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Anal canal development in the embryonic and early foetal period

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The aim of study is to investigate the development of the anal canal in human embryos and foetuses. In embryos at stage 19 the boundary between the ectodermal and endodermal linings of the anal canal is located just below the level of the internal anal sphincter muscle. Histological sections showed that the first signs of anal columns are observed in embryos at stage 21 (51 days).

key words: anal canal, development, rectum

INTRODUCTION

The anal canal is a distal part of the rectum and lies below the levator ani muscle. Division of the cloaca results in the formation of two compartments, the anterior, the urogenital sinus and the posterior, the anorectum. The anal canal has a twofold origin. The proximal part originates from the dorsal (anorectal) portion of the subdivided cloaca, while the distal part is formed from the proctodeum (the depression between 2 anal tubercles). The junction of the rectum proper and the anal canal is marked by anterior flexion caused by the musculus puborectalis. There are controversies in the literature regarding the formation of the urorectal septum as well as its location, and the subdivision of the cloacal membrane.

The exact border between the endodermal and the ectodermal portion of the anal canal is still disputed as is the development of the levator ani muscle and anal sphincters. There is no agreement as to secondary occlusion of the anal canal after rupture of the cloacal membrane and its recanalisation [1].

The aim of the present study is to investigate the growth and development of the anal canal in human embryos and foetuses.

MATERIAL AND METHODS

The study was performed on human embryos and foetuses aged between 5 and 14 weeks. The age of the embryos was established according to the 23 developmental stages and was from 32 to 56 days. The age of the foetuses was based on C-R length. Both embryos and foetuses were embedded in paraplast. Sections were stained by routine histological methods and/or impregnated with silver nitrate.

RESULTS AND DISCUSSION

The urorectal septum is formed by 1 superior and 2 lateral folds which fuse together (Fig. 1) and finally reach the cloacal membrane at stage 15 (36 days), dividing the membrane into the urogenital and anal membranes. Maldevelopment of the septum may lead to congenital defects in which the urethra, vagina, and rectum fuse to form a common channel that opens with a single orifice [2]. According to Nievelstein et al. [1] the urorectal septum does not descend to the cloacal membrane. In contrast to our studies, he observed a secondary, temporary occlusion of the anal canal. The latter marks the border between the endo- and ectodermal portions of the anal canal. The distal portion of the anal canal originates from the proctodeum which is the depression between two anal tubercles. The existence of the proctodeum is denied by some investigators [3]. The first sign of anal columns is observed in embryos at stage 21 (51 days). Their number and height increase

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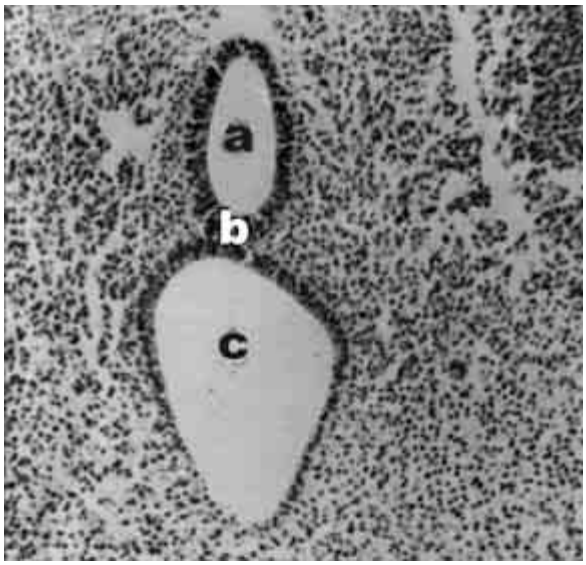

Figure 1. Transverse section of embryo at stage 15 (day 33). Division of cloaca. The anorectum (a) is separated by the urorectal septum (b) from the urogenital sinus (c).

Figure 2. Transverse section of foetus at 10 weeks. Anal canal, anal columns, and urogenital sinus.

in further weeks of development. In foetuses aged 10 weeks the anal columns are clearly evident, and are well developed (Fig. 2). Beginning at 10 weeks, the anal sinuses are also visible as depressions separated by anal valves (Fig. 3.). The levator ani muscles converge bilaterally and, descend toward the anal canal, merging with longitudinal and circular layers of the muscular coat of the rectum (Fig. 4). The latter forms the internal anal sphincter. In frontal sections of 10-week foetuses we also observed fibres of the external anal sphincter muscle surrounding the anal canal (Fig. 3, 4). At this time fibres of the pudendal nerve (forming the inferior rectal nerves) approach the anal canal (Fig. 4, 5). The boundary be-

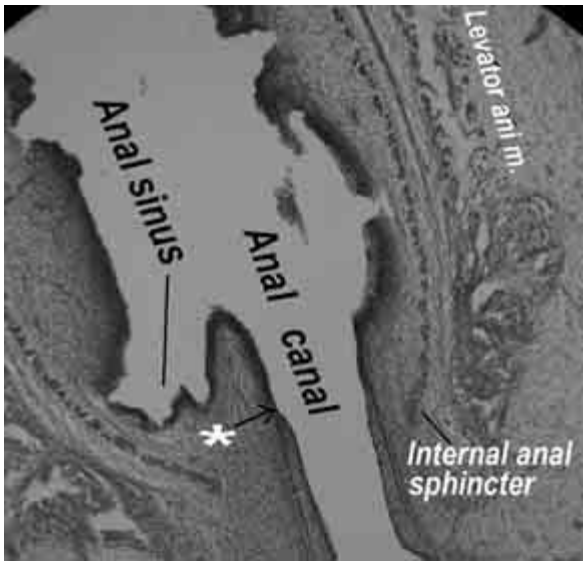

Figure 3. Frontal section of foetus at 12 weeks. Anal canal, internal anal sphincter, anal *sinus border of the epithelium.

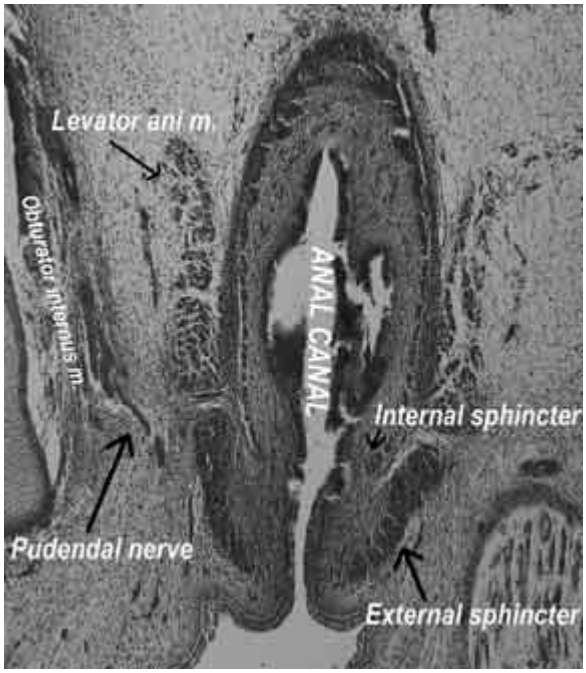

Figure 4. Frontal section of foetus at 10 weeks. Levator ani muscle, external and internal anal sphincters, anal canal, pudendal nerve.

tween the ectodermal and endodermal linings of the anal canal is recognizable in embryos of stage 19 just below the lower border of the internal anal sphincter (46 days) (Fig. 6). In 12-week foetuses this boundary is located just below the anal columns and anal sinuses (Fig. 3, 4). This site corresponds to the former position of anal membrane.

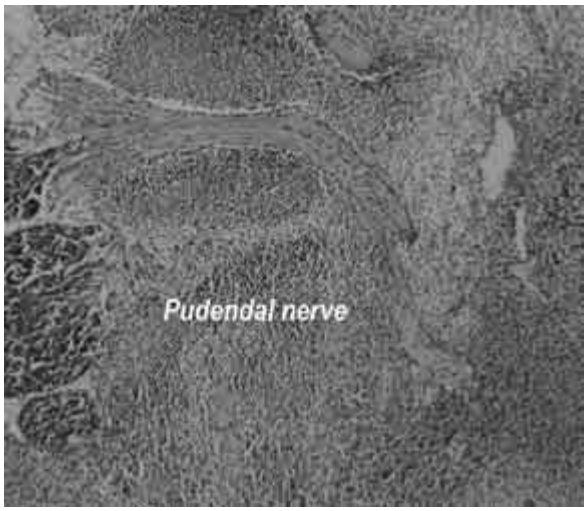

Figure 5. Sagittal section of embryo at stage 19 (day 46). Fibres of pudendal nerve approaching the anal canal.

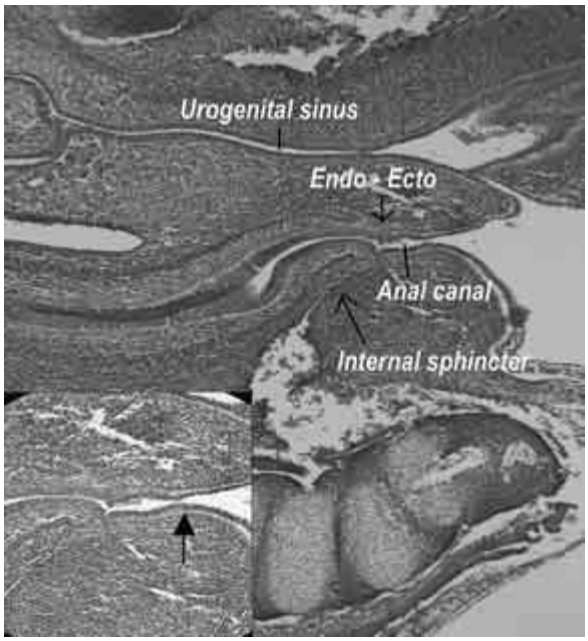

Figure 6. Sagittal section of embryo at stage 19 (day 46). Transitional zone of epithelium, anal canal, urogenital sinus, internal

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