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EDITORIAL

The practical value of levator ani muscle injury repair

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The levator ani muscles (LAM) and the endopelvic fascia are partners in providing pelvic support. A healthy levator ani muscle with normal tone absorbs some of the pressure transferred to the connective tissue. Once the muscles are damaged, the ligaments are burdened to carry an increasing share of the load which may result in connective tissue failure over time [1]. It is well known from the orthopedics literature that it is best to repair a muscle separated from the bony enthesis as soon as possible to prevent the muscle from undergoing significant atrophy. However, identifying levator ani separation immediately post-partum when delivery related pain and discomfort may mask levator ani muscle rupture can be very difficult (Fig. 1). The patient can be asymptomatic or in the cases of catastrophic injury have urinary retention, severe vaginal pain, or a cystocele. Most sign and symptoms of levator ani muscle injury during labour go unnoticed in modern labour and delivery units as the staff and physicians are not trained to recognize them or such injuries are viewed as a natural part of vaginal birth process. The patients who are seen at our "perineal" clinic for example, most often find us through internet search and investigation and are not referred by health care providers.

Levator ani injuries and anal sphincter injuries are very common. Murad-Regadas et al. studied 130 symptomatic women after delivery by performing both endoanal and endovaginal ultrasounds. Eighty nine (68%) had at least one defect of the anal sphincter or the pubovisceral muscle or both, (42 (32%) had a levator ani muscle defect with or without sphincter defects, 47 (36%) women had an intact levator ani muscle but sphincter defect); and 41 (32%) had intact anal sphincter and levator ani muscles [2]. These findings are perhaps not surprising since although the genital hiatus and the levator hiatus form two separate points of passage for the fetal head and body, both hiatuses are exposed to the same forces during vaginal delivery. Van Delft et al. reported a similar finding as one-third of primigravid women delivering vaginally developed levator ani hematomas within the levator ani muscles within hours of delivery [3]. The hematomas at the site of levator ani enthesis was associated with long term ultrasound defects consistent with persistent avulsion [4].

There are very few surgeons who have reported levator ani repair [5–8]. Various types of levator ani repair are described in the literature. We reported an ultrasound-guided repair technique in 2012 [6] and another technique to bridge the gap using fascia lata [5] in 2009. From our first-hand experience, we know that the most technical part of the procedure is the attachment of the levator ani muscles to the lateral structures. In this journal Ris et al. described a method for levator ani repair via a trans-vaginal approach [9]. Although the authors did not discuss the patient's presenting symptoms or if the symptoms are improved after surgery, they do mention pertinent physical findings that most likely would be missed by less trained eyes. The sensitivity or specificity of the physical findings has not been investigated. The authors discuss very nicely the process of dissection from the ischial spine to the pubic bone and how various divisions of the levator ani muscle are sutured (Fig. 2). Since the levator ani muscle has various subdivisions and points of attachment, complete reattachment of the muscle requires point by point suturing of the iliococcygeal, pubococcygeal and puborectal fibers [10]. Reconstituting the levator ani muscle subdivisions may be important for recreation and proper function of the levator plate (Fig. 3). Patients with levator ani muscle disruption lack normal anorectal plate function and present with anorectal dysfunction [11]. We strongly recommend pelvic floor ultrasonography or MRI preoperatively as women with pelvic organ prolapse have an odds ratio of 7.3 for having major levator ani defects as compared to women without prolapse. Women with new stress incontinence after their first vaginal delivery are twice as likely to have birth-associated levator defects. There is also an odds ratio of 8.3 for pelvic floor disorders

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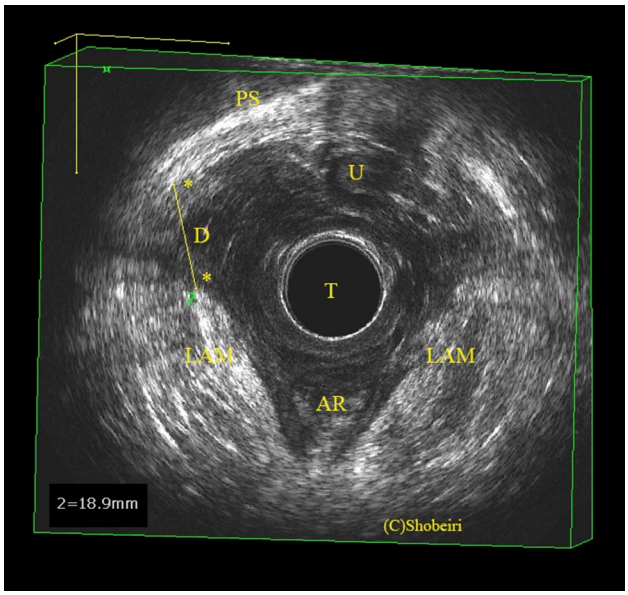

Fig. 1 Axial view obtained with 3D endovaginal ultrasound demonstrating a right postpartum persistent levator ani muscle defect 6 months after delivery. The pubic-levator distance of 18.9 mm is highlighted with asterisks*

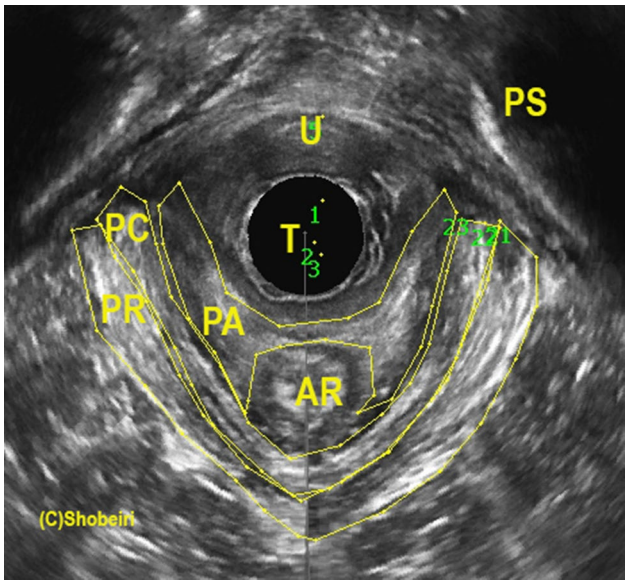

Fig. 2 Axial view obtained with 3D endovaginal ultrasound demonstrating an intact pelvic floor highlighting the LAM subdivisions

development when both levator defect and tissue failure are present [12]. Levator ani defects appear to be a necessary condition for architectural distortions to occur [13]. Given the wealth of accumulating evidence, the question is not whether we should scan the pelvic floor before attempting repair. Rather, what is the best way to scan the levator ani muscles? We believe that point of care levator ani imaging

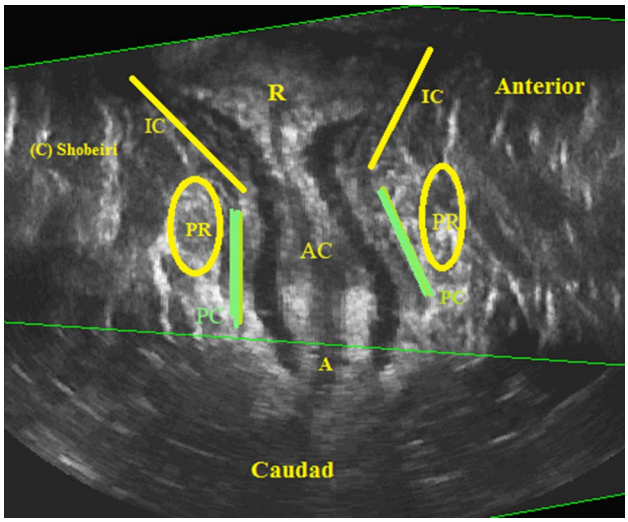

Fig. 3 Coronal view of the anorectal canal obtained with 3D endovaginal ultrasound demonstrating a normal woman's anorectal funnel created by PC in green, PR (the yellow circles), and the IC fibers. *A* Anus, *AR* anorectum, *D* defect, *IC* iliococcygeus, *LAM* levator ani muscle, *PA* puboanalis, *PC* pubococcygeus, *PR* puborectalis, *PS* pubic symphysis, *T* transducer, *U* urethra

is best accomplished using 3D endovaginal ultrasonography [14–18].

As stated, we know that levator ani injury during childbirth is a prevalent yet unrecognized condition. Immediately after delivery about 40% of patients have levator ani hematomas indicative of injury and in 6 months after delivery 13% of these defects persist [3, 4]. Ten years after delivery, the prevalence of levator avulsion is almost tripled after forceps delivery compared with vacuum-assisted vaginal delivery [19]. A recent long term study of patients 6–17 years from delivery revealed that although levator ani avulsion was strongly associated with anterior compartment defects, the relationship between avulsion and other pelvic floor disorders was not significant [20]. If the levator ani defects are asymptomatic after vaginal delivery and their long term association with pelvic floor disorders are questionable, what are the clear indications for repairing these defects? Although it is intuitive that a disrupted muscle should be reattached for proper pelvic floor function, any technique developed to repair the levator ani muscle injuries should be standardized and followed long-term with both ultrasound and validated patient-reported outcomes to assess objective and subjective changes.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all participants.

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