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Case Report
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Transendoscopic Electrosurgery for Partial Removal of a Gastric Adenomatous Polyp in a Horse

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Key words: Debulking; Electrocautery; Equine; Gastric mass.

A 9-year-old Hanoverian gelding used for hunter jumper and dressage disciplines was presented to the Colorado State University Veterinary Teaching Hospital's Equine Medicine Service for suspected gastric ulceration. The owner reported that the horse had become more reluctant to work and had soft stool when traveling and competing over the past year. According to the owner, the horse also seemed lethargic, paced the fence line, and displayed unsocial behavior toward other horses. Physical examination was within normal limits. Gastroscopy[a] identified a 10 × 5 × 4 cm, lobulated mass in the antrum just orad to the pylorus; no gastric ulcers were seen (Fig 1). Histologic examination of 2.5 mm diameter gastric mass biopsy specimens collected with endoscopic biopsy forceps[b] disclosed multifocal lymophoplasmacytic gastritis with mild fibroplasia. Plasma biochemistry results included a slightly increased total bilirubin concentration of 2.9 mg/dL (reference interval, 0.4–1.8 mg/dL) and icterus 5.0 mg/L (reference interval, 1.0–3.0 mg/dL; determined by spectrophotometry) attributed to the horse being fasted, but were otherwise normal. A CBC disclosed leukopenia with a decreased nucleated cell count of 3.1 × 10^3/μL (reference range, 5.5–10.5 × 10^3/μL), neutropenia 1.5 × 10^3 cells/μL (reference range, 3.0–7.0 × 10^3/μL), and a mildly decreased hematocrit (30%; reference range, 31–47%). Abdominal palpation per rectum and transcutaneous abdominal ultrasound examinations were within normal limits. Peritoneal fluid analysis was normal. Biopsy samples of the rectal mucosa showed mild, diffuse eosinophilic lymphoplasmacytic proctitis. The owner reported a negative fecal egg count 3 weeks before presentation.

Based on the concern for further growth of the gastric mass and risk of subsequent pyloric obstruction, transendoscopic debulking was suggested. Concurrently, this procedure would allow evaluation of a larger biopsy sample, because transendoscopic biopsies of the equine gastric mucosa often yield specimens too small to adequately evaluate.[1] The debulking procedure was performed under standing sedation using an initial dose of detomidine[c] (14 μg/kg IV) followed by 2 additional doses of detomidine (7 μg/kg IV) and butorphanol[d] (7 μg/kg IV) administered during the procedure. A 3 m endoscope[a] was passed into the stomach through which an insulated polypectomy snare[e] was passed. When the mass was visible at the level of the pylorus, the snare was looped around the base of the mass (Fig 2A). A surgical energy platform[f] combined with patient return electrode[g] was used to deliver monopolar electrocautery through the snare in blended cut mode at 50 W at intervals of 5–10 seconds until the mass was separated from the underlying base. The residual base then was monitored for any evidence of hemorrhage (Fig 2B), after which the mass was retrieved for histopathology with 3.5 m endoscopic grasping forceps.[h] In this fashion, 40% of the mass was removed in multiple sections. There were challenges with loop performance at the 3 m length making minor adjustments of position difficult. We elected therefore to reevaluate the resection site the next day and remove more tissue if needed. Histopathology of 2 sections of the mass indicated an adenomatous polyp with focal surface ulceration and mild, suppurative and lymphoplasmacytic inflammation (Fig 3). The mass was well defined and unencapsulated and composed of well-differentiated, hyperplastic gastric glands lined by a single layer of tall columnar cells with small, round, basally located nuclei separated by moderate amounts of fibrovascular stroma. The differentiation of gastric adenomatous polyp from adenoma was based on the low mitotic activity, minimal cellular atypia, and glandular structures lined by only a single layer of well-differentiated epithelial cells. The horse was given flunixin meglumine[i] (0.9 mg/kg IV) once and sucralfate[j] (29 mg/kg PO) q8h after the procedure. The next day, an additional 30% of the mass was resected transendoscopically using the same technique. Twenty-four hours after the initial resection, the surface of the resection site had an edematous appearance with a thin layer of yellowish fibrin covering the defect. After this second procedure, the horse again was given 1 dose of flunixin

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This work was performed at the James L. Voss Veterinary Teaching Hospital at Colorado State University.

None of the information presented here has been reported elsewhere.

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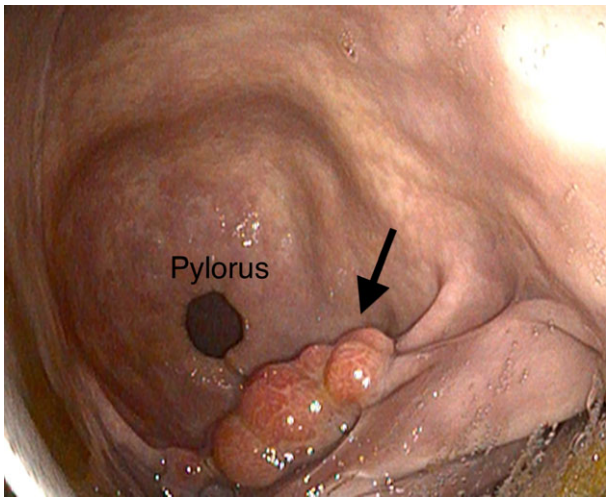

Fig 1. Endoscopic photograph of the polypoid adenoma. The black arrow points toward the large lobulated mass located in the antrum of the stomach orad to the pylorus.

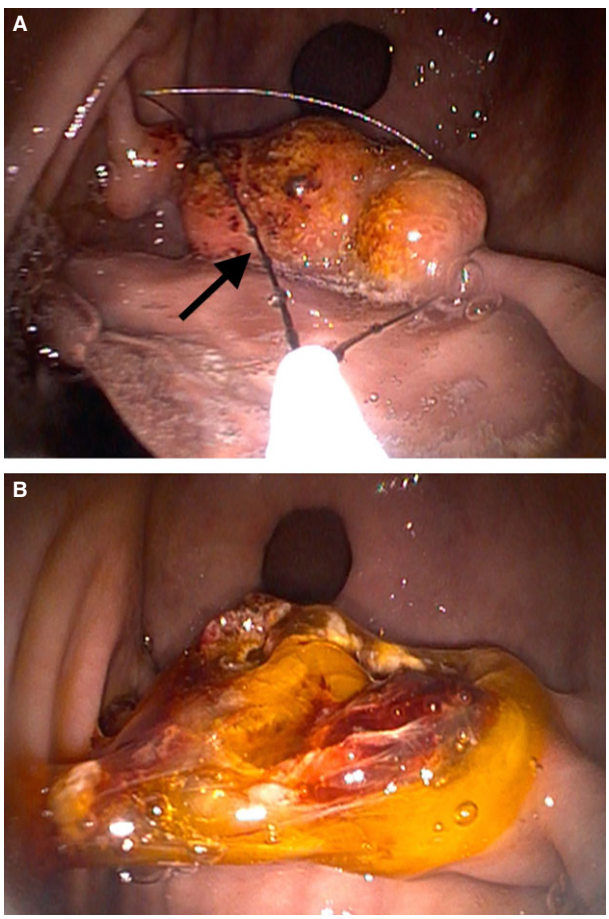

Fig 2. Endoscopic photographs taken during the polypectomy procedure. (**A**) The polypectomy snare (black arrow) is being placed around the mass. (**B**) The polypectomy site immediately after removal of a large section of the mass.

meglumine and was continued on sucralfate. In total, an estimated 70% of the mass was removed. Further resection was not attempted because of the risk of

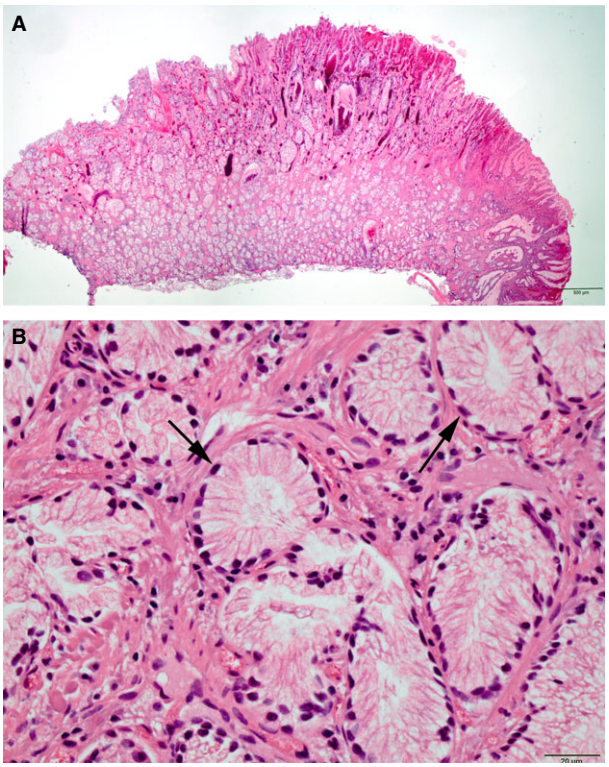

Fig 3. Photomicrographs of the adenomatous polyp. (**A**) Overview of the polypoid mass composed of well-differentiated hyperplastic gastric glands supported by fibrovascular stroma. Bar = 500 μm. Hematoxylin and eosin stain at 2×. (**B**) Hyperplastic glands are lined by a single layer of tall columnar epithelial cells (arrow). Notice the lack of cellular atypia and mitotic figures. The supporting stroma is infiltrated by rare lymphocytes and plasma cells. Bar = 20 μm. Hematoxylin and eosin stain at 40×.

complications related to complete mass removal and accurate discernment of the extent of the polypoid tissue endoscopically. The horse returned to its normal diet within 24 h and was discharged from the hospital 2 days after the second mass resection with recommendations for treatment with sucralfate (29 g/kg PO q8h) and omeprazole[k] (0.8 mg/kg PO) for 4 weeks to support healing of the gastric mucosal lesion associated with the partial polypectomy. Gastroscopy 6 weeks after transendoscopic partial polypectomy showed that the site was healing well with healthy gastric mucosa covering the antral region where the mass had been removed. No gastric ulceration was seen. Another follow-up gastroscopy performed 10 weeks after the transendoscopic resection showed a smooth mucosal layer where the mass had been located with no appreciable regrowth (Fig 4). The horse was doing very well 9 months after mass removal; its attitude had improved substantially and the horse was back to normal athletic function. Specific changes reported by the owner included a return of normal behavior in pasture and willingness to move under saddle. The horse no longer ran away in pasture when being caught for riding, appetite and water consumption had improved, and no more manure stains were observed down the pelvic limbs,

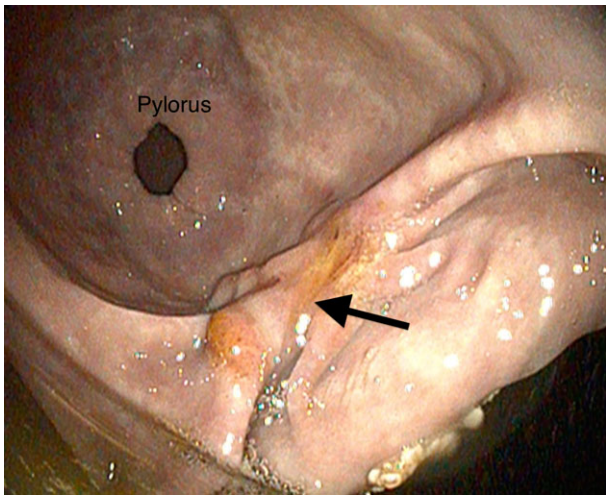

Fig 4. Endoscopic photograph of the antrum of the stomach 10 weeks after transendoscopic partial polypectomy. The black arrow indicates the location of the previous polypoid adenoma.

suggesting that the horse was passing normal formed manure.

Gastric masses in horses are of critical concern because the majority are neoplastic and metastatic.[2–4] A recent study that characterized 24 gastric neoplasms in horses described 19 squamous cell carcinomas, 2 leiomyomas, 1 lymphoma, and 1 adenocarcinoma.[2] Although considered locally invasive and slow to metastasize,[3] 68% of squamous cell carcinomas were shown to be malignant.[2] Masses located near the pylorus in the horse frequently result in pyloric outflow obstruction.[2–4] In affected horses, the stomach is difficult to approach surgically,[3,5] making it challenging to perform mass excision for horses with gastric masses, even if they are benign. Limited surgical options are, in part, responsible for the high fatality rates and short mean survival times observed in horses with gastric neoplasia.[2]

Although benign gastric adenomatous polyps are rare in the horse, 2 case reports described gastric hyperplastic polyps causing pyloric outflow obstruction. The first report described a 13-year-old Arabian gelding that presented with a 24 h history of abdominal pain unresponsive to medical therapy.[6] The horse was euthanized at surgery after an exploratory laparotomy during which a firm mass obstructing the pylorus was discovered. Clinicopathologic findings of the mass were similar to hyperplastic gastric polyps described in the human literature. The second report described an obstructive polyp causing gastric impaction in a 13-year old Percheron gelding that failed to resolve with medical therapy.[7] The horse was euthanized because of the grave prognosis and postmortem examination identified a 14 × 11 × 10 cm ulcerative, pedunculated mass arising from the margo plicatus. Histopathology of the mass indicated an inflammatory polyp with no evidence of a neoplastic process. Reportedly, the mass was rich in inflammatory cells but there was no mention of mucus or mucin secreting glands, making it unlikely to have been an adenomatous polyp. Both of these cases demonstrate the risk of fatality subsequent to uninhibited growth of a benign mass in the stomach of a horse. Furthermore, normal antral contractions result in circumferential peristaltic waves that progress toward the pylorus. These are designed to propel ingesta through the pylorus and into the duodenum. Therefore, such contractions of the antrum may advance a mass in this location toward the pylorus causing partial or dynamic obstruction. We speculate such an obstruction may have occurred in the horse described in this report, and could explain why the horse's clinical signs improved after partial polypectomy.

In humans, adenomatous gastric polyps can be precancerous and surgical excision often is warranted.[8–10] It is unclear whether or not hyperplastic polyps in the gastrointestinal tract of horses are premalignant. However, gastric masses in horses carry a grave prognosis, and attempted removal of masses, whether benign or malignant, appears justified. Although gastrotomy has been well described in foals with gastric outflow obstruction,[11] in adult horses, access to the stomach is more challenging with increased potential for abdominal contamination and postoperative peritonitis. Successful treatment of gastric impaction by gastrotomy has been reported,[12] most recently in a case during which techniques were employed to decrease the chance of abdominal contamination.[13] To the authors' knowledge, no reports describe gastrotomy for gastric mass removal in horses.

In humans, endoscopic polypectomy has been the preferred method of gastric and colonic mass excision since the 1970s,[8,14–16] and multiple surgical techniques have been developed to perform these polypectomies. Endoscopic snare polypectomies frequently are performed for benign gastric polyps, whereas endoscopic mucosal resection or endoscopic submucosal dissection commonly is used for more precise excision of neoplastic masses.[17] A retrospective cohort study compared human patients having subtotal and complete gastrectomy versus endoscopic submucosal dissection for treatment of early gastric neoplasia, and concluded that patients had similar oncological but better perioperative outcomes with endoscopic submucosal dissection.[17] In dogs, excision of gastric masses by partial gastrectomy and palliative treatment by gastrojejunostomy or gastroduodenostomy remain the primary treatment methods for gastric masses,[18] but recent reports document the use of endoscopic polypectomy in dogs and cats.[19–21] In horses, endoscopic polypectomy for mass removal has not yet been described, but transendoscopic electrosurgical removal of a pulmonary granular cell tumor has been performed successfully in a horse.[22] Similar to what we describe here, transendoscopic removal of a local, isolated, nodular mass located in the airway was described after early detection.[22]

An endoscopic biopsy method was developed to obtain full-thickness specimens of antral mucosa to permit complete examination of the tissue.[1] The premise was that tissue specimens of antral mucosa obtained by

standard endoscopic biopsy techniques typically yield little diagnostic information because of tissue size and depth limitations. The biopsy method involved a 3 m videoendoscope to which a 3.2 m polypectomy snare was attached on the outside of the endoscope insertion tube. Passage of the endoscope with the attached sheathed cautery wire was facilitated by application of lubricant. Forceps were used to grasp the mucosa and retract it through the open polypectomy loop. The loop then was closed tightly around the mucosa, and the mucosa was biopsied using electrocautery, while still grasped by the biopsy forceps, and removed along with the entire endoscope. This method allowed for removal of approximately 1.0 × 0.5 cm tissue samples from the gastric antrum that contained the entire mucosa, including epithelium and glands. The mucosa suffered little trauma from the cautery procedure. This technique was performed in 15 horses with no complications reported during or until 7 days after the procedure. Repeat gastroscopies showed healing or healed biopsy sites in 11 of the 15 horses by day 5–7 after the procedure.

Complications are rare during endoscopic polypectomy procedures in humans where 93–95% of endoscopic polypectomies are performed without problems.[23,24] Potential complications include acute or delayed hemorrhage, symptomatic ulcers, stomach perforation, peritonitis, and polyp recurrence. Acute hemorrhage of the polypectomy site is the most common complication associated with polypectomies in humans,[24] and typically is treated endoscopically by submucosal injections of epinephrine or thermocoagulation. One of the 15 previously described horses had persistent hemorrhage after retrieval of a large biopsy specimen, but no further long-term consequences were reported.[1] In horses, aside from hemorrhage, other potential complications of this procedure include accidental perforation of the stomach, abscess formation at the biopsy site, and peritonitis. For the biopsy procedure, gastric perforation is considered an unlikely complication in a mature horse if the specimen is obtained from the antrum near the pylorus, because the muscular layer of the wall of the stomach is relatively thick in that region. The wall is thinner in the stomach body and fundus, and this procedure may carry a greater risk for perforation or focal peritonitis at these sites.[1] The risk of these complications also may be higher if the stomach wall is abnormal because of infiltrative disease, including mass lesions.

The procedure described here is similar to that used in humans and other veterinary species and is a useful treatment option for horses with gastric polyps that are at risk for developing pyloric obstruction in the future. Additionally, this procedure appears promising for intervention in horses with other gastric masses should they be diagnosed early in the disease process. In conclusion, endoscopic polypectomy provides a minimally invasive method to obtain larger samples for histopathology, to perform resections of mass lesions within the stomach of horses, to debulk obstructive masses, and possibly to provide palliative treatment for malignant gastric neoplasms in horses.

Footnotes

[a] KARL STORZ ENDOSKOPE Veterinary Video Endoscope 60130NKS G28-300, 10.4 mm diameter × 300 cm length with 2.8 mm working channel, KARL STORZ GmbH & Co. KG, Tuttlingen, Germany
[b] KARL STORZ ENDOSKOPE Biopsy Forceps 60330 LA, KARL STORZ GmbH & Co. KG
[c] Detomidine, Dormosedan, Zoetis Inc., Kalamazoo, MO
[d] Butorphanol, Torbugesic, Fort Dodge Animal Health a Division off Wyeth a Subsidiary of Pfizer, New York, NY
[e] KARL STORZ ENDOSKOPE Polypectomy Snare 60330 LF, KARL STORZ GmbH & Co. KG
[f] Force Triad Energy Platform, Covidien, Mansfield, MA
[g] REM PolyHesive II E7507, Valleylab, Boulder, CO
[h] KARL STORZ ENDOSKOPE Grasping Forceps 60330 DG, KARL STORZ Gmbh & Co. KG
[i] Flunixin meglumine, Banamine, Bimeda-MTC Animal Health Inc., Cambridge, ON, Canada
[j] Sucralfate, TEVA Pharmaceuticals, North Wales, PA
[k] Omeprazole, GastroGard, Merial Limited, Duluth, GA

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Conflict of Interest Declaration: Authors declare no conflict of interest.

Off-label Antimicrobial Declaration: Authors declare no off-label use of antimicrobials.

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