

Functional and anatomic comparison of 2 versus 3 suture placement for uterosacral ligament suspension: a cadaver study

T. Ignacio Montoya, MD; Shena J. Dillon, MD; Sunil Balgobin, MD; Clifford Y. Wai, MD

OBJECTIVE: The objective of the study was to compare the vaginal apex pullout distance using 2 vs 3 suspension sutures during transvaginal uterosacral ligament suspension (USLS) and to describe relationships to ipsilateral ureter and nerve structures.

STUDY DESIGN: Eight fresh-frozen female cadavers were studied. After hysterectomy, a transvaginal USLS was performed with placement of 3 suspension sutures per side. The 2 most distal sutures on each ligament were tied. A screw-and-washer attachment was secured in the middle of the vaginal cuff and tied to a pulley system with surgical filament. Distal traction was applied with sequentially increasing weight loads. Distal migration of the vaginal apex from baseline with each weight load was recorded. The most proximal suspension suture was tied and the procedure repeated. Horizontal distances between each USLS suture to the ipsilateral ureter were

measured. Three discrete points were marked on sacral nerves S1-S3, and the shortest distance between each point and each ipsilateral USLS suture was measured. Descriptive statistics and repeated-measures analysis of variance were performed.

RESULTS: Application of each load resulted in greater migration distances for the 2 suture configuration when compared with 3 sutures ($P < .05$). Differences were greatest for the 3 kg load (mean \pm SEM, 2.0 ± 0.2 vs 1.5 ± 0.1 cm, respectively). Distances to ipsilateral ureter between the 2 most cranial sutures were comparable ($P > .05$). The most cranial USLS suture was closest to sacral nerves S1-S3.

CONCLUSION: In this cadaveric study, 3 USLS sutures provided more support to the vaginal apex than 2 sutures, although the absolute difference may not be clinically significant. The most cranial suture had the smallest distances to sacral nerves S1-S3.

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BACKGROUND AND OBJECTIVE

The uterosacral ligament suspension (USLS) is performed to correct prolapse of the vaginal apex. Using interrupted sutures, the surgeon fixes the vaginal apex to the uterosacral ligaments (USLs) bilaterally at or above the level of the ischial spines. Possible complications during suspension suture placement include injury to structures present in close proximity to the USLs, including the ureters and sacral nerves.

Variations in technique exist, including the number of suspension sutures placed per ligament. Using more sutures may provide more support to the vaginal cuff, whereas using fewer

may be associated with lower risk for ureteral or sacral nerve injury.

The objective of our study was to compare vaginal apex strength with the use of 2 vs 3 suspension sutures during transvaginal USLS and to describe anatomic relationships to ureter and nerve structures near the suspension sutures.

MATERIALS AND METHODS

In each of 8 female cadavers, after hysterectomy, a surgeon performed transvaginal USLS by passing 3 sutures through each USL. The sutures were passed through the anterior and posterior vaginal cuff, respectively, and distributed evenly along the entire width of the cuff. The 2 more caudal sutures, sutures 2 (middle) and suture 1 (most caudal), on each USL were tied first, leaving the most cranial suture (suture 3) on each side untied.

After the cuff was closed, a 9/16-inch (14 mm) diameter metal metric fender washer was placed above the vaginal cuff. A one eighth inch diameter bolt was threaded through the washer and passed through the center of the cuff and out the

vagina, where it was affixed to a number 7 waxed polyester surgical filament. The surgical filament was oriented parallel to the table surface and passed over a 3 inch fixed single pulley.

Successive 500 g slotted weights were added to a weight hanger to provide increasing loads of 0.5, 1, 1.5, 2, 2.5, and 3 kg against the vaginal cuff. The distance traversed by the vaginal apex supported by the 2-suture configuration from a baseline position after application of each weight load was measured and recorded. On the same cadaver, the tagged remaining most cranial USL sutures on each side (suture 3) were tied. Distances traversed with each weight load were measured.

Measurements were taken from each suture on the USLs to the shortest horizontal distance to ipsilateral ureter and the shortest distance to ipsilateral sacral nerves S1, S2, and S3 at 3 discrete points along each nerve.

RESULTS

The [Figure](#) illustrates the distal migration of the vaginal cuff for each weight load with 2 and 3 sutures per side. With the

From the Department of Obstetrics and Gynecology, University of Texas Southwestern Medical Center, Dallas, TX.

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exception of the 0.5 kg load, application of each load resulted in significantly greater migration distances for the 2 vs 3 suture configuration. The most caudally placed sutures on each USL were located significantly closer to the ureters than either of the 2 more cranially placed sutures.

All 3 discrete points of the S3 nerve were closer than those of either the S2 or S1 nerves to each individual USLS suture ($P < .05$). The most caudally placed suture (suture 1) was farthest from the sacral nerves and their discrete points, followed by the middle suture (suture 2), with the most cranial suture (suture 3) closest to the sacral nerves.

COMMENT

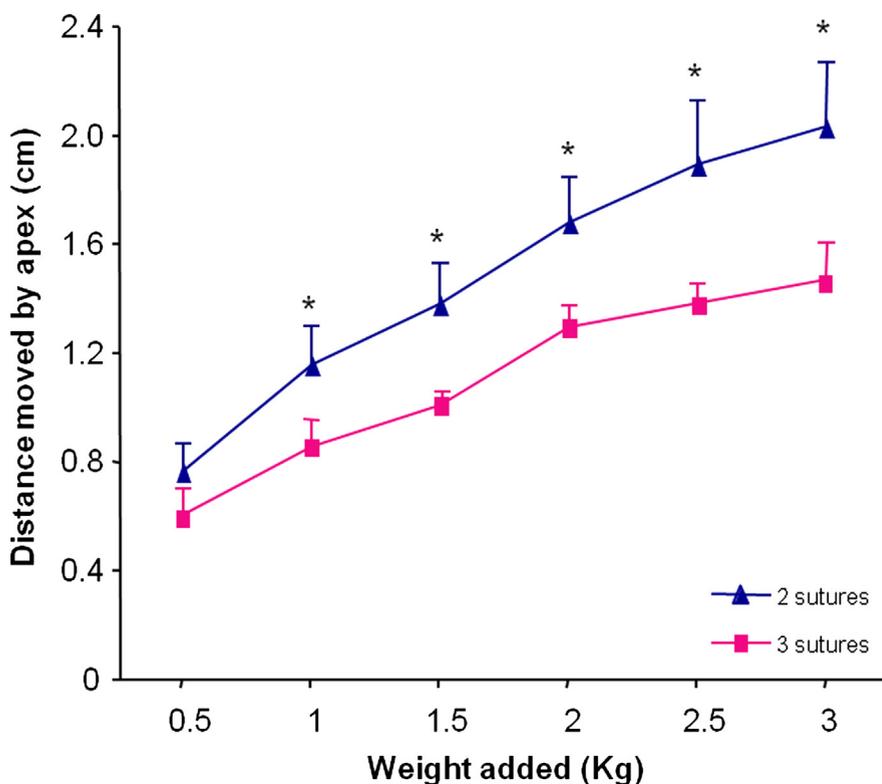
The use of 3 sutures per side appears to provide greater vaginal apical support. The observed differences in distal migration of the cuff, however, were small and may not be clinically significant. One may speculate that in patients with conditions associated with chronic or sustained increases in abdominal pressure, the placement of 3 sutures may be considered for potentially better longer-term support.

The nearest relationship present on either side was that of the ureter to the ipsilateral, most caudal USL suture. Therefore, when ureteral ligation or kinking is encountered during transvaginal USLS, the most caudal suture should be removed first.

The relationship of the sacral nerves to the sutures along the USL was closest to the S3 nerve, with the closest distances observed between this nerve and the most cranial USL suture. However, the statistically significant difference in distances, when compared with the second USL suture, was small. This difference in the context of a 2.1 cm average absolute distance between this suture and S3 may not translate clinically to additional risk for nerve injury with placement of the third USL suture.

Limitations are associated with this anatomical study. The application of weight loads by pulling distally on the vaginal cuff is only a model for acute intraabdominal pressure applied to the pelvic floor in vivo. Each cadaver was used as its own control to minimize the effect of confounding variables inherent

FIGURE
Distance traversed by the vaginal apex with application of weight loads



Mean distance (\pm SEM) traversed by the vaginal apex (centimeters) with application of successive 500 g slotted weights to provide increasing loads of 0.5, 1, 1.5, 2, 2.5, and 3 kg against the vaginal cuff. Blue triangles indicate 2 sutures, and pink squares indicate 3 sutures. Asterisk indicates $P < .03$, 2 vs 3 sutures.

Montoya. Two vs 3 suture comparison in transvaginal uterosacral ligament suspension. *Am J Obstet Gynecol* 2013.

in cadaveric studies. Other limitations associated with the use of cadaveric specimens include lack of muscular tone and deterioration of tissue since time of death. We are unable to draw conclusions regarding long-term effects of using 2 vs 3 USL suspension sutures with this model.

Our findings suggest that using 3 USLS sutures per side is associated with stronger vaginal apical support than using 2 sutures. Although the addition of a third, most cranial USL suspension suture does not seem to increase risk for ureteral injury, it is associated with a smaller distance to the sacral nerve structures, particularly S3. Although findings support the use of 3 USL suspension sutures per side, the pelvic surgeon should continue to rely on personal comfort level, judgment, and technical expertise when

deciding how many suspension sutures to place during transvaginal USLS.

CLINICAL IMPLICATIONS

- Placing 3 suspension sutures per side during transvaginal uterosacral ligament suspension (USLS) may provide greater support to the vaginal apex than placing 2 suspension sutures per side.
- When ureteral occlusion is suspected during transvaginal USLS, the most caudal ipsilateral suture should be removed first.
- The use of 3 vs 2 suspension sutures per side during USLS moves the suspension closer to S1-S3 as measured in this study; whether this increases risk of injury to these structures is unclear. ■