The Rectogenital Septum: Morphology, Function, and Clinical Relevance

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PURPOSE: The rectogenital septum (known in clinical literature as Denonvilliers’ fascia) forms an incomplete partition between the rectum and the urogenital organs in both men and women. It is composed of collagenous and elastic fibers and smooth muscle cells intermingled with nerve fibers emerging from the autonomic inferior hypogastric plexus. The aim of this study was to investigate the fetal development of the rectogenital septum, and the origin and innervation of the longitudinal smooth muscle cells within the septum, as well as to consider possible effects on function of operations that compromise the integrity of these structures. METHODS: Macroscopic dissections on embalmed human pelves and plastination histology of 40 fetal and newborn pelvic specimens were performed. By means of conventional and immunohistochemical staining methods using monoclonal and polyclonal antibodies for tissue analysis and neuronal labeling, the motor and sensory innervation of the longitudinal muscle bundles within the septum was defined. RESULTS: The rectogenital septum is formed by a local condensation of mesenchymal connective tissue in the early fetal period. The longitudinal muscle bundles could be traced back to the longitudinal layer of the rectal wall, and, using the septum as a guiding structure, it was possible to identify autonomic nerve fibers and ganglion cells innervating the muscle cells and crossing the midline without detectable gender differences. CONCLUSIONS: Because of a coinnervation of the rectal muscle layers and the adjacent longitudinal muscle fibers of the septum, a functional correlation between the two structures during defecation is postulated. On the basis of these findings, a safer dissection of the anterior rectal wall during rectal resection is postulated, thus limiting functional disturbance and preventing neural damage. [Key words: Rectogenital septum; Longitudinal muscle; Autonomic innervation; Defecation]

Charles Denonvilliers was the first to describe a thin layer of dense tissue separating the rectum from the bladder, seminal vesicles, and prostate in men in 1836. He referred to this layer as the “prostatoperitoneal” membranous layer. As a consequence, the septum was given his name, and Denonvilliers’ fascia is a term still in use by urologists and coloproctologists. The structure orients surgeons operating on the pelvic floor and performing low anterior resection. A similar structure is found in female pelves, separating the rectum from the vagina and consisting of essentially the same tissue components. Some authors term this layer the “rectovaginal septum.”

When referring to either the rectovesical or the rectovaginal septum in this article, we use the term “rectogenital septum.” Since its original description, the morphology and function of this septum has remained controversial. In some studies it has been suggested that the rectogenital septum is formed by peritoneal fusion, whereas
other investigators have suggested that it is more a result of condensation of loose areolar tissue after peritoneal fusion,2–7 and still others have rejected the peritoneal fusion theory.4 The rectogenital septum constitutes an incomplete partition between the rectum and the urogenital organs ventrocranially, and it is completed by the perineal body caudally.1,4 Different tissue components have been described as constituting the rectogenital septum, with a variable composition of connective tissue consisting mainly of collagenous fibers derived from mesenchymal condensation.4,6,8 Smooth muscle bundles are evident in a craniocaudal orientation, although their origin is unclear.1,2,5 These longitudinal smooth muscle fibers have been described as being accompanied by small nerve bundles attached to the connective tissue of the perineal body. Silver6 suggested a morphologic correlation of these muscle fibers with the rectal muscular sheaths but failed to elaborate on their possible functional significance.

Although the causes of postoperative incontinence are multifactorial, it has been postulated that, after operations such as restorative proctectomy, where the ventral rectal wall is extensively dissected in its anterocaudal part, incontinence may eventuate simply by virtue of disruption of the rectogenital septal anchoring mechanism.9,10 In this respect, there is comparatively little anatomic information concerning the orientation and distribution of smooth muscle fibers as well as the innervation of the rectogenital septum in humans.11

The aims of this study were to redefine the morphology, function, and development of the rectogenital septum by using human fetal and adult preparations as well as plastinated specimens, and to speculate on the significance of these findings and their potential effect on function after the different operative techniques in which the integrity of the septum may be compromised.

MATERIALS AND METHODS

Macroscopy

The topographical relationships of the rectogenital septum to the surrounding pelvic organs were studied in two female and two male pelvic specimens; one fetal specimen and one adult specimen of each. The specimens were obtained from the dissecting course at the Institute of Anatomy, Histology and Embryology of the University of Innsbruck/Austria and showed no macroscopic abnormalities in the urogenital and/or rectal regions. They were fixed in a phenol-formalin solution normally used for preserving human corpses at our Institute. The rectogenital septum was dissected in accordance with the technique described by Pernkopf12 using a lateral approach.

Microscopy

Plastination histology. Plastination histology of 20 female and 20 male fetal and newborn pelvic specimens, ranging in age from 9 to 37 weeks postcoitus, was processed according to the method described by Fritsch.13 The fetal preparations were obtained from miscarriages or legal abortions and were approved for use by the local ethics committee for scientific investigations. After fixation by immersion in formalin (4 percent), acetone dehydration at −20°C for five weeks, and defatting in methylene chloride at room temperature for two weeks, the specimens were impregnated with the epoxy resin BIODUR™ E 12 (BIODUR Products, Heidelberg, Germany). Axial, coronal and sagittal sections with a thickness of 300 to 700 µm were then cut with a diamond-wire saw (Model 3241, Well Diamantdrahtsägen GmbH, Mannheim, Germany). After mounting and polishing, the sections were stained with azur II/methylene blue and counterstained with basic fuchsin for macroscopic examination (Wild/Leica M420, Stuttgart, Germany).

Light microscopy. In four additional female pelves (ranging in age from 35 years to 76 years) and two male pelves (6 and 58 years of age), the rectogenital septum was investigated by conventional histologic staining methods (hematoxylin/eosin, Masson’s trichrome III) and immunohistochemical staining of neural structures. The anterior wall of the rectum and the posterior part of the vagina in the female, and the posterior part of the bladder in the male were removed as a single unit and fixed in 4 percent paraformaldehyde 0.1M (pH 7.4) for further processing. The specimens used for immunohistochemistry showed no macroscopic macerations or abnormalities, nor was there a history of prior pathology in the region under examination.

The tissue blocks were embedded in paraffin for conventional histologic sections. Sagittal and axial sections of 6 µm thickness were cut with a microtome and stained with hematoxylin/eosin and Masson’s trichrome III to differentiate the connective tissue com-