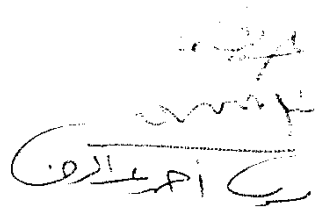
A MORPHOMETRIC STUDY ON THE DUODENAL MUCOSA IN THE PARANATAL PERIOD



THESIS

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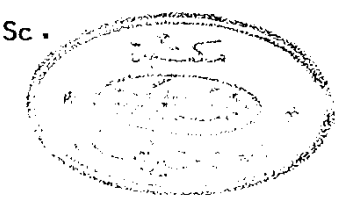

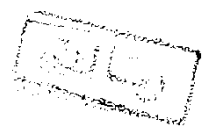

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A C K N O W L E D G E M E N T S

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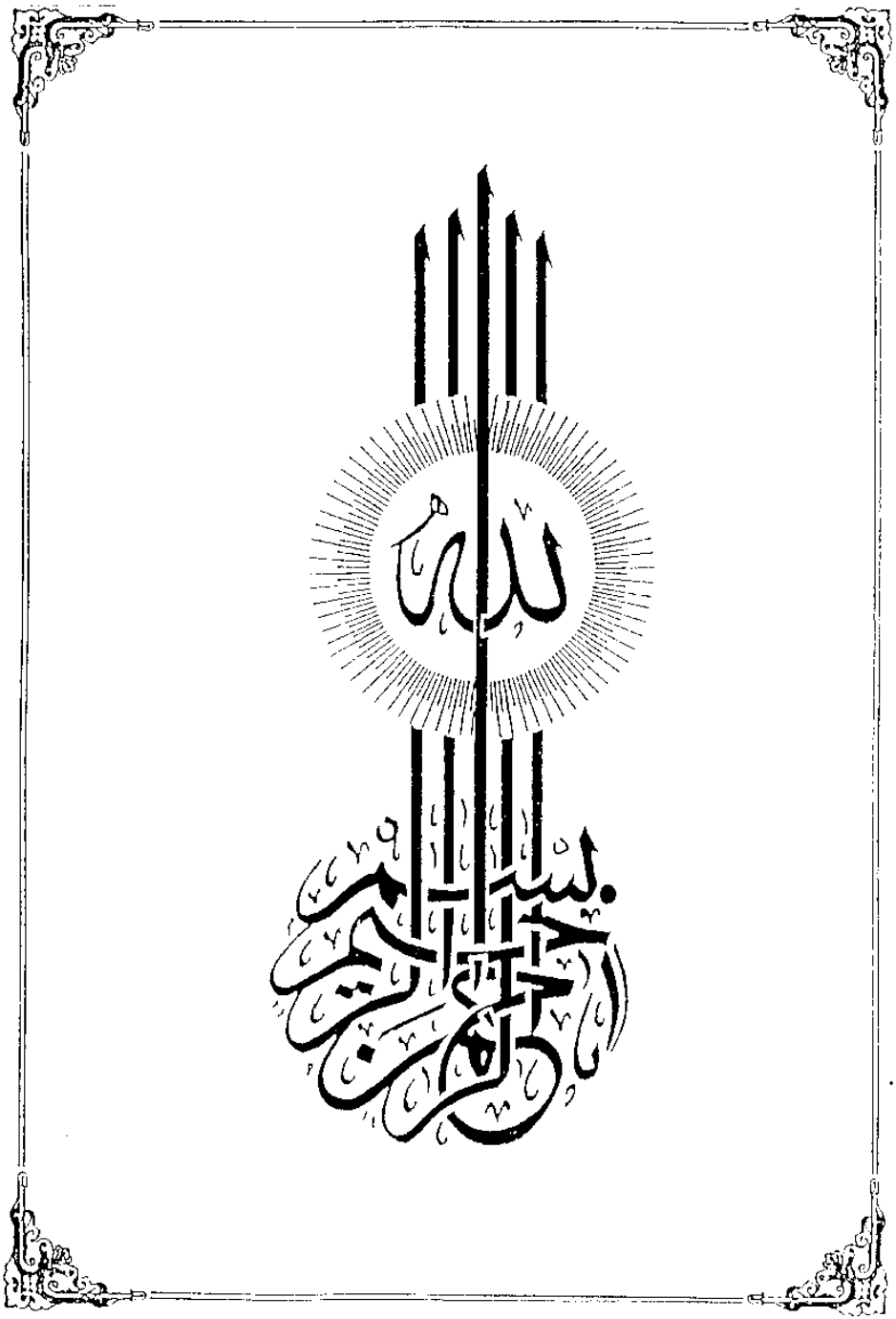

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INTRODUCTION

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The aggressive action of the gastric acidity on the duodenal mucosa of the human individuals was illustrated by Bockus (1963) and Maingot (1957) and by Oshida and Sugiemura (1959) who found that about 85% of chronic duodenal peptic ulcers were found 2.5 cm distal to the pyloric ring, 10% were within the next 3 cm and the remaining 5% were beyond the first 5 cm and above the papilla of Vater.

Again endoscopic biopsies were indicated for chronic peptic ulcers of the first and second parts of the duodenum (Nyhus, 1977; Decker and Plessis, 1986).

Accordingly, the present study was focussed on the detailed structure of the mucosa of the first and second parts of the duodenum, as their detailed architecture in textbooks of histology (Weiss and Greep, 1977; Wilfred et al, 1981; Cormack, 1987) and embryology (Patten, 1946; Hamilton et al, 1952; Langman, 1982) were megre especially in the paranatal period, where that mucosa was healthy and not subjected to disease. So, it became the aim of the present work to study the morphometric findings of the normal duodenal mucosa in the paranatal period.

REVIEW OF LITERATURE

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I- MACROSCOPIC ANATOMY OF DUODENUM

Snell (1973) in his description of the duodenum mentioned that the first part of the duodenum was 2 inches (5 cm) long. It began at the pylorus and ran upward and backwards on the right side of the first lumbar vertebra. It, thus, lay on the transpyloric plane. The second part of the duodenum was 3 inches (8 cm) long. It ran vertically downward in front of the hilus of the right kidney on the right side of the second and third lumbar vertebrae. The third part of the duodenum was 3 inches (8 cm) long. It ran horizontally to the left on the subcostal plane, following the lower margin of the head of the pancreas. The fourth part of the duodenum was 2 inches (5 cm) long. It ran upward and to the left and then turned forward at the duodenojejunal junction.

Hall-Craggs (1985) described the interior of the duodenum as being thrown into irregular circular folds (plicae circulares). On the posteromedial aspect of the descending part could be found the duodenal papilla which marked the site of entry of the combined biliary and pancreatic ducts.

Decker and Plessis (1986) mentioned that the dudenojejunal

flexure was at the left side of the 2nd lumbar vertebra just below the pancreas. It was a fixed part of the gut. It was supported by a ligament containing unstripped muscle which passed to it from the region of the left crus of the diaphragm. That was the suspensory ligament of the duodenum (ligament of Treitz).

Williams, Warwick, Dyson and Bannister (1989) described the circular folds (plicae circulares or 'valves' of Kerkring) as being crescentic folds of mucosa which projected into the intestinal lumen transverse to the long axis. Unlike gastric folds, they were not obliterated by distension. Most extended round about one-half or two-thirds of the luminal circumference; some were complete circles, some bifurcated and joined adjacent folds, and some were spiral but extended little more than once round the lumen, though occasionally two or three times. Larger folds were about 8 mm deep at their broadest, but most were smaller. Larger and smaller folds often alternated. Plicae began to appear about 2.5-5 cm beyond the pylorus. Distal to the major duodenal papilla they were large and close together.

Medonca, de Carvalho and de Souza (1989) studied the internal anatomy of the first part of the duodenum in 39 specimens obtained from necropsies. Three mucosal folds were observed in the aboral part of that segment: two folds

had a radial disposition and the third a circular one. The localization of these folds corresponded to the narrow zone observed externally in the first part of the duodenum.

Fuse, Tsuchihashi, Takamasu, Kawamoto, Kodama, Fujita and Kashima (1989) measured the thickness of Brunner's glands using an ocular micrometer in 297 cases of surgically resected peptic ulcer and in 120 autopsy cases (control group). The mean maximum thickness of Brunner's glands in the control group was 1.55 ± 0.37 mm (mean ± SD) and no difference in thickness was noted for each decade of age. The mean maximum thickness of Brunner's glands in patients with gastric ulcer, duodenal ulcer and gastroduodenal ulcer was 2.34 ± 1.06, 3.18 ± 1.07 and 3.24 ± 1.05 mm, respectively. When an ulcer was within the duodenum, Brunner's glands near the ulcer were thicker than those contralateral to it. In patients with gastric ulcer, Brunner's glands were the thickest in the pyloric ulcer group and negative correlation was noted between the thickness of Brunner's glands and the distance to the ulcer from the pyloric ring. Since gastric acidity was supposed to be lower when an ulcer was located more proximally, these results suggested that Brunner's glands became hyperplastic not only with the presence of an ulcer in the duodenum, but also by acid hypersecretion of the stomach.

Cassar-Pullicino, Davis, Hubscher and Burrows (1990) did a retrospective study of barium meals in 120 patients with chronic renal failure and demonstrated duodenal abnormalities in 38 cases (31%). Multiple nodular filling defects were shown in 28 patients (23%), while in 10 cases (8%) peptic ulceration was found on a background of smooth duodenal mucosa. There was no common cause for the renal failure in the group with nodules. The nodular changes were a direct consequence of the uraemia and were unrelated to dialysis, renal transplantation or drug therapy. They were found almost exclusively in males, and in the more severe degrees of uraemia. Associated dyspeptic symptoms were infrequent and there was no apparent relationship between the nodules and peptic ulceration. Radiologically the nodules were typical of Brunner's gland hyperplasia while endoscopic and histological assessment excluded ulceration, infection, duodenitis and malignancy. Hyperplasia of Brunner's glands was commonly associated with chronic uraemia.

Fuse, Tsuchihashi, Takamasu, Kodama, Fujita and Kashima (1990) measured the thickness of Brunner's glands with an ocular micrometer in 75 cases of surgically resected duodenal ulcer and in 75 autopsy cases (control group). Endoscopic findings before operation were also studied. Maximum mean thickness of Brunner's glands in the control

group was 1.54 ± 0.38 mm (mean ± SD), and no regional difference in thickness was noted. The thickness of Brunner's glands in the duodenal ulcer group was widely distributed, from 0.5 mm to 5.0 mm, and the average value was 3.0 ± 1.0 mm, with a statistically significant difference from that of the control group. In most duodenal ulcer cases Brunner's glands were thickest within 1 cm from the center of an ulcer. Only six cases of duodenal ulcer (8.0%) showed a diffusely thin layer of Brunner's glands, less than 1.5 mm thick. These results showed that the Burnner's glands became hyperplastic in duodenal ulcer patients, especially near the ulcer. In the healed ulcer, Brunner's glands were thin at the center of an ulcer scar, and the average thickness was 0.42 ± 0.26 mm. This histologic finding corresponded to the depressed scarred area observed endoscopically, suggesting a decreased mucosal resistance at this area.

II- MICROSCOPIC ANATOMY OF DUODENUM

Ham (1969) mentioned that the duodenum, as part of the small intestine, consisted of mucosa, submucosa, musculosa together with a serosa. The mucosa consisted of: Intestinal epithelium: which covered the villi and lined the crypts. Corium of connective tissue surrounding the crypts and extending as central cores in the villi. It contained blood vessels, lymphatics, nerves, lymphocytes (or solitary lymph follicles), macrophages and plasma cells. Muscularis mucosa: consisted of an outer longitudinal and an inner circular smooth muscle layers underlying the bottoms of the crypts.

The intestinal villi: the villus was a finger-like projection of the mucosa extending into the lumen of the intestine. The villus was formed of: Central core connective tissue which was identical and continuous with the corium, it contained a central lymphatic capillary (the central lacteal). Villous epithelium: simple columnar type, showing columnar absorbing cells (90%), goblet cells (9.5%), entero-endocrine cells and some caveolated cells (0.5%). The villi in the duodenum were broad and leaf-like.

The crypts of Lieberkuhn (intestinal glands): the crypt was a simple tubular gland occupying the thickness of the corium. It was invaginated from the surface epithelium between the bases of the villi, extending down to the muscularis

mucosa. The crypt epithelium was simple columnar showing many types of cells; undifferentiated columnar cells, columnar absorbing cells, goblet cells and oligomucous cells, Paneth's cells, entero-endocrine cells and caveolated cells. In between the cells there were tight junctions.
The submucosa: consisted of loose connective tissue with blood vessels, lymphatics and nerves (forming Meissner's plexus), It contained "Brunner's glands" which were mucous secreting glands of the compound tubulo-alveolar type. They opened by ducts into the bottoms of the crypts.
The musculosa: consisted of an inner circular, and an outer longitudinal smooth muscle layers, with "Auerbach's plexus" of nerves in between.
The serosa: consisted of a layer of mesothelial cells covering a subserous coat of loose connective tissue.

Subbuswamy (1971) demonstrated that goblet cells of the small intestine produced predominantly neutral mucin, while those of the colon predominantly produced acid mucin. That appeared to be a fundamental difference between the cell types, and not merely caused by differences in environment.

Crouch (1935) added that, the duodenum differed from other parts of the small intestine by having duodenal (Brunner's) glands in the submucosa. These were compound