

## Simplified anal sphincter anatomy

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Dear Editor:

Accurate understanding of anal anatomy is a prerequisite to understanding the pathophysiology of anorectal disease so as to allow correct management. However, the details of the anatomy of the anal sphincter complex are still controversial. Milligan and Morgan (1934) proposed the concept of the external anal sphincter (EAS) complex having three layers, the subcutaneous, superficial, and deep. Goligher et al. (1995) described the EAS as being only one continuous sheet. Oh et al. (1972) reported that the EAS comprised of two compartments, superficial and deep compartments, each of the compartments composed of two layers of sphincter muscles. Shafik (1975) popularized the triple-loop system of the EAS. Regarding the levator ani, it is generally accepted that this muscle is divided into three distinct muscles, the puborectalis, pubococcygeus, and iliococcygeus. To find out the truth for ourselves, we have been performing detailed anatomical dissection of anal sphincters from soft cadavers since 2005 until the present. During the course of our experience, we have since discovered that the anatomy of this region appears to be different from what is described in the current textbooks.

We started the anal anatomy study in soft cadavers in 2005, in which time we have dissected more than a hundred of cases. There are two major advantages of using soft cadavers in anal anatomy study. First, the preserved tissue is similar to fresh cadavers which is easy to dissect along the natural cleavage planes. Second, the clear demarcation between adjacent

muscle bundles can be identified using different color shades. At the beginning of our dissection, we tried to identify the anal structures according to the standard text books. Later, we found that many anatomical findings were different. From our anal anatomy study, we categorize the levator ani as a part of the anal sphincter, unlike in the literature. This may be explained by the functions of the levator ani which are similar to anal sphincter. The levator ani had single fascial coverage which could not separate the fiber into puborectalis, pubococcygeus, and iliococcygeus muscles and attached to the coccyx posteriorly. Levi et al. (1991) described the puborectalis, pubococcygeus, and iliococcygeus muscles embryologically arising from a common origin and having identical innervation, which may support our findings.

We would like to simplify the anal sphincter complex as consists of the levator ani, the superficial EAS, and the subcutaneous EAS. The levator ani is a single broad muscle which attaches to the pubic symphysis and arcus tendineus anteriorly and the coccyx posteriorly. This simplified anal anatomy may have a major impact on our understanding and management of anorectal diseases especially with regard to fistula in ano and defecation problems.

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