



## Full Length Research Article

### A HISTOLOGICAL STUDY OF SUB MUCOSAL GLANDS IN OESOPHAGUS AND SMALL INTESTINE OF DOG AND RAT

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#### ABSTRACT

Submucosal glands occurred in the esophagus of certain mammals and in the duodenum of all mammals. The Brunner's gland began at the gastrointestinal junction in some animal and showed extension proximally in to pylorus for short distance and occasionally distally in the first part of jejunum. The study was undertaken in the department of anatomy, Pt JNM Medical College during period of 1977 to 1980. Distribution of submucosal glands in the oesophagus and small intestines of dog and rat was studied. Submucosal glands of oesophagus were seen only in dog and showed decreased compactness when traced distally. Brunner's glands commenced at the pyloroduodenal junction in all with proximal extension in pylorus of dog and rat. Glands were confined to the first part in dog and rat. The glands were purely mucous type in dog.

**Key words:** Brunner's Gland, Acini, Duodenum, Rat.

#### INTRODUCTION

Submucosal glands occurred in the esophagus of certain mammals and in the duodenum of all mammals. Brunner (1968) named these glands as glandular duodeni or pancreas secundarium, since he took them as accessory pancreas. But this term had the disadvantage that it might be misinterpreted to mean all of the glands contained in the duodenum. Middeldorpf (1846) pointed out first that the secretion of these glands differed from pancreatic juice therefore suggested that they might be designated as 'Glands of Brunner' instead of pancreas secundarium. The Brunner's gland began at the gastrointestinal junction in some animal and showed extension proximally in to pylorus for short distance and occasionally distally in the first part of jejunum.

The acini of the glands were composed of mucous cells except in horse and rabbit which had serous cells also. Hosoda (1956) believed on histological ground that the serous cells of Brunner's glands were residue of pancreas. The evidences presented by Wolff (1961) weighed heavily against this view. He found the development of serous cells in rabbit was unrelated to the development of pancreas. On the basis of histological evidences available, the question whether serous cells were residual of pancreatic zymogen cells has not yet been answered unequivocally. Submucosal glands of esophagus were also known as esophageal glands. These compound tubular glands had their acini composed of mucous cells. Johns (1952), however, described the presence of serous cells or demilunes in the submucosal glands of the esophagus

in its upper one third. Similar glands were also found in the lamina propria in the upper and lower part of esophagus and were called superficial glands. The present work has been undertaken to establish the distribution of sub mucosal glands in the esophagus and Brunner's glands in the intestine of common Laboratory animals

#### MATERIALS AND METHODS

The study was undertaken in the department of anatomy, Pt JNM Medical College during period of 1977 to 1980. For this study 3 dogs and 3 rats were studied. The animals were anesthetized in supine position with ether. The thorax was opened by a midline incision. Normal saline was pushed in left ventricle of heart and a nick was made in right atrium for the outflow of fluid. As the blood washed off, the fixative (10% formal saline) was injected. The entire esophagus, small intestine including pyloroduodenal junction in adult animals were dissected out. Tissues were cut at similar location in all animals and tissue prepared for Hand E staining. Hand E staining was done according to the standard technique as described in Carleton's Histological technique and tissue was studied under microscope.

#### Observations

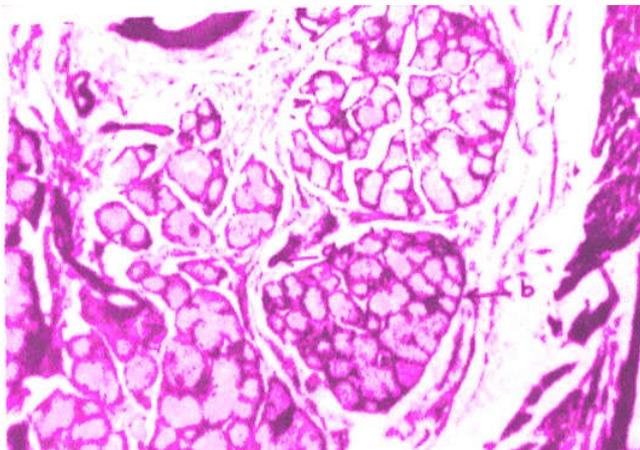
Submucosal glands described in the esophagus and duodenum were studied in dog and Rat. Histological examination was done to find out the presence, distribution and nature of these tubuloalveolar glands

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## Adult Dog (*Canis Familiaris*)

### (A) Oesophagus

- Upper part-The submucosa in the upper part of esophagus was not demarcated from mucosa as the muscularis mucosa was absent. Glandular tissue occupied the space between the epithelium and the muscularis externa and formed a continuous stratum all around the lumen. when traced distally the glandular stratum thickens. The glandular tissue consisted predominantly of mucous acini and serous demilune related with some mucous acini, arranged round the ducts in lobular form, separated from each other by loose connective tissue
- Middle part – In this part well developed muscularis mucosa having circularly arranged smooth muscle fibres formed a clear demarcation between the mucosa and the submucosa. The glandular tissue in submucosa formed lobules separated from each other by connective tissue encircling them. The glandular tissue were evenly distributed all around but they were not compact as seen in the upper part of esophagus
- Lower part – Submucosa was clearly demarcated from mucosa by well developed muscularis mucosa having longitudinally arranged smooth muscle fibres. The glandular tissue present in the submucosa formed a continuous stratum of glandular lobules surrounding the lumen but when traced distally the lobule are separated more and more from each other by greater amount of connective tissue

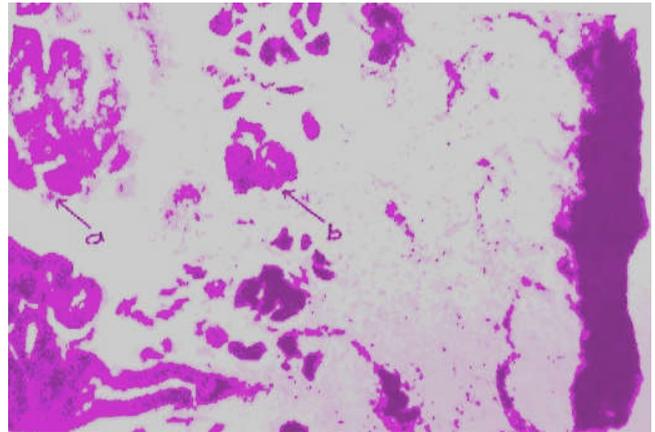


Dog-Upper part of oesophagus with oesophageal glands (Arrow)

### (B) Small intestine

- **Pyloroduodenal junction:** In longitudinal section of this junctional region, towards the pylorus, the mucous acini were seen in the deeper part of lamina propria separated from the submucosa by thick muscularis mucosa. when traced distally, few glandular cells were seen in the submucosa. Gradually the glandular tissue became more and more dense. The mucous acini had similar characteristics as seen in the esophageal glands
- Second part of duodenum : Submucosal glands were not seen. muscularis mucosa was well marked and thick.
- Third part of duodenum: Submucosal glands were not seen
- Fourth part of duodenum: Submucosal glands were not seen

- Proximal piece of jejunoileal part of gut : Submucosal glands were not seen
- Terminal piece of jejunoileal part of gut : Submucosal glands were not seen, lymphoid follicles were present occupying the space between the epithelium and muscularis externa replacing the lamina propria, submucosa and muscularis mucosa.
- Terminal part of ileum : lymphoid follicles surrounded by connective tissue were seen more frequently. They occupied the space between the mucous membrane and muscularis externa, replacing at places muscularis mucosa and lamina propria.

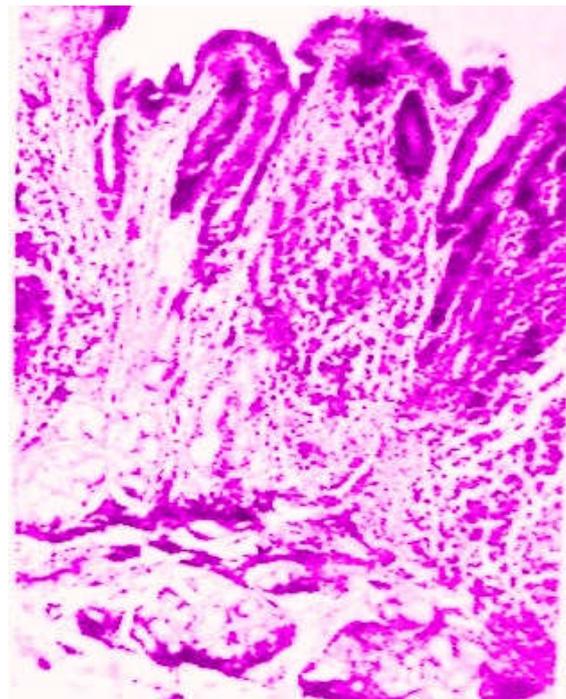


Dog-lower part of oesophagus with well developed muscularis mucosae(a) glands in submucosa(b)

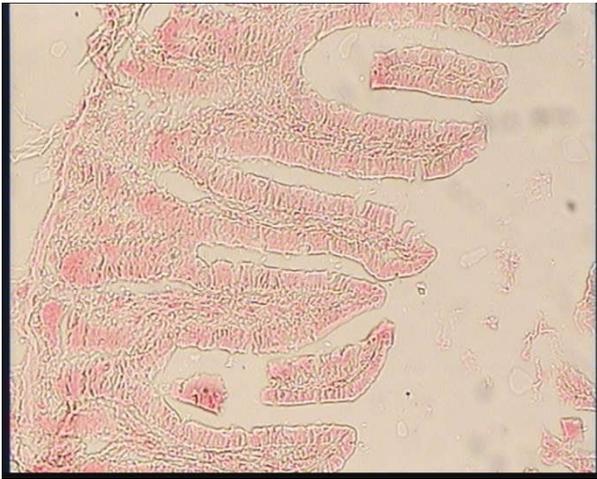
## Adult Albino Rat (*Ratus Norvegicus*)

### (A) Oesophagus

- Upper part ; No glandular tissue was seen in submucosa
- middle part ; No glandular tissue was seen in submucosa
- lower part ; No glandular tissue was seen in submucosa



Dog-pyloroduodenal junction showing Brunner's gland



**RAT duodenum**

### (B) Small intestine

- pyloroduodenal junction: submucosal glandular tissue found towards commencement of duodenum, lobules of glandular tissue were found in deeper part of lamina propria and in the submucosa.
- second part of duodenum : No submucosal glands were found forming a sheet. The thickness of sheet was less than in the region of first part of duodenum. proportion of serous acini was found to be increased but main glandular tissue was of mucous type
- Third part of duodenum: Glands were not found .
- Fourth part of duodenum : glandular tissue was not seen in the submucosa
- Proximal piece of jejunum-ileal part : No glands were seen in submucosa
- Distal piece of jejunum-ileal part : no glands were seen in submucosa. muscularis mucosa was well formed and continuous
- Terminal part of ileum : no glands were seen in submucosa.

## DISCUSSION

Number of workers made observations on submucosal glands of oesophagus and duodenum in different animals and did pre and post natal studies. In the present work the presence, distribution and nature of these glands in dog and rat was examined

### Oesophagus

Oesophageal glands were found to be present only in dog. Rat showed total absence of these glands. Bloom and Fawcett (1970) also mentioned that in some species like rodents, horse and cat no glands were found. Johns (1952) in his post-natal study in man emphasized the presence of superficial and deep glands in the oesophagus. Superficial ones being located in the lower part as minute glandular areas and deep glands, which were numerous, occupied the whole length of oesophageal submucosa. In the present study deep submucosal glands were found to be present through out the whole length, but the superficial glands were not observed in any part of dog oesophagus. Schaffer (1897) and Schumacher (1927) stated that the deep glands were solely mucous in type where as

Johns (1952) mentioned about the presence of serous acini and demilunes also. The present study was in favour of the later worker as the serous demilunes were seen capping many mucous acini.

Muscularis mucosae did have features similar to the usual description in man where it started at the termination of pharynx and consisted of longitudinally arranged smooth muscle fibres. In the mammals studied it showed species variation. Upper part of oesophagus presented negligible muscularis mucosae in dog and scanty in rat. Arrangement of fibres was circular in the rat. In dog it was thick circular in the middle third and longitudinal in the lower. Muscularis externa was found to be arranged in two layers in dog and rat as is usually described. The muscle was of skeletal variety in all the three animals throughout the whole length of oesophagus. This finding was in contrast to common description in man in whom smooth muscle fibres gradually replaced the skeletal muscle fibres from the middle part and in lower third, only smooth muscle was found. Arrangement of muscle fibres described to be irregular by all was seen in the present study also (Bloom and Fawcett, 1970). In rat it was predominantly oblique in both the layer with slight mixing of longitudinal fibres throughout. In dog it was inner longitudinal and outer circular in upper and lower thirds with reversal in the middle.

### Small Intestine

Most common site of submucosal glands happened to be the duodenal part of small intestine with possible extension proximally in the pyloric wall and distally in the jejunum. In the present study a search was made from the pyloroduodenal region upto terminal part of ileum. Landboe-Christensen (1944) and Grossman (1958) mentioned that Brunner's glands in man extended into the substantia propria of pyloric mucosa. In this study similar observations were made in dog where glandular mass resembling Brunner's glands was seen in the lamina propria of the pyloric mucosa and in the mucosa of the duodenum near the pylorus. In case of rat, the Brunner's glands were found invading the wall of the pyloric part of stomach where they formed a compact lamina all around the circumference. Similar observations were reported by Krause and Leeson (1967). The distance, Brunner's glands extended from the pylorus was highly variable between species and within species (Grossman, 1958). This was evident in the present study as well. In dog and rat no submucosal glands were found beyond first part of duodenum Kuozymske (1890) correlated the short extent of the glands in carnivora, moderate in omnivore and longer in herbivore and classified the extent accordingly. In the present study the longer extent was observed only in rabbit who happened to be herbivorous.

As reported by Bensley (1903) the lower limit of extent of glands was above the entrance of the bile and pancreatic duct in dog and rat as glands were not seen even in the proximal portion of the second part of duodenum in both these animals. According to Villemin (1922) the lower extent of glands in rabbit could be related to the opening of pancreatic duct in the fourth part of duodenum. Krause and Leeson (1967) working on rat and Landboe Christensen (1944) on man mentioned that the compactness of glands was most marked at the beginning and when traced distally away from the pylorus, the continuity of the glandular tissue was lost and small separate lobules were found scattered in the submucosa.

In the present study the compactness was gradually reduced distally and in the lower most part, glandular tissue was seen in the form of few acini and ducts. Even in rat in which glands were extending proximally in the pyloric wall the compactness was most marked close to the pyloric part as seen by Krause and Leeson (1967) also.

Krause and Leeson (1967) observed that the Brunner's glands were less developed on the side associated with the pancreas in rat, but present study did not show such correlation. Glands were well developed on the side of the pancreas as in the rest of the circumference. In this light the suggestion of Krause and Leeson (1967) and Lendboe Christensen (1944) about close vicinity of pancreas affecting the vascularity of duodenum could not be accepted. In dog and rat Brunner's glands were exclusively of mucous type. The ducts were lined by cuboidal or low columnar type of cells. The ducts draining the glands were found opening in the deeper parts of crypts of Lieberkuhn in all the three animals studied. However, glands present in the submucosa propria of dog's pylorus were seen opening in the deeper parts of pyloric glands.

### Summary and Conclusion

Submucosal glands of oesophagus were seen only in dog and showed decreased compactness when traced distally. Brunner's glands commenced at the pyloroduodenal junction in all with proximal extension in pylorus of dog and rat. Glands were confined to the first part in dog and rat. The glands were purely mucous type in dog and rat.

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