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CASE REPORT

# Surgical repair of bilateral levator ani muscles with ultrasound guidance

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**Abstract** Separation of the levator ani muscles from pubic bone is a common major levator trauma that may occur in vaginal delivery and is associated with pelvic floor dysfunctions. We describe a novel ultrasound-guided technique to repair these muscles. A 33-year-old woman presented with a history of difficult vaginal delivery and complaint of numbness and weakness of the vagina. In evaluation, bilateral levator defects were diagnosed by physical examination, three-dimensional endovaginal ultrasound, and magnetic resonance imaging. With ultrasound guidance the detached ends of muscles were tagged and sutured to their insertion points at the pubic bone. The patient's normal anatomy was restored with the return to normal pelvic floor tone. A follow-up ultrasound showed restored levator anatomy at 3 months.

**Keywords** Puborectalis avulsion · Pelvic floor surgery · Levator hiatus · Ultrasound

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## Introduction

It is generally accepted that the levator ani muscle complex plays a major role in pelvic floor support in women. These muscles are unique striated muscles which play a critical role in pelvic organ support. Their activity automatically adjusts to variations in posture and abdominal pressure to provide upward support to the pelvic viscera. Recent studies have demonstrated that levator ani damage can occur after vaginal birth [1]. Damage to the levator ani muscle is associated with pelvic organ prolapse and has been documented on dissection and with radiography [2]. The goal of pelvic floor reconstruction is to restore the anatomy and hope that will translate into restoration of physiology and ultimately improve the patient's symptoms. Pelvic organ prolapse recurrence after pelvic floor surgery is a common problem and studies have shown that major levator ani defects are associated with recurrent prolapse and its symptoms [3]. In the current case we describe a new technique for site-specific repair of levator ani defect by ultrasound guidance.

## Case

A 33-year-old woman presented to the clinic with the complaints of numbness of the vaginal area and weakness of pelvic floor muscles. She had one vaginal delivery 3 years earlier that was difficult and required her to push for 3 h. No third- or fourth-degree lacerations were sustained. She did not have problems with voiding or defecation. On physical examination, Pelvic Organ Prolapse Quantification (POP-Q) examination did not reveal prolapse. Upon instruction to contract her

pelvic floor muscles, the patient stated she did not know if she was contracting her muscles (no voluntary muscle contraction). By digital examination, twitching of the muscles and an Oxford score of 0/5 were felt. Three-dimensional endovaginal ultrasound (EVUS, BK Medical, Peabody, MA, USA) revealed bilateral levator ani separation (Fig. 1). Levator ani avulsion by 3-D EVUS was defined as discontinuity of the levator muscle to its retropubic insertion. Levator-pubic gap was measured as the vertical distance between the levator ani and the pubic ramus in the axial plane. Urethra-levator gap was the distance between the levator ani muscle and mid urethra in the axial plane. Minimal levator hiatus diameters and area were obtained in the plane containing minimal distance between the levator plate and pubic symphysis. Magnetic resonance imaging (MRI) confirmed bilateral separation of the levator ani muscles from the pubic bone. The patient was counseled about the findings and the available literature relating levator ani defects to pelvic floor disorders. The patient was counseled that restoration of the levator ani anatomy does not guarantee restoration of the function. She was also counseled that although there is no guidance on how she should deliver if she become pregnant in the future, just as in patients with anal sphincter injury, there is literature to support a cesarean delivery.

Intraoperatively, the patient underwent 3-D EVUS, and under ultrasound guidance (Fig. 2) the detached levator muscles were tagged with J-hook needles (MPM Medical, Elmwood Park, NJ, USA) bilaterally. The needle could be manipulated to identify the torn ends of muscles. A vertical incision was made on the lateral wall of the vagina cephalad to the puboperinealis muscle which is the muscle traversing between the pubic symphysis and the perineal body [4]. The dissection was made laterally to reach the area of the needle.

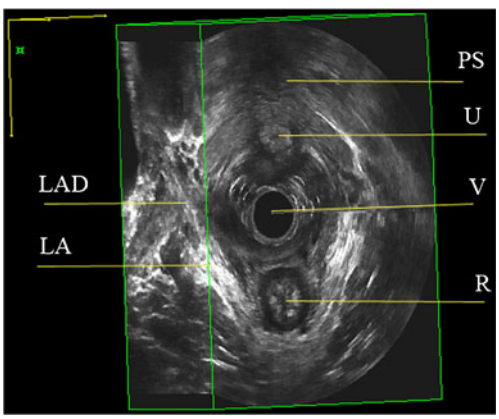


**Fig. 1** Bilateral puborectalis avulsion in endovaginal 360° 3-D volume. *PS* pubic symphysis, *U* urethra, *LAD* levator ani defect, *V* vagina, *LA* levator ani, *R* rectum

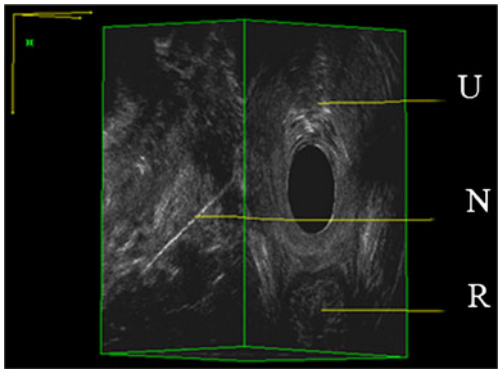


**Fig. 2** J-hook needle in the puborectalis muscle by endovaginal 360° ultrasound. *U* urethra, *N* needle, *R* rectum

The tissue was grasped and then, with a finger in the rectum to ascertain rectal elevation, 2.0 vicryl sutures were passed (Fig. 3), 1 cm apart, and these were brought anteriorly to the level of the arcus tendineus insertion into the pubic bone under direct visualization and tied sequentially. The procedure was repeated on the contralateral side with palpable lift of anorectal angle.

The patient was evaluated 3 and 6 months after surgery, and right and left muscles were palpable. By 3-D EVUS, normal continuity of the levator ani muscles was observed (Fig. 4) and all the parameters measured were decreased postoperatively (Table 1). The patient had return of vaginal tone with an Oxford score of 3/5 and no twitching. Normal vaginal sensation has not been attained 6 months after surgery.

## Discussion

One of the ultrasonically visible forms of levator ani defect is separation of the levator ani muscle from the retropubic

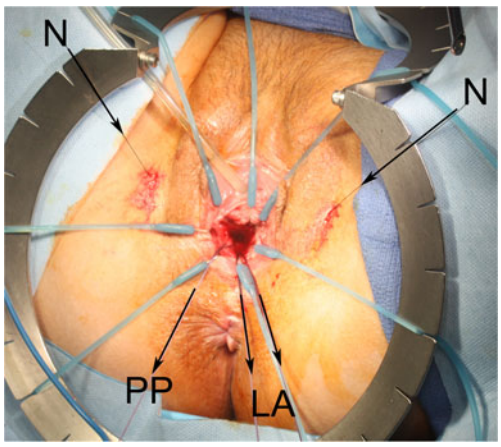


**Fig. 3** Vaginal approach through the vertical incision on the lateral vaginal wall cephalad to the puboperinealis muscle, demonstrating sutures that have been placed in torn ends of the levator ani muscle. *N* needle, *PP* puboperinealis, *LA* levator ani

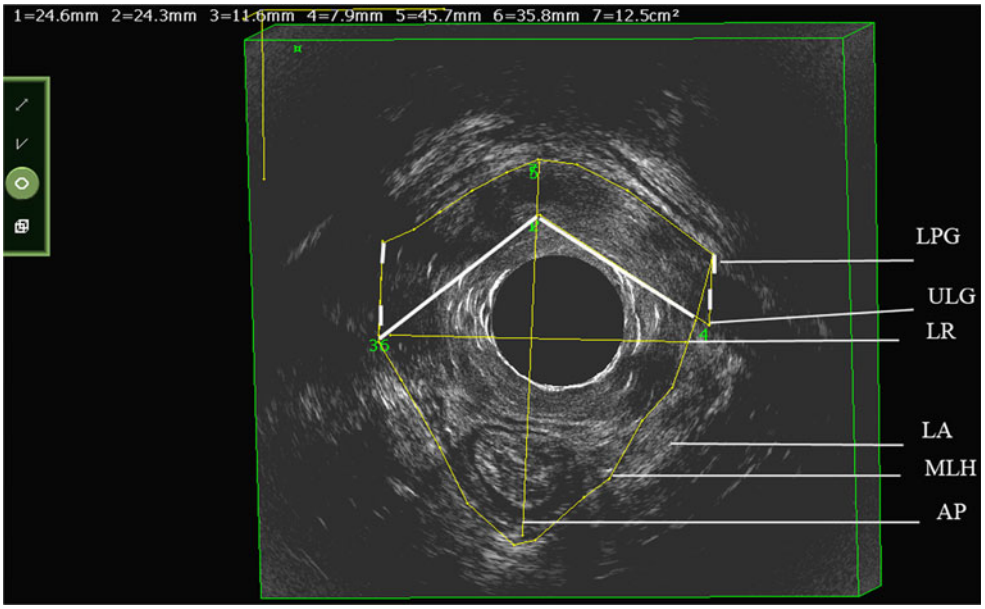


**Fig. 4** 3-D EVUS measurements after surgery. *LPG* levator-pubic gap, *ULG* urethra-levator gap, *LR* transverse diameter, *LA* levator ani, *MLH* minimal levator hiatus, *AP* anteroposterior diameter

area. This type of injury can occur during crowning of the fetal head. This defect has been associated with pelvic organ prolapse and pelvic floor dysfunction symptoms [2].

Many surgical methods have been described for patients with pelvic organ prolapse but it is shown that patients with larger levator hiatus which is associated with levator injury have a higher recurrence rate [5]. To restore the normal anatomy, if we repair the levator ani muscles, normal functioning of the muscles may resume as long as the innervation is intact. With new imaging techniques, pelvic floor muscle defects can be found at the onset. Current "routine" surgical practice does not address these defects, but the sequelae of pelvic floor injuries appear years after their occurrence. The question remains if the identification and repair of these muscles early on will spare the patient from future pelvic organ prolapse and incontinence.

We had previously described a method for bridging deficient levator ani muscle. In the current case report, we have described a new method to find and repair damaged levator ani muscles in a patient with a more recent trauma. This technique is potentially useful for patients who are not remote from the initial trauma as muscle atrophy and shortening of muscles can result from prolonged muscle detachment. Since identification of the muscle fibers is difficult without a localization technique, attempts at repairing these muscles without intraoperative visualization may have questionable results. In the absence of symptoms prompting levator ani muscle repair, it will require a large cohort and long-term follow-up to determine if preemptive repair of the levator ani muscles will translate into reduction of incontinence or pelvic organ prolapse.

**Table 1** Pre- and post-ultrasound measurements

| | Pre-repair | Post-repair |
|---|---|---|
| Right urethra-levator gap (RULG) | 35.6 mm | 24.6 mm |
| Left urethra-levator gap (LULG) | 32.8 mm | 24.3 mm |
| Right levator-pubic gap (RLPG) | 29.3 mm | 11.6 mm |
| Left levator-pubic gap (LLPG) | 24.5 mm | 7.9 mm |
| Anterior-posterior dimension of MLH | 58.1 mm | 45.7 mm |
| Left-right dimension of MLH | 41.1 mm | 35.8 mm |
| MLH area | 17.8 $cm^2$ | 12.5 $cm^2$ |

*MLH* minimal levator hiatus

**Conflicts of interest** None.

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