Veterinary Bioscience: Digestive System

LECTURE 7
THE SIMPLE STOMACH AND ABOMASUM

LECTURER

PROFESSOR SIMON BAILEY

bais@unimelb.edu.au

INTENDED LEARNING OUTCOMES

At the end of this lecture, you should be able to:

- Utilise your knowledge of the anatomy of the stomach in order to integrate its structural features with their function.
- Apply an understanding of the position of the stomach within the abdominal cavity, in order to determine the nature of displacements or obstructions when they occur.
- Apply an understanding of the relationship of the stomach with other abdominal organs and structures, in order to relate this to the potential for their involvement in disease or displacement.
- Utilise your knowledge of species differences in stomach anatomy in order to integrate these structural differences with differences in digestive function.

KEY WORDS

Simple stomach; abomasum; fundus; body; pylorus; glandular regions; saccus caecus; comparative anatomy.

LECTURE OVERVIEW

The simple stomach is the dilated part of the alimentary canal in which the processes of digestion are initiated. The structure of the stomach is determined by the feeding habits of the species: Horses, pigs and carnivores have a simple stomach, while ruminants have a compound stomach – the abomasum has a similar glandular structure and fulfils a similar role to the simple stomach.

The stomach is a musculo-glandular organ interposed between the oesophagus and the small intestine. It consists of two distinct parts that converge and join at a ventral angle forming a C- or J-shape.

The cardiac, fundic and body regions form the larger part - into which the oesophagus opens. This part of the stomach lies mainly to the left of the median plane, well forward under cover of the ribs and is in direct contact with the liver and diaphragm. It is relatively distensible.

The pyloric region is the second part which is narrower, has thicker walls and is more constant in appearance. It passes to the right to continue into the duodenum at the pylorus.

The stomach has two surfaces - both variably convex. The cranial or parietal surface is mainly in contact with the liver and diaphragm, and the caudal or visceral surface is in contact with the intestinal mass, the left kidney, the pancreas and the greater omentum.

The stomach also has two curvatures (the borders between the two surfaces). Both run between the cardiac and pyloric openings. The lesser curvature is very short and sharply concave and is connected with the liver by the lesser omentum. The greater curvature is very long and convex and gives attachment to the greater omentum and the gastrosplenic ligament which attaches the spleen with the stomach. The two extremities of the stomach are the cardia (the oesophageal orifice into the stomach) and the pylorus (the opening of the stomach into the intestine).

The stomach wall

As with most other parts of the gastrointestinal tract, there are 4 main layers in the wall of the stomach:

The **mucosa** forms gastric pits -lined by mucus secreting simple columnar surface epithelium. The function of the mucus is to protect the gastric mucosa. Tubular glands are present in the laminar propria. These extend to the muscularis mucosa and open into the base of the gastric pits.

The **submucosa** contains no glands, but is rich in blood vessels and nerves, and contains mainly collagen fibres.

The **muscularis externa** is very thick and churning of the ingesta enables further mechanical breakdown. It has 3 incomplete layers of smooth muscle: the inner layer which is oblique; the middle circular layer (which helps form the thick ring of the pyloric sphincter and the weaker ring of the cardiac sphincter) and the thinner outer longitudinal layer.

The outer **serosa** consists of a serous membrane (simple squamous epithelium) which reduces friction, overlying connective tissue conducting nerves and blood vessels.

Glandular regions within the stomach

Within the stomach there are different zones or regions, based on the distribution of the types of glands in the walls. In the dog (and human) these glandular regions correspond to the major parts of the stomach, i.e. cardiac glands in the cardia, fundic glands in the fundus and body, and pyloric glands in the pylorus. However, in the other species, the glandular regions to not correlate with the gross anatomical regions of the stomach, which can be confusing.

The true fundic glands secrete HCl and pepsin, as well as mucus, and this glandular region is generally the largest. The cardiac and pyloric regions are mainly mucus secreting.

Comparative aspects

In the dog, the stomach is C-shaped and is relatively large (2.25 litres in an average sized dog). When empty the stomach does not contact the abdominal wall and lies cranial to the last rib, but when distended it may extend caudally quite considerably. There are three distinct regions to the mucosa. Cardiac glands are found in a very narrow pale zone around the cardiac opening and scattered along the lesser curvature. The fundic gland region has a thick reddish-brown mucosa which lines about 2/3 of the stomach and has prominent longitudinally orientated rugae. The pyloric mucosa is thin and pale. The greater omentum is very extensive and may contain much fat. When the abdomen is opened ventrally it covers the entire intestinal mass, extending from the greater curvature of the stomach to the pelvic inlet.

In the horse, the stomach is relatively small (5-15 litres) and has a sharply curved J-shape. The fundus is extensive, forming a large non-glandular sac (the saccus caecus). Internally, the saccus caecus is separated from the rest of the stomach by a mucosal fold-the margo plicatus, which marks the boundary between the non-glandular and glandular regions of the gastric mucosa.

The pig has a relatively large stomach (approximately 9 litres), with an irregular J-shape. It has a large region of cardiac glands in the fundus.

Ruminants have a complex stomach that was covered in a separate lecture.

Birds have two distinct parts to the stomach, separated by a constriction (the isthmus). The first part is the proventriculus, a small cranial glandular stomach which is elongated and spindle-shaped. Ducts of the mucosal glands open on visible papilla which project into the lumen. The second part is the Gizzard (Ventriculus) which is the large caudal muscular stomach.

FURTHER READING

Dyce, Sack and Wensing: *Textbook of Veterinary Anatomy* 3rd edition 2002.

Boyd: *Color Atlas of Clinical Anatomy of the Dog and Cat* 2nd edition 2001.

Eurell JA, Frappier BL. *Dellman's Textbook of veterinary histology.* 6th Edn. 2006.

Constantinescu: *Clinical Dissection Guide for Large Animals*, 1991.

Getty: *Sisson and Grossman's The Anatomy of the Domestic Animals*, Volumes I and II, 5th edition, 1975.

Miller, Christensen and Evans: *Anatomy of the Dog* 1964.

Smallwood: *A Guided Tour of Veterinary Anatomy*, 1992.