronounced apical and posterior compartment intraoperative prolapse as compared to the preoperative status assessed by POP-Q. However, there is no consensus for a standard approach to management. Foon et al,[3] in their 3-month follow-up study, reported that "intraoperative cervical traction" with apical prolapse < −1 cm did not inform them of the need to perform concurrent vaginal hysterectomy at the time of anterior repair. However, Crosby et al[12] reported that a C point > 5 cm (a threshold at which they would intervene) was evident in 33% of 206 women studied in their series. Surprisingly, this difference was more evident in women with lesser degrees of prolapse: 70.3% (57/81) with stage 1 prolapse versus 9.3% (4/43) with stage 2 prolapse, and 8.5% (7/82) with for stage 3 prolapse ($p < 0.001$).[12]

Our study differs significantly from these aforementioned studies by taking it one step further along and explores the anatomical outcomes based on our intraoperative threshold (defined as ≥ −1 cm) or enterocele (defect > 3 cm measured in pelvis) for additional prolapse repair following concomitant hysterectomy and anterior compartment repair. Our prospective database yielded follow-up data in 88% of our patients over time. We found that the anterior compartment was very stable following repair with low recurrence. The posterior compartment was the least surgically intervened as it either remained *status quo* or improved. However, the apical compartment was the most vulnerable with a significant number of women requiring surgical intervention. Even accounting for the surgical approaches to hysterectomy route, there was no difference in anatomical outcomes between those who had vaginal and abdominal approaches, except for the longer duration of follow-up and longer time to secondary surgery for those who had abdominal hysterectomy. This result may reflect the smaller size cohort, which represents one in four women treated.

Many studies have reported higher anatomical recurrences following anterior repair with a standard anterior colporrhaphy technique, with failure rates as high as 70%.[12] This phenomenon may be attributed to (1) dynamic changes in vaginal pressure forces
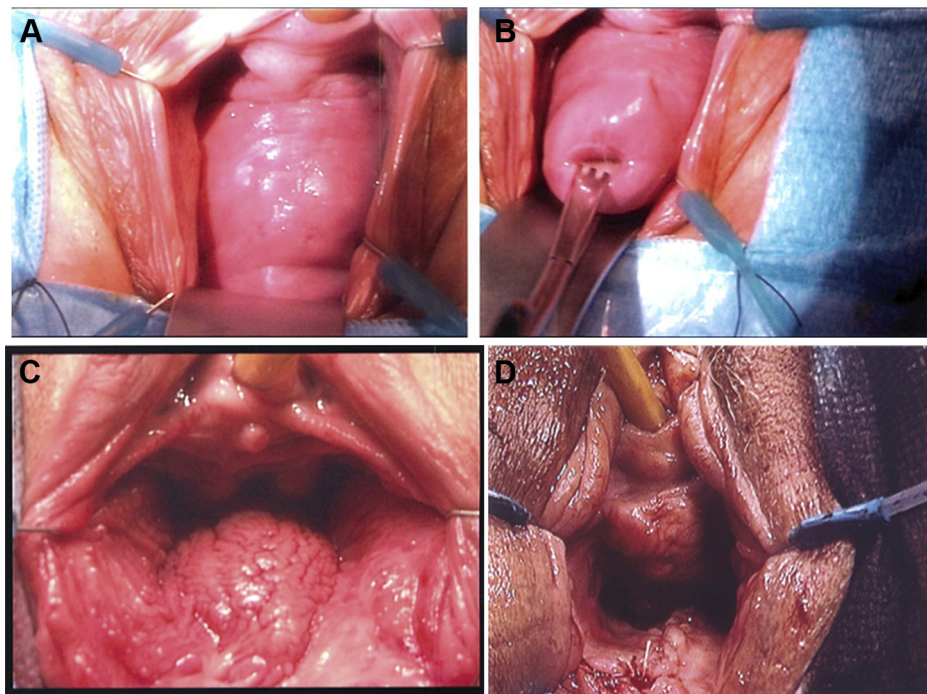


Fig. 2. (A) Stage 2 anterior compartment prolapse. (B) Cervix on traction with tenaculum revealing uterine descent. (C) Following anterior vaginal wall suspension (AVWS) for cystocele and hysterectomy, posterior compartment defect was noted, including weak apical support. (D) Vaginal repair of apicoposterior compartment defect with posterior colporrhaphy and enterocele closure with vault fixation [high midline levator myorrhaphy (HMLM)].

accentuating areas of fascial tears in other compartments following repair of one compartment, or (2) unrecognized defects at the completion of the initial prolapse repair procedure.[13–15] Some recurrences are purely anatomical and tend to remain asymptomatic when mild or moderate. Our technique for anterior compartment repair, the AVWS procedure, relies on retropubic scar formation to correct the paravaginal defect and hold the bladder neck and bladder base in place. Standing cystograms done preoperatively and at about 6 months postoperatively objectively confirmed the clinical findings (Fig. 3A–C). As noted in other series,[16,17] our patients with anterior compartment recurrences had significant apical component defects requiring corrective SCP.

In our study, a secondary prolapse repair/different site was avoided in about 80% of patients at a time lag of 6 years. There was no added morbidity from peri- or postoperative complications from additional repairs, but the risks of ureteric injuries, additional bleeding, and lengthening the procedure should be evaluated on a case-by-case decisional process. A transabdominal mesh repair was recommended to those who failed the initial native tissue repair procedures. For those who did not receive additional repairs and were observed, about one in five women experienced a secondary compartment prolapse, with the majority proceeding to a repair procedure at a mean follow-up period of 31 months (range 10–101 months).

We also observed the presence of a rectocele in > 50% of our patients postoperatively, but a formal posterior repair was rarely necessary once the anterior and apical compartments were repaired. This trend toward a low overall progression rate for rectocele has been observed in other series and explains the current trend to do less anterior–posterior repairs than in the past. Furthermore, a substantial proportion of our patients (48% in Group 1 and 26% in Group 2) had significant improvement and/or resolution of their rectocele postoperatively on POP-Q staging. This mirrored the findings of Guiahi et al,[18] who reported topographical posterior compartment improvement after abdominal mesh SCP alone at 12 months of follow-up, with only 8% having ≥ stage 2 posterior compartment prolapse compared to 61% preoperatively.[18] Part of this postoperative stabilization or improvement in the posterior compartment defect may also be attributed to a better bowel regimen, or greater compliance with diet changes and prevention of constipation.

The strengths of this study come not only from the relatively large number of patients and their long-term follow-up in both groups, but also from the consistency of the surgical team's approach and their experience. Outcomes included objective examination with POP-Q points, and a standing bladder X-ray to evaluate the anatomical correction of the cystocele and bladder neck support. The use of a 3-cm enterocele depth cutoff to repair or observe an enterocele defect was arbitrarily chosen. It is our experience that once the uterus is removed, there is a frequent descent noted in the pouch of Douglas (enterocele) at the back of the closed vaginal cuff. From our data, we postulate that if the
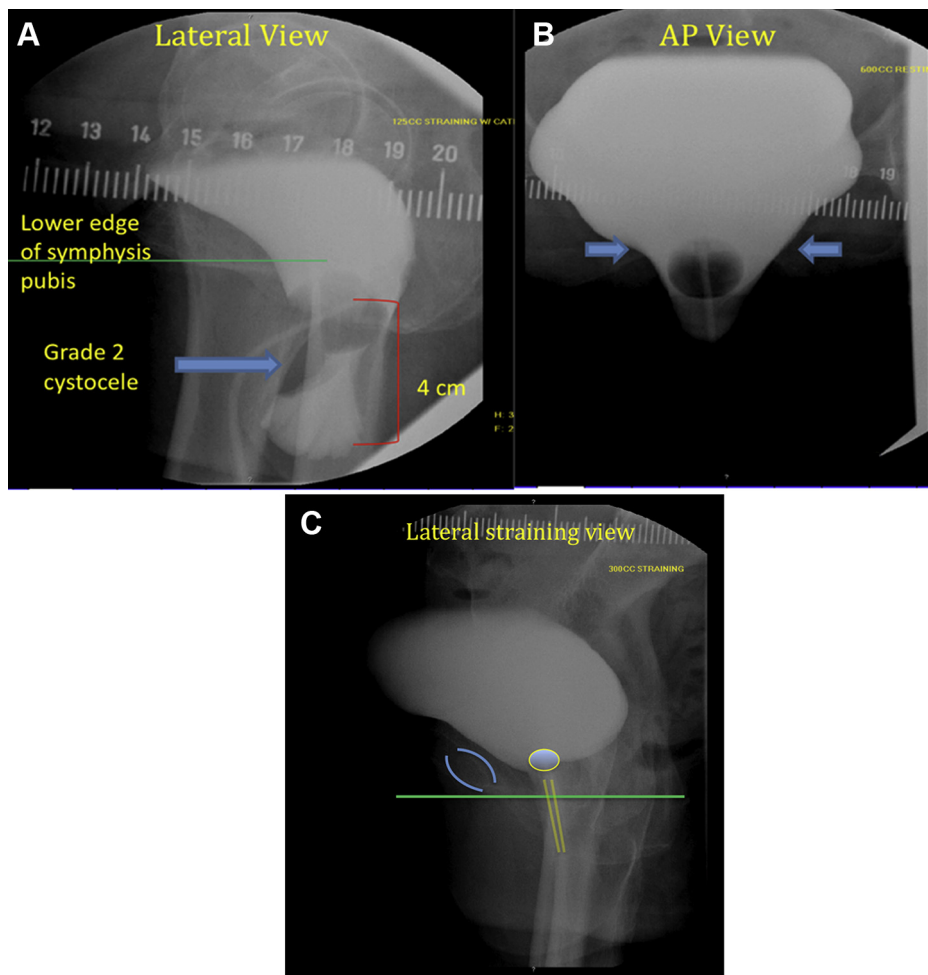


**Fig. 3.** (A) Grade 2 (2–5 cm) cystocele with lateral height at 4 cm on voiding cystourethrogram using lower edge of symphysis pubis as reference point. (B) AP view indicates the level of pelvic floor defect (⇒). (C) Six months after anterior vaginal wall suspension procedure, anatomical correction of cystocele is documented on standing VCUG. AP = anteroposterior; VCUG = standing voiding cystourethrogram.

enterocele is small, the likelihood of progression with time is low. However, progression is more likely if the enterocele defect is already well established and exceeds 3 cm in depth (based on our experience), and this was factored into our decision to repair intraoperatively. Despite this being a retrospective series, all of the patients were followed prospectively, and apical recurrences or progression in those not repaired remained small with our chosen criterion. For our study, the recent American Urogynecologic Society guidelines[4] were adhered to and facilitated the reporting of each involved POP compartment.

Study limitations include the retrospective nature of this study, the lack of generalizability to vaginal eversion because we had few such cases in this series, and a specific vaginal repair procedure for the anterior vaginal compartment using needle suspension. Another important limitation is that the importance of intraoperative POP-Q measurements and the effect of traction on unmasking POP are unknown, thus leading us to identify defects that may or may not require concomitant repair. We do acknowledge that the techniques for apical repair may not be generalized across the discipline to other techniques as we chose, under surgeon discretion, to perform a high midline levator myorrhaphy transvaginally or ureterosacral ligament suspension depending on the approach of the TH for apical suspension. For the group that received additional repairs intraoperatively, it would have been ideal to subdivide it into two cohorts, one serving as a comparator group (significant prolapse without intervention) to objectify our findings. Although challenging, a multicenter trial or case series will have sufficient patients to power such a study. However, given the lack of consensus among reconstructive surgeons and not infrequent encounter with this clinical dilemma, long-term results do matter.

Our data are valuable as both groups had sufficient duration of follow-up. Mean times to reintervention for apical prolapse are long at 17 months and 35 months, respectively. Our study serves to offer a realistic estimate of the recurrence rate, information that is somewhat lacking in the current literature. Furthermore for POP, our repair threshold was acceptable with adequate long-term results and is not that much different from the recurrence rates published in the literature so far.

In summary, improvement in intraoperative staging is desirable to assist in the decision to repair or observe additional compartment defects noted upon completion of any pelvic floor reconstruction. Occult pelvic floor defects might lead to recurrence and should be further investigated to better evaluate and possibly improve the outcomes of POP repairs. Finally, the utilization of MRI imaging in the preoperative setting is generating interest, which may assist in the decision-making process for surgical planning in prolapse management.

## 5. Conclusion

At long-term follow-up, women who had concurrent cystocele repair and TH for both uterovaginal and bladder prolapse with (Group 1) or without additional prolapse repairs (Group 2) reported 20% apical recurrence. In addition, stable anatomical results were noted in the anterior compartment, whereas the posterior compartment required the least surgical intervention. Intraoperative measurements and detection of pelvic floor defects after completion of hysterectomy require additional research and long-term investigations.

Although this is a retrospective analysis, this was a prospective study in which we had decided not to fix an enterocele defect when it is not deeper than 3 cm. This must be better emphasized to make a stronger conclusion.

The other point that requires more emphasis is that for POP, long-term results matter. Both groups had sufficient duration of follow-up to offer a realistic estimate of the recurrence rate, clinical information that is completely lacking in the current literature. Mean times to reintervention for apical prolapse are long at 17 months and 35 months, respectively. It seems that we could conclude that our repair threshold was acceptable with adequate long-term results, which are not that much different from the recurrence rates published in the literature to date.

## Conflicts of interest

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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