How to Perform Gastroduodenoscopy

Michael J. Murray, DVM, MS

Author’s address: Marion duPont Scott Equine Medical Center, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, P.O. Box Leesburg, VA 20177. © 2002 AAEP.

1. Introduction
Many equine practices have recently acquired moderately priced video endoscopy equipment of good quality suitable for equine gastroscopy. The purpose of this presentation is to provide guidelines and suggestions that can facilitate the performance of gastroduodenoscopy and enhance the quality of information obtained from the procedure.

2. Materials and Methods

Equipment
This section will cover only new equipment available for purchase. Factors to consider when purchasing endoscopy equipment include the following:

- Types of horses to examine: foals, yearlings, adults?
- Does the equipment need to be mobile or will it remain in a clinic?
- Budget for equipment purchase

Types of Horses to Examine
The primary considerations are the length and outer diameter of the endoscope to be purchased. The length requirement is the ability to perform a duodenoscopy in adult horses, and the diameter requirement is the ability to examine foals. To perform gastroduodenoscopy on foals and young horses, the endoscope outer diameter should be less than 11 mm. For adult horses, up to a 15-mm outer diameter is feasible, but 12–13 mm is preferable. To perform duodenoscopy in adult horses consistently, the endoscope should be 3 m long (working length). Most endoscopes manufactured for use in horses are 3 m long, but most also are 13–15 mm in outer diameter. Human small bowel endoscopes are typically 250 cm long and 10 mm in outer diameter, and they are used in some practices because of their versatility. Many practitioners find that endoscopes of larger diameter are easier to pass into and around the stomach. An important caution is that human small bowel endoscopes are manufactured to be highly flexible, and these are very prone to retroflexing in the horse’s pharynx. Many of these endoscopes have suffered catastrophic damage while being used by very experienced equine endoscopists! Table 1 summarizes the types of endoscopes that are available.

Mobility of Equipment
Endoscopic equipment manufactured by the two major companies in the human medical field, Olympus and Pentax, are excellent instruments, but they are designed to reside in an endoscopy suite in a human medical facility. These systems are set up to remain in one place. The systems generally are quite large and do not lend themselves to the mobility
required in many equine practices. New models of video endoscopes, which rely on a large color chip and 150-W halogen light source, are more lightweight and thus are more portable. The less powerful light source (150-W halogen versus 300-W xenon) can be disadvantageous in viewing a large stomach, but with experience, the endoscopist can adequately examine the entire stomach.

**Budget for Equipment Purchase**

Purchased new from Olympus or Pentax, video endoscope systems with an endoscope long enough for a duodenoscopy in adult horses will cost in the range of $45,000–$65,000. The quality of this equipment is excellent. An important consideration is the turn-around time on repairs. Pentax has produced a 3-m-long endoscope for use in horses and has supported this equipment by providing domestic repairs. Traditionally, 3-m Olympus endoscopes have been custom-made and repairs have been done in Japan, requiring up to 1 yr for return to service! Currently, repairs on custom-made 3-m endoscopes are repaired by Olympus or their distributors in the United States. The 2.5-m small bowel endoscopes are repaired in the United States, but because of their flexibility, the potential for severe damage is great!

Recently, 3-m-long video endoscopes made in Germany (Eurocam Pro) have become available in the United States. These endoscopes provide good images and are approximately $20,000, which typically includes the endoscope, processor, monitor, and color printer. This author is not familiar with the repair history of these endoscopes.

**Other Equipment**

A hand pump, such as used for fluid infusion, is useful for insufflating the stomach with air. It in- sufflates more rapidly than the endoscope air channel. A biopsy forceps is also useful in the procedure. Often, it is difficult to advance the endoscope to the antrum because of resistance in the ventral portion of the stomach. Advancing the endoscope forcefully usually results in bowing the endoscope within the stomach. This stretches the stomach wall, which is objectionable to many horses. The biopsy forceps can be used to grab onto mucosa in the antrum and literally pull the endoscope to the antrum.

A suction pump is very useful for removing fluid from the stomach to enhance visualization and to remove insufflated air from the stomach. Suction is applied directly to the biopsy channel, and suction is usually applied when the endoscope is in the dependent portion of the stomach. Removing 300 ml to 1 l of fluid can enhance visualization of the antrum and pylorus in many cases. These are relatively inexpensive (<$1000) and are worth the expense in time saved and patient comfort after the exam. This is usually the most effective method of removing residual fluid after food deprivation. As much as 4 l may remain in the dependent portion of the stomach, and intubation with a standard nasogastric tube usually does not facilitate removal of this residual fluid.

**Preparation for Endoscopic Procedure**

Proper patient preparation is crucial. Suckling foals not eating solid feed are allowed to nurse up until 2–4 h before endoscopy. Foals eating solid feed should have feed withheld for 8–12 h, with nursing permitted until 2–4 h before endoscopy. Longer periods of withholding feed and preventing nursing can be used, but the foal’s hydration status needs to be considered. Sedation is not always required in young foals, although if the foal struggles excessively, sedation will facilitate the procedure for both the foal and the endoscopist. The procedure may be performed with the foal standing or lying on a mat. Options for sedation include the following:

- Xylazine, 0.5 mg/kg, IV
- Xylazine, 0.5 mg/kg, IV plus diazepam, 0.1 mg/kg, IV

### Table 1. Endoscopic Equipment Available for Gastroduodenoscopy in Foals and Horses

<table>
<thead>
<tr>
<th>Endoscope Product</th>
<th>Typical Dimensions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small bowel endoscope (Olympus, Pentax)&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Working Length 250 cm, Outer Diameter 10 mm</td>
<td>Suitable for all ages, except adult duodenoscopy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Highly flexible and prone to retroflexing into pharynx. 300 W xenon light source</td>
</tr>
<tr>
<td>Equine gastroscope (Eurocam Pro)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Working Length 330 cm, Outer Diameter 12 mm</td>
<td>Large o.d. inappropriate for young foals. 300 W xenon or 150 W halogen light sources available.</td>
</tr>
<tr>
<td>Equine gastroscope (SureVision)&lt;sup&gt;d,e&lt;/sup&gt;</td>
<td>Working Length 300 cm, Outer Diameter 14 mm</td>
<td>Large o.d. inappropriate for foals. 150 W halogen light source.</td>
</tr>
<tr>
<td>Equine gastroscope (Pentax)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Working Length 300 cm, Outer Diameter 10 mm</td>
<td>Suitable for all ages, including adult duodenoscopy. 300 W xenon light source</td>
</tr>
</tbody>
</table>

o.d., outer diameter.
HOW-TO SESSION

- Xylazine, 0.5 mg/kg, IV plus butorphanol, 0.01–0.02 mg/kg, IV
- Acepromazine, 0.02 mg/kg, IV; 20 min later xylazine, 0.5 mg/kg, IV. This facilitates a longer examination, such as required for duodenoscopy.
- Detomidine, 0.02 mg/kg, IV. This facilitates a longer examination, such as required for duodenoscopy.
- If delayed gastric emptying is suspected or known, pre-treatment (45 min) with bepanthenecol, 0.025 mg/kg, SC, will facilitate advancing the endoscope throughout the stomach.

Endoscopic Procedure

Passage of the endoscope through the nares is usually what is most objectionable to the animal. The endoscope is advanced to the rima glottis and into the esophagus. In older foals and adult horses, swallowing is facilitated by squirting water through the endoscope biopsy channel onto the rima glottis. It is better to have the horse swallow and then pass the endoscope than try to force the endoscope into the esophagus, because the endoscope may inadvertently and unknowingly retroflex and be advanced into the mouth!

The esophagus should be carefully examined as the endoscope is advanced. In an adult horse, the lower esophageal sphincter and entrance into the stomach is typically 170–180 cm from the nares. Some resistance may occur at the lower esophageal sphincter, but it should be relatively easy to advance the endoscope into the stomach.

The stomach is distended by insufflation of air through the endoscope and is distended until the nonglandular and glandular regions of the gastric surface can be observed. Distention with air is tolerated by foals and horses and has been associated with signs of abdominal discomfort only rarely in the patients examined by the author. Gastric contents should be thoroughly rinsed from the stomach surface using tap water flushed through the biopsy channel. Excessive fluid within the stomach may need to be aspirated, which may be accomplished through the endoscope biopsy channel, or often more effectively using a nasogastric tube.

When the endoscope first enters the stomach, the endoscopist sees the right side and the greater curvature of the stomach. As the endoscope is advanced, it will travel against the right side of the stomach and then dorsally toward the caudal portion of the stomach. As it is advanced further, the lesser curvature and cardia can be seen. To pass the endoscope to the pylorus, it will be advanced around the curvature of the stomach such that the tip goes into the ventral part of the stomach (Fig. 1). In many horses, the endoscope travels into the dorsal hemisphere of the stomach as it is advanced. In these cases, it can be useful to use the biopsy forceps to grab onto mucosa in the ventral part of the stomach and pull the scope ventrally. In the ventral part of the stomach, the endoscope will become submerged in gastric fluid and remains of ingesta, and the endoscopist’s view will be obscured. It will be helpful to aspirate fluid and insufflate with air, and then carefully advance the endoscope until the antrum and pylorus can be seen. This may require several minutes and it is important to be patient! If resistance is met while passing the endoscope, the biopsy forceps can be used to grab onto mucosa to advance the scope. This is generally done blindly, because ingesta and secretions obscure the endoscopist’s view. With some experience, the endoscopist will become familiar with the orientation of the stomach and will be able to guide the forceps to the antrum.

When observing the cardia and pylorus, it is important to recognize that the endoscope is pointing cranially, so that the left side of the animal appears on the left side of the endoscopist’s field of view. With sufficient length of endoscope, it may be advanced through the pylorus into the duodenum. It will initially move into the duodenal ampulla, and when advanced further, the lens will be pressed against mucosa and the field of view will be a blurred red. As the proximal duodenum extends past the pylorus, it makes a 180-degree turn caudally, which is what the endoscope must do to continue to be advanced. It usually is not possible to advance the endoscope further than the major duodenal papilla. In most cases, the endoscopist will be able to see to the major duodenal papilla by advancing the endoscope a few centimeters while rotating the endoscope and maximally retroflexing the tip. In this way, the endoscopist is actually looking back at the duodenal papilla, rather than forward. With the tip fully retroflexed, one will notice that when the endoscope is first pulled back to leave the duodenum, it will...
appear as if the endoscope is advancing toward the duodenal papilla.

When the endoscopic procedure is completed, it is helpful to remove air from the stomach. Post-endoscopy abdominal discomfort is unusual, but can be prevented by keeping the duration of the examination as short as possible and removing air insufflated into the stomach.

3. Discussion
Veterinarians with whom I have spoken who have purchased 3-m-long endoscopes for gastroscopy in horses have all been pleased with their purchase. All have thought that it was a cost-effective purchase. Many practitioners, though, thought that they had not performed enough examinations to become highly proficient, and were particularly frustrated with trying to reach the pylorus and duodenum. This is an important region of the stomach to examine. We recently reported that 59% of 162 horses had erosions or ulcers in the antrum/pylorus, and in many cases the lesions were severe. Also, many horses with lesions in the antrum had normal gastric squamous mucosa, so it was not possible to infer the presence or absence of lesions in the antrum on the basis of the appearance of the dorsal, squamous portion of the stomach. The author has examined the proximal duodenum in more than 100 horses, and in most cases, there are no abnormalities. Changes we have seen have included pronounced mucosal reddening, erosions, and raised, irregular lesions.

Examination of the antrum requires that horses have feed withheld for at least 8 h, preferably 12 h. It can take several minutes to advance the endoscope to the antrum and pylorus, and some practitioners have said that this was a deterrent to their performing a complete examination. Use of the biopsy forceps, in particular, to advance the scope into the antrum can expedite the procedure.
References and Footnotes


Manufacturers' and Distributors' addresses: note that there are several distributors that sell Olympus and Pentax products.

a. Olympus America, Two Corporate Center Drive, Melville, NY 11747.

b. Pentax Precision Instrument Corp., 30 Ramland Road, Orangeburg, NY 10962-2699.
c. U.S. distributor for Eurocam Pro endoscope: Scope Source, P.O. Box 660523, Miami Springs, FL 33266.