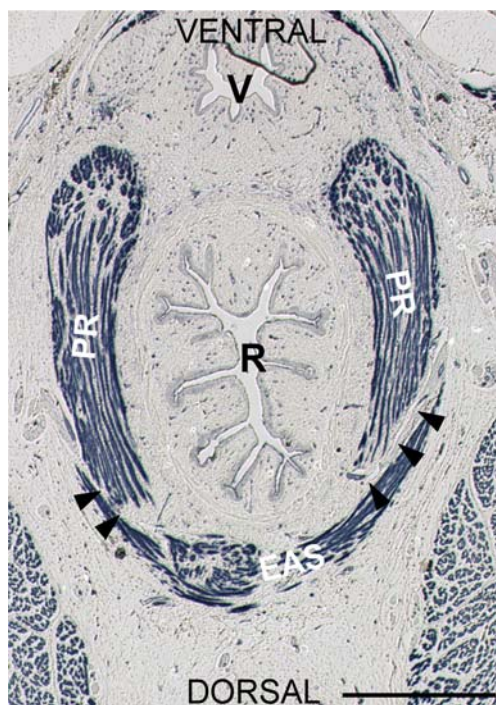


Is the Puborectalis Muscle Part of the Levator Ani Muscle?

To the Editor—With great interest I have read the article by Guo and Li¹ on the anatomy of the levator ani, and especially the puborectalis muscle by use of MRI and CT. The authors state that the levator ani has a transverse portion and a vertical portion and that the puborectalis muscle is a u-shaped muscle outside the vertical portion. Based on those

FIGURE 1. Transverse section through the external anal sphincter muscle (EAS) and the puborectalis portion (PR) of the levator ani muscle (female fetus, 14 weeks of gestation). The section was stained immunohistochemically for striated muscle, as described elsewhere.⁶ Note the clear separation of the two muscles (arrowheads). Bar= 1 mm. EAS=external anal sphincter muscle; PR=puborectalis muscle; R=rectum; V=vaginal vestibule.



findings, the authors conclude that the puborectalis is not a part of the levator ani muscle. The concept that the puborectalis muscle is anatomically a part of the external anal sphincter muscle, rather than the levator ani muscle has been previously proposed from a cadaver study.²

Although the puborectalis and external anal sphincter muscle form a functional unit in maintaining continence, developmental studies provide evidence that the puborectalis is anatomically a part of the levator ani muscle. Studies on the levator ani muscle from (immuno)histochemically stained serial sections of human fetuses clearly show that the pubococcygeus and puborectalis muscle have inter-vening and inseparable muscle fibers at their pubic origin,^{3,4} whereas the puborectalis muscle and external anal sphincter muscle have no muscle fiber connection and are separated by connective tissue (Fig. 1).^{3,5} Additionally, the puborectalis and external anal sphincter muscle appear at different time points during development.⁵ Furthermore, developmental and conventional dissection studies show that the levator ani muscle (including the puborectalis) is innervated by the levator ani nerves on the superior side, whereas the pudendal nerve innervates the external anal sphincter and has only a minor contribution to the levator ani muscle innervation.⁵⁻⁷ Therefore, it can be concluded that the puborectalis is anatomically a part of the levator ani muscle and not of the external anal sphincter. Studies such as those by Guo and Li^{1,8} give important and clinically relevant results on the function of the pelvic floor muscles in continence. Caution should, however, be taken to draw anatomic conclusions from such studies without considering robust developmental and anatomic studies.

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