

THE ANATOMY OF THE MUSCLE WALL OF THE HUMAN COLON

1. The inter-tænia continuity of the longitudinal muscle coat

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Introduction

Contradictions exist in the literature as to whether the outer muscle coat of the human colon is complete or not. There are conflicting points of view as to the presence and extent of the longitudinal muscle in between the tæniæ.

Lowitz (1896) described the outer coat as forming a continuous layer and Rost (1912) positively asserted that there were longitudinal fibres forming a thin layer of muscle in the intertænia regions. Kelly and Herdon (1905), however, suggested that postnatally no longitudinal muscle at all is to be found in between the tæniæ; like Broman (1921), they described the outer coat as being continuous only up to the time of birth when the pressure of the colonic contents causes the coat to split into three bundles between which the inner coat becomes exposed. Poirier and Charpy (1912), like Walmsley (1921), stated that the outer coat in between the tæniæ is almost but not quite devoid of longitudinal fibres, there being isolated bits of muscle at these sites.

A review of the more recent literature reveals similar conflicting statements. Thus, the outer muscle coat of the human colon is described as being:

a) extremely thin between the tæ-

niæ but complete (Hamilton 1946; Foster (1962).

b) usually (Arey 1963) or to a certain extent (Ham 1965) complete.

c) occasionally interrupted (Bremer and Weatherford 1948; Deane *et al.* 1966) or partially deficient (Nonidez and Windle 1953; Windel 1960).

d) represented in between the tæniæ by only a few scattered longitudinal fibres (Wood Jones 1953; Golden 1949). Golden makes the point that it is the resultant weakness that allows the wall to bulge into haustra between the tæniæ.

e) incomplete (Davenport 1966). Le Gros Clark (1965) states that the longitudinal wall in between the tæniæ is entirely absent so that here the circular muscle is exposed to the surface. Other authors appear to be of the same opinion but their statements are less emphatic. Hence the coat is described as being discontinuous (Bruce *et al.* 1964; Thorek 1962), as being in the form of and limited to the tæniæ (Bockus 1964; Hoskins and Bevelander 1959; Magee 1962), or as failing entirely to surround the large bowel as it does in the small intestine (Anson and Maddock 1959; Bloom and Fawcett 1962; Grant and Basmajian 1965; Hollinshead 1962; Leeson and Leeson 1966).

f) complete or otherwise according to circumstances. Lineback (1925) states that the outer coat, when contracted or moderately distended, form a distinct continuous layer of longitudinal fibres and it is only with extreme distension that there may seem to be in some places no longitudinal fibres present.

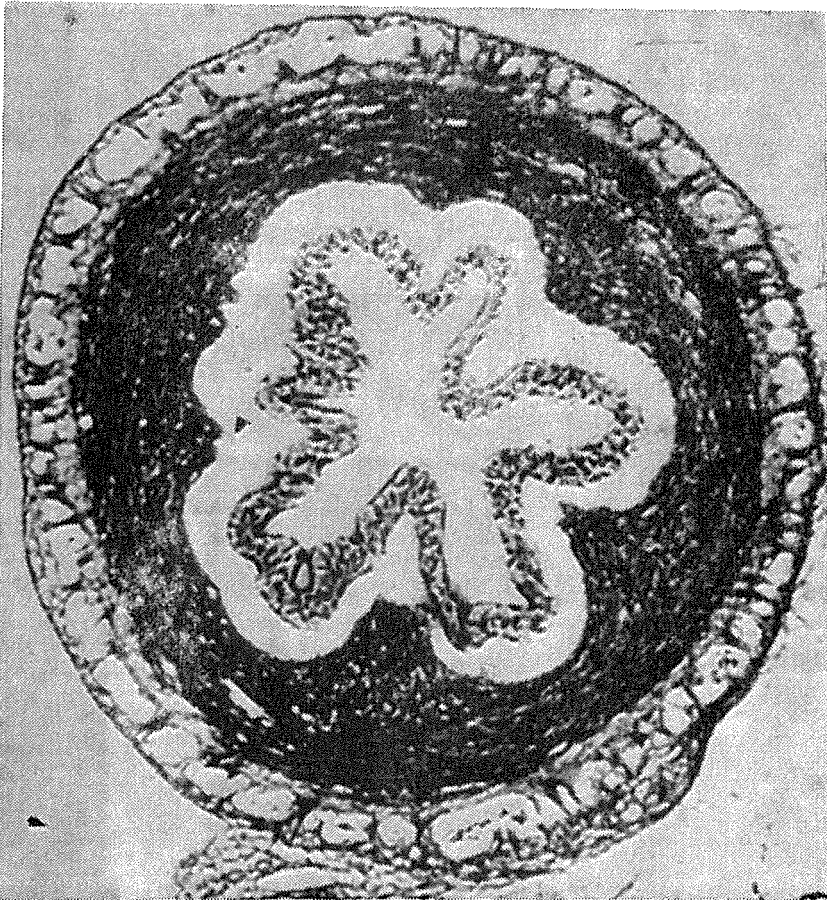
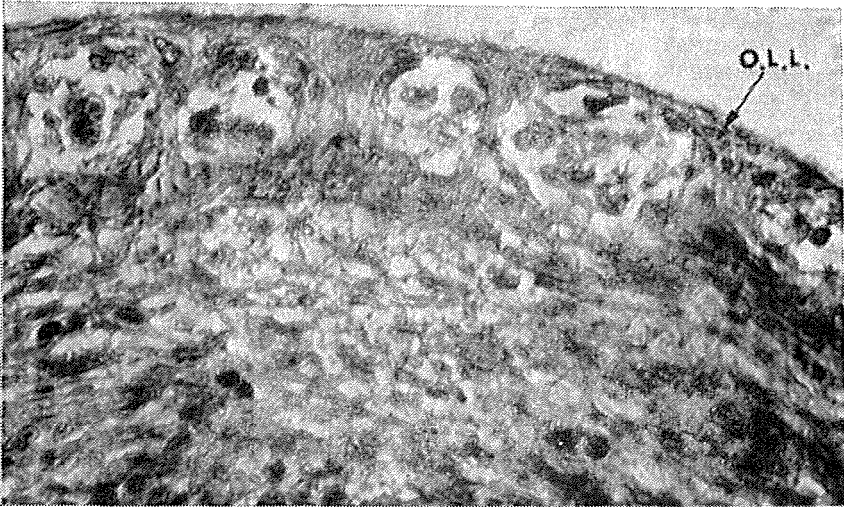


Figure 1. Transverse section of mid-ascending colon (11 weeks foetus). The outer longitudinal layer of muscle (O.L.L.) forms a complete coat.

- a. \times 150 Stain: Gomeri.
- b. \times 400 Stain: Mallory.

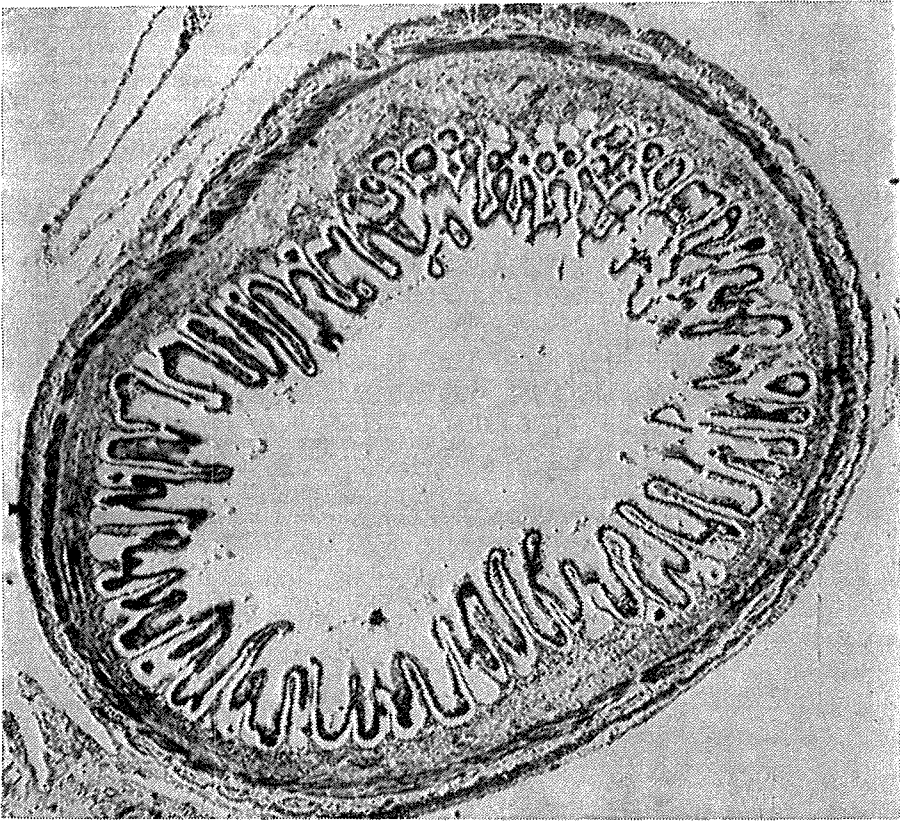
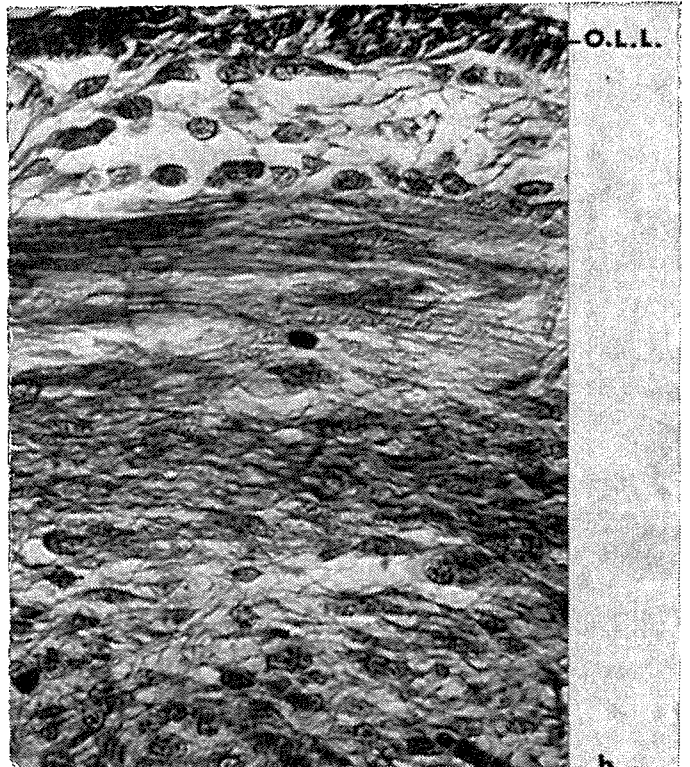


Figure 2. Transverse section of mid-pelvic colon (20 week foetus). The outer longitudinal muscle layer (O.L.L.) forms a complete coat and tænia thickenings (T.) have appeared in it by the 20th week of foetal life.

a. $\times 100$:

b. $\times 400$:

Stain: Mallory.



Material and Methods

The material used consisted of 112 human postmortem colons, with a few surgical specimens, ranging in age from 11 weeks foetal to 88 years. Portions from the different named regions of the colon, fixed in various states of distension, were used.

The methods of microdissection were combined with those of histology. The intertænia wall was examined under the dissecting microscope in an attempt to detect the presence and the continuity of the outer longitudinal coat at this site. Histological sections were cut as follows: transverse, of the whole circumference; longitudinal, of the intertænia wall.

Results

In the human colon the outer coat, though thin, forms a complete and continuous layer. This is so at all ages, in all

regions of the colon and, with some exceptions, in all states of distension.

The outer coat of the colon can be seen to form a continuous layer as early as the 11th week of foetal life (*Fig. 1*): at this stage there are no tænia thickenings and the outer coat consists of an extremely thin layer, only one or two cells thick. The continuity of the outer coat can be seen more distinctly in a foetus of 20 weeks (*Fig. 2*) because the layer has now become slightly thicker and the tænia thickenings quite marked. At the 7th foetal month, the tæniæ are well marked and, in between, the outer layer is continuous and uniformly thick, muscle fasciculi being as yet inconspicuous. At 2 months postnatal (*Fig. 3*), however, the outer layer, which has now become relatively thick, no longer forms a uniform sheet because the muscle cells, both at the tæniæ and in the inter-tænia regions, are aggregated into fascicles: these fascicles

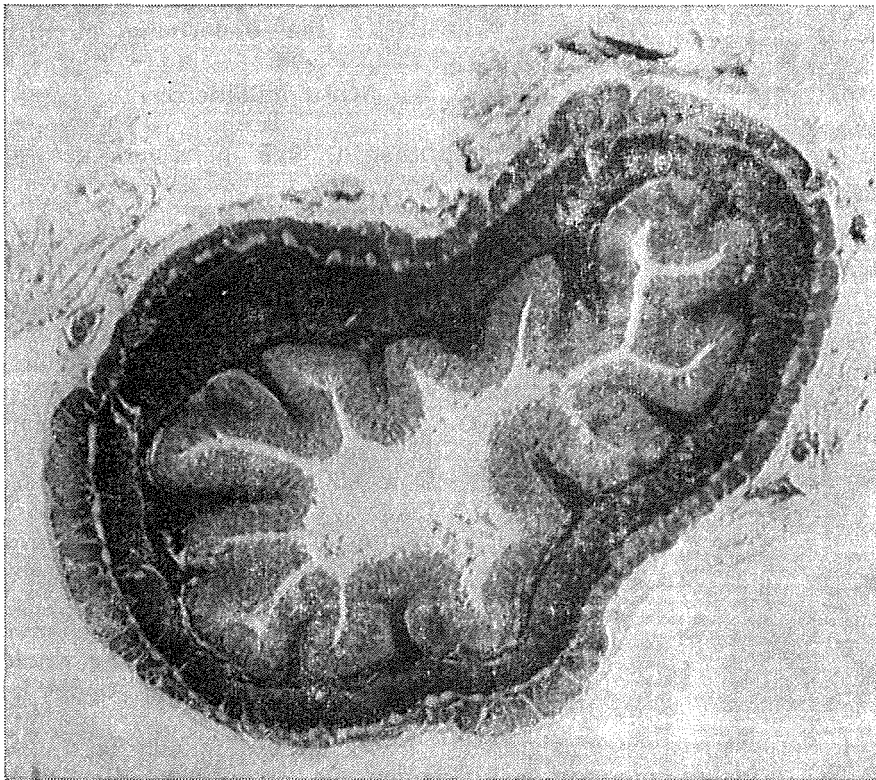


Figure 3. Transverse section of mid-pelvic colon (infant, 2 months). The longitudinal muscle forms a thick and complete coat consisting of fascicles in contact with one another.

a. $\times 15$. Stain: Mallory.

are however in contact with one another and therefore maintain the continuity of the layer. With increasing age the muscle fascicles become better defined, but in later life they tend to flatten out; even so, the intertænia longitudinal muscle fibres are still demonstrable in old age (Fig. 4) so that continuity of the layer is still maintained. It should be pointed out that there is some variation in the age at which these changes occur.

Slight or moderate grades of distension have no effect on the continuity of the outer coat of the colon. With maximal distension, the outer layer is still continuous but the muscle fascicles become markedly flattened out and are occasionally separated from one another by quite appreciable gaps; these are filled in by the interfascicular connective tissue (Fig. 5). The fascicles of the tænia also become slightly separated from one another



Figure 4. Serosal surface of sigmoid colon (88 years) to include mesenteric (M) and antimesenteric tænia.

- a. The serosa has been dissected off to show the presence of inter-tænia longitudinal muscle fibres.



- b. The inter-tænia longitudinal muscle has been removed to reveal the underlying circular muscle coat.

Scale: millimetres.

other though gaps do not appear in between.

Summary

1. Contradictions still exist in literature as to whether the outer longitudinal muscle coat of the human colon is complete or not.

2. The material used consisted of 112 human colons, mainly postmortem, from subjects ranging in age from early foetal to 88 years. Portions from the named regions of the colon fixed in various states of distension were examined.

3. The methods of microdissection were combined with those of histology. Sections, transverse of the whole circumference and longitudinal of the intertænia wall, were studied.

4. It was found that in the human colon the outer longitudinal coat, though thin in between the tænia, forms a complete and continuous layer. This is so at all ages, in all regions of the colon and in all states of distension except maximal

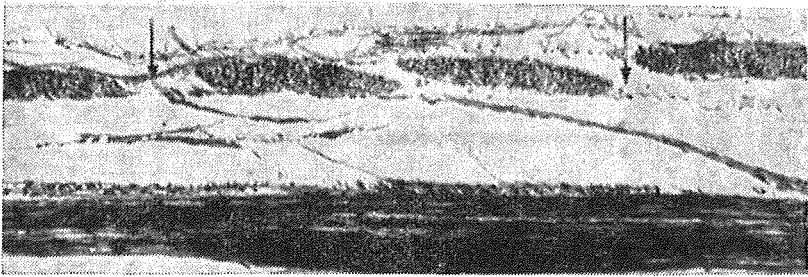
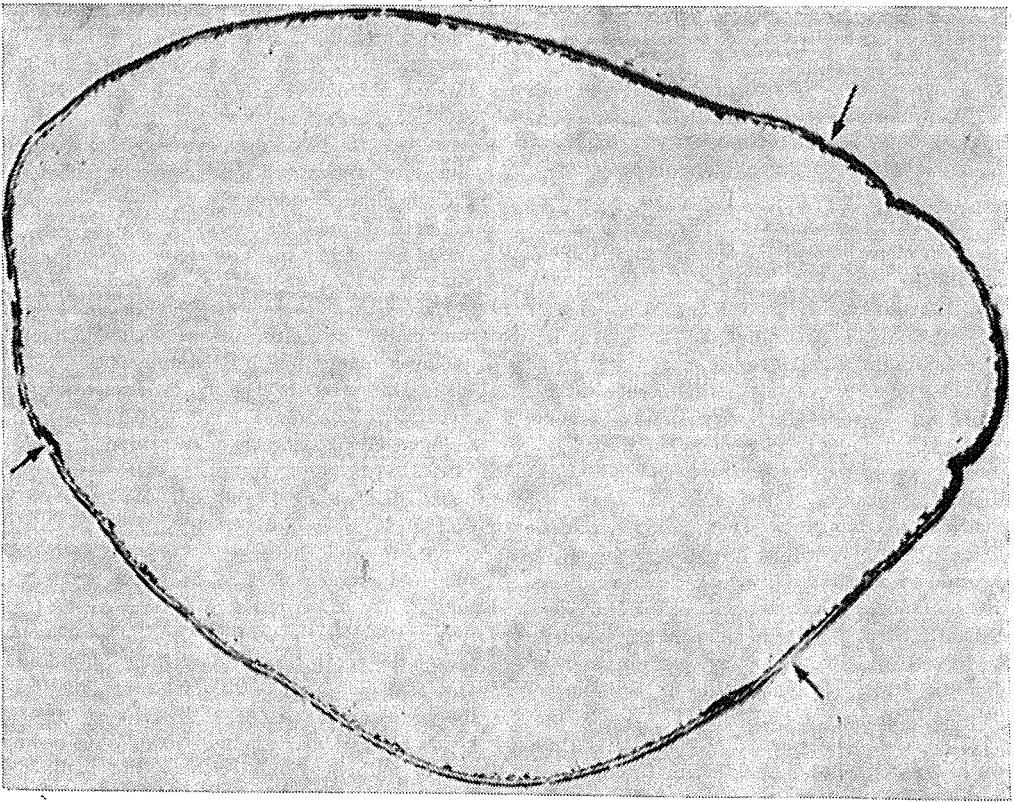


Figure 5. Transverse section of mid-transverse colon in maximal distension. The outer muscle layer is continuous but the fascicles are separated by quite appreciable gaps (arrowed) filled in by connective tissue.

a. 1 day postnatal $\times 7$

b. 60 years $\times 400$

Stain: Mallory.

when the muscle fascicles become separated by gaps filled in with connective tissue. Under no circumstances was the outer coat found to consist only of a few scattered longitudinal fibres and isolated bits of muscle, or to be entirely absent.

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