The distance between the perceived and the actual arcus tendineus fascia pelvis during vaginal paravaginal repair

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KEY WORDS
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Objective: This study was undertaken to determine whether the arcus tendineus fascia pelvis (ATFP) can be accurately identified from the paravaginal space (PVS) without entering the retropubic space (RPS).

Study design: Eight patients undergoing vaginal paravaginal repair were enrolled. The paravaginal dissection was completed to the most cephalad portion of the PVS without entering the RPS. The apex of each PVS was stained with methylene blue. The RPS was entered, the ATFP visualized, and 4 sutures were placed along its length to be used for the repair. The perpendicular distance between each suture and the most cephalad area of stain was measured.

Results: The mean distance from the perceived to actual ATFP at each suture point (1-4) was 3.5 cm, 2.75 cm, 2.0 cm, and 0.91 cm, respectively.

Conclusion: In these 8 cases, the RPS had to be entered to accurately identify the ATFP. The degree of error increases as the ischial spine is approached ($P < .001$).

The arcus tendineus fascia pelvis (ATFP) is a fibrous thickening of the endopelvic fascia running within the fascia covering the pubococcygeus, iliococcygeus, and obturator internus muscles. It can be accurately identified from the retropubic space (RPS) along its course, medial to the obturator internus muscle, extending from the inner surface of the body of the pubic bone (4 mm lateral to the symphysis pubis) narrowing to the most medial tip of the ischial spine.\(^1\)-\(^3\) The ATFP forms the inferior margin of the RPS as well as the superior margin of the paravaginal space (PVS).

The primary support of the anterior vaginal compartment is thought to be the lateral connection of the midvagina to the ATFP via the vesicovaginal adventitia.\(^3\)-\(^5\) It has been demonstrated that the most common cause of anterior compartment prolapse is a lateral detachment of the midvagina from its connection to the ATFP.\(^3\)-\(^6\)

In cases where a paravaginal defect can be demonstrated, surgery to re-establish normal anatomic attachments would not only correct the defect but may also prevent recurrence.\(^6\) Although the principle of the paravaginal defect repair is unchanged, the technique for its accomplishment has varied. In 1909, White\(^7\) proposed a paravaginal repair using a transvaginal approach. This procedure lost recognition as Kelly's...
anterior colporrhaphy, using a midline plication of the vesicovaginal adventitia, gained wider acceptance. In 1976, Richardson et al.6 popularized reattaching the anterolateral vaginal sulcus to the ATFP via an abdominal approach. Shull et al.8 and Grody.9 reintroduced the vaginal approach to paravaginal defect repair in 1994.

Debate continues among surgeons regarding the best technique for paravaginal repair.10 The transabdominal approach allows clear identification of the ATFP.3,4,11,12 Site-specific defects can be easily identified and repaired without disruption of intact supports. However, the concomitant abdominal incision may be associated with increased pain, time to recovery, and altered cosmesis when compared with the transvaginal approach. Debate also exists as to whether the retropubic space needs to be entered during a vaginal approach to the paravaginal repair. Some surgeons believe the ATFP can be accurately identified from the PVS, by palpation, without entering the RPS.7,13-16 Others believe the increased dissection needed to enter the RPS is necessary to accurately identify the ATFP before re-establishing its connection to the mid vagina.8,17,18

The purpose of our study was to determine whether the ATFP can be accurately identified from the PVS, by palpation, without entering the RPS during vaginal reconstructive surgery.

Methods

Institutional Review Board approval was granted for this prospective observational cohort study (IRB no. 03-110). The cohort consisted of women in the private practices of 2 of the previously stated authors (J.M. and R.C.) undergoing vaginal paravaginal repair either alone or in conjunction with concomitant surgery. Inclusion criteria included all women over the age of 18 years scheduled to undergo vaginal paravaginal repair surgery for symptomatic anterior compartment defects with intact or mostly intact paravaginal attachments at the time of surgery. Exclusion criteria were limited to age younger than 18 years and complete bilateral detachment of the vesicovaginal adventitia from the ATFP, noted at the time of surgery. Complete detachment of the vesicovaginal adventitia was defined as a complete separation of the vesicovaginal adventitia from the ATFP between the ischial spine and the level of the urethrovesical junction. Under these conditions the RPS communicates with the PVS. The ATFP is easily visualized after very minimal dissection into the PVS therefore eliminating the need for palpation of the ATFP.

Consent was obtained from 9 patients preoperatively. Eight patients fulfilled inclusion/exclusion criteria. Demographic data, including age, hormonal status, history of pelvic surgery, and International Continence Society (ICS) stage of anterior compartment prolapse (based on Pelvic Organ Prolapse-Quantified examination19) were collected and recorded.

Intraoperatively, the anterior dissection was either performed first or immediately after vaginal hysterectomy. A midline incision was made in the anterior vaginal wall from the vaginal apex to a level 1 cm proximal to the urethra meatus. The vaginal mucosa was sharply and bluntly dissected off the vesicovaginal adventitia. The paravaginal dissection was completed to the most cephalad portion of the PVS, which we defined as the apex of the PVS. This was the point where the ATFP could be easily palpated along its course from the ischial spine to the pubis, without entering the RPS. As the 2 primary surgeons customarily enter the RPS during vaginal paravaginal repair, the level of the dissection was independently evaluated by a senior consulting surgeon (M.G.) for concurrence. Paravaginal defects were observed as either an extreme attenuation of the vesicovaginal adventitia at this level or a separation of the vesicovaginal adventitia from the ATFP that resulted in a communication between the PVS and RPS. Hemostasis was ensured, the area blotted dry, and the apex of the PVS was stained with methylene blue. The RPS was entered, the ATFP visualized, and 4 sutures were placed along its length to be used for the paravaginal repair. The first suture was placed at the level of the ischial spine to the pubis, without entering the RPS. As the 2 primary surgeons customarily enter the RPS during vaginal paravaginal repair, the level of the dissection was independently evaluated by a senior consulting surgeon (M.G.) for concurrence. Paravaginal defects were observed as either an extreme attenuation of the vesicovaginal adventitia at this level or a separation of the vesicovaginal adventitia from the ATFP that resulted in a communication between the PVS and RPS. Hemostasis was ensured, the area blotted dry, and the apex of the PVS was stained with methylene blue. The RPS was entered, the ATFP visualized, and 4 sutures were placed along its length to be used for the paravaginal repair. The first suture was placed at the level of the ischial spine (suture 1). Sutures 2, 3, and 4 were placed 1.5 to 2 cm from the preceding suture up to the level of the urethrovesical junction (suture 4). The perpendicular distance between each suture and the most cephalad area of stain was measured in centimeters.
rounded to the nearest 0.5 cm using a firm ruler (Figure 1). This was then repeated on the contralateral side.

Statistical analyses for the factors ICS stages, surgeons, and menopausal status consisted of comparing average distances (right and left side combined) at each suture point with 2-tailed permutation tests at a .05 significance criterion. The mean equivalence of left and right side measures at each suture point were tested with Wilcoxon signed rank tests. Trend contrasts across suture points were tested by using a mixed model analysis of variance to account for the repeated measures from patients. These analyses were performed with SAS version 9.0 statistical software (SAS Institute, Cary, NC).

Results

In 8 women, the RPS was not entered on either the right or left side before staining, allowing for a total of 16 paravaginal dissections. One patient with ICS stage III had bilateral complete detachment of the vesicovaginal adventitia from the ATFP and therefore was excluded from the study (per exclusion criteria). Demographic data are represented in Table I. The mean age of participants was 53.3 years with a range 32 to 70 years. Of the 8 women, 5 (62.5%) had ICS stage II prolapse, 2 (25%) had ICS stage III prolapse, and 1 (12.5%) had ICS stage I prolapse. There were no patients with ICS stage IV prolapse.

Patient age, ICS stage, surgeon performing the procedure (J.M. vs R.C.), and menopausal status were not found, statistically, to affect the distances noted at each suture point (Table II). No difference was found between measurements recorded from the right PVS and those recorded from the left PVS: suture 1 \( P = .99 \), suture 2 \( P = .81 \), suture 3 \( P = .99 \), suture 4 \( P = .99 \). The mean distance from the perceived to actual ATFP at suture 1 (near the ischial spine) was 3.5 cm (range 2-4 cm), at suture 2 was 2.75 cm (range 2-4 cm), at suture 3 was 2.0 cm (range 1-3 cm), and at suture 4 (near the pubis) was 0.91 cm (range 0-2 cm) (Table III). In all subjects the distance between the perceived and actual ATFP decreased as the pubis was approached: with a significant linear trend \( F_{1,21} = 131.62, P < .001 \) (Figure 2).

Comment

Techniques for the repair of anterior compartment prolapse continue to evolve as our understanding of
the origin of pelvic organ support and clinical anatomy grows. In these 16 dissections (8 cases), the RPS had to be entered to accurately identify the ATFP. The degree of error between the perceived and actual ATFP increased as the ischial spine is approached. One possible explanation for these data is bias introduced as a result of incomplete dissection of the PVS. Two steps were taken to minimize this potential bias. First, the surgical team varied between patients (Table I). Therefore, the degree/technique of dissection was not surgeon specific. In addition, a senior consulting physician accustomed to performing paravaginal repairs without entering the RPS was in concurrence that the paravaginal dissection was as extensive as he performed before placement of suture in the ATFP during "closed technique."

We believe that the decrease in the measured distances between sutures 1 and 4 may be explained by reattachment of the previously torn vesicovaginal adventitia in a more distal and medial location. The resultant scar tissue would then give the impression of the ATFP on digital palpation. This theory would seem to be supported by the finding of Delancey that the most common location of separation of the vesicovaginal adventitia from the ATFP arises at or near the ischial spine but rarely at the pubis. In addition, we found that in our patient with stage I prolapse, the distance at suture 1 was relatively close to the actual ATFP. Although no statistically significant difference was found between the degree of prolapse and the measurements at each point, this may have been due to type II error introduced by low sample size.

If this theory is correct, by staining the perceived ATFP and measuring the distance to the visualized ATFP at the pelvic side wall, we have quantified the extent of the paravaginal defect. Certainly, further studies are needed to either accept or refute this hypothesis.

We recognize that the small number of participants enrolled to date may have limited our ability to detect a difference between the measurements at each point and the patient’s hormonal status, the stage of prolapse, or the operating surgeon. Another limitation of this study was the elastic nature of the stained tissues. Introduction of instruments necessary to visualize the pelvic sidewall may have caused stretching of the marked tissue nearer the ischial spine, as it lies deeper within the pelvis, increasing the measurement between the actual and perceived ATFP. This limitation is being addressed in an ongoing study.

In conclusion, in these 8 cases the RPS had to be entered to identify the ATFP accurately. The degree of error increases as the ischial spine is approached. This observation may be due to medial detachments of the ATFP arising at or near the ischial spine with reformation of scar tissue at a more caudal location giving the impression of the ATFP on digital palpation. Further study is needed to determine whether the actual ATFP
may be reached with suture during vaginal paravaginal repair, without entering the RPS.

References