SCANNING ELECTRON AND LIGHT MICROSCOPY OF THE MUCOSA OF THE EQUINE ILEOCAECAL JUNCTION

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INTRODUCTION

Scanning electron microscopy (SEM) has been widely used in studies of the surface morphology of the intestinal mucosa of man and domestic animals (De Ocampo, Nolasco & Bundac, 1983; Roberts & Hill, 1974; Wille, 1975). The effects of hypoxia on the small intestinal mucosa in ponies has also been investigated using this technique (White, Moore & Trim, 1980; Moore, White, Trim & Garner, 1980).

Changes in surface morphology that occur between the small and large intestine at the ileocaecal junction of the equine have not been studied. The purpose of this paper is to describe the surface features of the transitional region in normal horses and a donkey as revealed by SEM and light microscopy (LM).

MATERIALS AND METHODS

Animals

Tissues were collected from 5, clinically healthy, 4–7 year old thoroughbred horses of either sex and a 5 year old female donkey. They were anaesthetised with 20% chloral hydrate and exsanguinated after the left common carotid artery had been catheterised. The ileocaecal junction together with the adjacent regions of the ileum and caecum of each animal was removed immediately after death and opened longitudinally along the mesenterial border.

Light microscopy

Longitudinal strips, 5 mm wide and 8 mm long of the ileocaecal junction, including the very distal portion of the ileum, the junction and the caecum immediately adjacent to the junction were fixed for 8 h in Bouin’s solution. The specimens were then fixed for 24 h at 4 °C in glass bottles containing fresh fixative. In an attempt to remove mucus from the surface of the tissue, some of the specimens were subsequently treated with a 0.2 M sucrose solution in 0.1 M phosphate buffer for a further 24 h (Ludwig, Patek, Nilsson, Metzger & Hafez, 1975).

Specimens were dehydrated through an ascending ethanol series and transferred to the chamber of a Polaron E 3000 critical point drying apparatus. Samples were then dried using carbon dioxide as the transitional fluid, mounted on aluminium stubs using double-sided tape, earthed to the stub with colloidal silver, and coated with carbon and gold in a sputter coater prior to examination in a Hitachi S450 electron microscope operated at 15 KV.

RESULTS

On SEM and light microscopy, 4 distinct regions reflecting differences in mucosal surface morphology, were observed along the length of the ileocaecal junctions examined.

The distal part of the ileum adjacent to the ileocaecal junction displayed long finger-like villi which tapered slightly towards the tips (Fig. 1a & 3a). The surface of the villi presented a corrugated appearance due to horizontal or transverse clefts which did not completely encircle the villi (Fig. 1a).

This region was followed by a narrow zone (measuring between 1–2,2 mm in length) where the villi abruptly became shorter, stubbier, and slightly flattened in cross section, with the tips of the villi having a definite rounded appearance on SEM (Fig. 1b). On LM these villi were shorter and wider compared to villi in the distal part of the ileum (Fig. 3a & 3b).

This area gradually changed into a 3rd region which seemed to represent the true transitional zone between the small and large intestine. It varied in length from 17,5–30,1 mm in the horses, and 0,8–1,2 mm in the donkey. The villi were shorter than those in the 2nd region and fused to form low ridges in a circular, semi-circular or S-shaped fashion (Fig. 2b). The tips of the fused villi were often indented to form conspicuous pits which caused the villi to have a doughnut-like appearance (Fig. 2a, 2c, 2d & 2e).

Sagittal sections of this region revealed that these pits did not extend to any great depth (Fig. 2d, 2e; Fig. 3b, 3c).

The transitional zone continued into the caecal portion of the ileocaecal junction, where the villi disappeared completely (Fig. 3d), and the mucosa...
FIG. 1a Real part of the ileocaecal junction showing typically long, finger-like villi having a corrugated appearance due to irregular horizontal clefts or furrows (arrow).

FIG. 1b Shorter, stubbier and slightly flattened appearance of villi adjacent to the true junction of ileum to caecum.

FIG. 1c Caecal portion of the junction, showing a crypt opening (single arrow), surrounded by a slightly elevated mound (double arrows), and circular groove (triple arrows).

FIG. 1d A low magnification of the caecal mucosa adjacent to the junction, showing the evenly spaced crypt openings (one of which is marked with an arrow), and the inter-cryptal areas forming slight circular mounds around each opening. The folded appearance of the mucosa may be due to muscular contraction or the effect of fixation.

formed well developed folds (Fig. 1d). Openings of the crypts of Lieberkuhn were visible on the surface at regular intervals (Fig. 1c & d) and the inter-cryptal areas were slightly raised in a circular fashion around each crypt opening (Fig. 1d). On higher magnification, these raised areas seemed pushed together in some places, forming a groove around each mound (Fig. 1c).

DISCUSSION
Three major types of villi have been described in the small intestine of humans and other species, namely, finger-shaped, tongue-shaped and leaf-like villi (De Ocampo et al., 1983; Marsh & Swift, 1969).

Long, finger-like villi identified in the ileal part of the ileocaecal junction in this study are similar to the
villi observed in the small intestine of the horse
(Roberts & Hill, 1974), man (Leeson, Leeson &
Paparo, 1988), calf (Mebus, Newman & Stair, 1975)
and dog (Hoskins, Henk & Abdelbaki, 1982). Stubby,
flattened villi detected in the second region
of the ileocaecal junction can be compared with a
variation of the finger-shaped villi noticed in the hu­
man small intestine (Marsh & Swift, 1969). Irregular
transverse furrows on the villous surfaces noted in
this study have also been reported the small intestine
of clinically normal horses (Roberts & Hill, 1974)
and ponies (Moore et al., 1980; White et al., 1980).
Similar furrows have also been reported in the hu­
man small intestine (Marsh & Swift, 1969) and are
due to the contraction of smooth muscle elements in
the villous core (Neutra & Padykula, 1983).

Low circular, semi-circular and S-shaped ridges,
formed by the fused villi in the transitional area be­
tween the ileum and caecum, seen in this study, can
be compared to the ridge-like villi observed in the
small intestine of the Philippine swamp buffalo (De
Ocampo et al., 1983) and in pigs (Mouwen, 1971). In
addition, bridged and convoluted villi have been de­
The scanning electron microscope is now widely used in the early diagnosis of diseases that cause changes in the normal mucosal architecture of the intestine (Siew, 1983; Traynor, Costa, Blumgart & Wood, 1981). On SEM and light microscopy, the changes that occur in the mucosa of the normal ileocaecal junction of the horse is described, and an anatomical basis is provided for research in pathology involving this segment of the intestinal tract.

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REFERENCES


