

RELATIVE CONTRIBUTIONS OF THE LEVATOR ANI SUBDIVISIONS TO LEVATOR ANI MOVEMENT

Hypothesis / aims of study

To describe the levator ani fiber number and relative contribution of the human the female levator ani muscle subdivisions to the levator ani movement.

Study design, materials and methods

Although levator ani tears are thought of as an all or none phenomenon, there is a gradient to the levator ani defects that exist in women. Therefore, the term levator ani deficiency has been used to investigate the relationship of levator ani support with perineal descensus and pelvic organ prolapse (1-3). Separating levator ani into functional subgroups is important as it is postulated that injury to different groups may cause different symptomatology.

Detailed microdissection of ten fresh female levator ani muscles was performed. Specimens were processed by modified Sihler's staining technique. Levator ani fiber count and directions for puboperinealis, puboanalis, puborectalis, pubococcygeus, and the iliococcygeus were established. Five normal nulliparous 3D endovaginal ultrasound volumes were reconstructed to calculate volumes of different levator ani subdivisions. Motion tracking software was used to track the movement of the levator plate in relation to the levator ani fibers.

Results

Six hemi-levator ani muscles were stained and muscle fibers were digitally recorded (Figure 1). There was no distinct separation between puboperinealis and the puboanalis as the puboperinealis formed the most media portion of the puboanalis fibers that joined the perineal body. In the pubovisceralis group, there were no distinct separation between pubococcygeus and iliococcygeus fibers as the pubococcygeus formed the most medial portion traversing between pubic bone and the anococcygeal ligament. The fiber count is as shown in Table 1. By 3D endovaginal ultrasound reconstruction of nulliparous subjects, puboanalis, puborectalis and pubovisceralis groups had the volume of 4.4 cm³ (Range 2.1-6.7 cm³), 4.2 cm³ (Range 1.9-6.5 cm³), 4.5 (Range 2.2-6.8 cm³) respectively. Although they have a wide range in volumes, the proportions remain constant within the individual (Figure 2). Motion tracking results is shown in Figure 3.

Interpretation of results

The three functional groups of the levator ani muscles as defined by origin-insertion points are: 1) puboanalis/puboperinealis {PA}, 2) puborectalis {PR}, and 3) the pubovisceralis (iliococcygeus and pubococcygeus) {PV}. These groups have similar relative volumes. While PA stabilizes the perineal body, the PR overlaps on the PV fibers to create the levator plate and form the anorectal angle.

Concluding message

The Levator ani can be divided into three functional groups. The lifters are the pubovisceralis and the puborectalis, and the stabilizers are the puboanalis muscles. Although each muscle group can have wide variations in normalcy, their relative volumes stay constant with each contributing to 1/3 of levator ani muscle bulk. This information is important for constructing a levator ani scoring system that takes contribution and function of all muscle groups into account.

Figure 1.

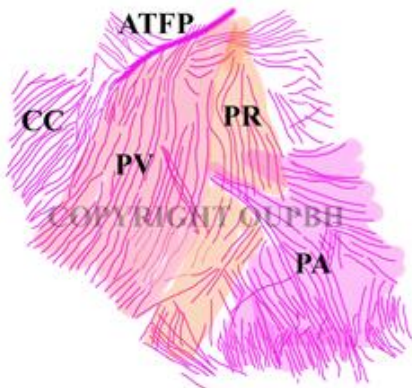


Figure 2.

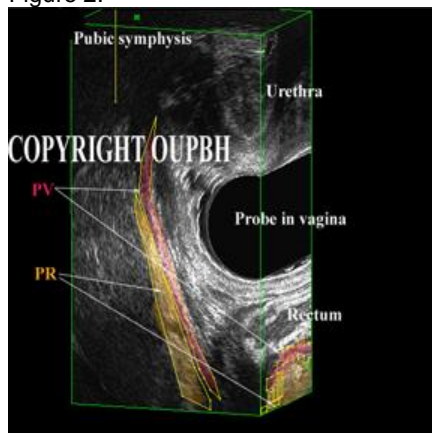


Figure 3.

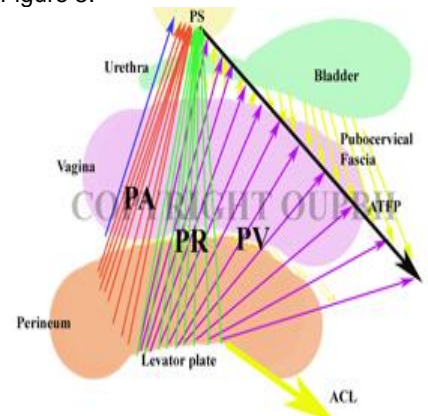


Table 1. Fiber count

Subgroup	1	2	3	4	5	6	Average
PV	21	23	19	18	20	28	21.5
PR	14	12	-	-	15	20	17
PA	15	23	13	-	-12	21	16.8
Location	L	L	L	R	R	L	

References

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Disclosures

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