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Diaphragmatic hernias are an uncommon cause of abdominal pain in foals and adult horses. Surgical intervention helps confirm and repair the lesion; however, the prognosis is poor overall. Authors’ address: Hagyard Equine Medical Institute, 4250 Ironworks Pike, Lexington, KY 40505; e-mail: RodgersonD@hagyard.com (Rodgerson). © 2006 AAEP.

1. Introduction
Diaphragmatic hernias are an uncommon surgical lesion in horses.1 The etiology is most commonly trauma or congenital in select cases.2,3 In foals, diaphragmatic hernia can develop in association with rib fractures that occurred as a result of parturition. Clinical signs can vary from mild to severe signs of abdominal pain. Diagnosis can be attained using transthoracic ultrasonography, thoracic radiography, or exploratory celiotomy. Surgical repair has been described through celiotomy or thoracoscopy using direct suturing methods or with mesh sutured or stapled to the defect. The purpose of this report was to describe the outcome of diaphragmatic hernias confirmed at surgery in 22 cases.

2. Materials and Methods
We reviewed the medical records of all horses having a diaphragmatic hernia diagnosed or confirmed at Hagyard Equine Medical Institute’s Davidson Surgery Center from 2001 to June 2006 (total 66 mo). Information obtained from the medical records included signalment, side of the hernia, treatment, and outcome. Horses that had the diaphragmatic hernia repaired were evaluated based on the technique used to close the defect and long-term prognosis.

3. Results
From 2001 to June 2006, 25 cases having a diaphragmatic hernia diagnosed or confirmed at surgery were included in the study. In 20 cases, the side of the hernia was noted in the medical record; 15 cases had the defect on the left and 5 had the defect on the right. The segment of bowel within the thorax was recorded in 22 cases: small intestine (15 cases), large intestine (3 cases), small intestine and large intestine (3 cases), and small intestine, large intestine, spleen, and stomach (1 case).

Six cases involved foals and 19 cases were observed in horses 1–25 yr old (mean, 11 yr; median, 12 yr). Three foals had the hernia repaired by direct suturing and three were euthanized at surgery because of the severity of the damage to the bowel through the defect in the diaphragm (>40% of the bowel was severely compromised). Two foals died in the immediate post-operative period, and one foal...
was discharged from the hospital and successfully performed as a racehorse.

In adults, 8 of 19 horses were euthanized at surgery because of the severity of bowel strangulation (2 horses), severity/size of the diaphragm hernia (2 horses), rupture of the large colon during removal from the left thorax (1 horse), or at owner request because of the poor prognosis (3 horses). One horse died during surgery after removing the comprised bowel from the thorax. In the remaining 10 horses, an attempt to repair the hernia was performed. Three of these 10 horses also underwent a small intestinal resection and anastomosis. In five cases, direct suturing using nonabsorbable and absorbable suture material along with incorporation of a portion of the omentum into the repair was performed. Closure of the defect using direct suturing along with incorporation of a synthetic polypropylene mesh was secured to the diaphragm using staples was performed in the remaining five horses.

In all 10 cases having the defect repaired, the affected side of the thorax was decompressed after the repair using a teat cannula attached to a suction hose. Two horses that had the defect repaired died shortly after being placed in a padded recovery stall (one had the defect repaired by suture alone and one had the defect closed using mesh and direct suturing). Attempts were made to alleviate a potential developing pneumothorax in these cases by placing a chest drain in recovery. In one horse, the most dorsal aspect of the repair could not be closed adequately. The dorsal aspect of the defect was directly against the thoracic spine and associated ribs. In this case, the mesh could not be adequately secured dorsally with either staples or sutures. The horse recovered, but within 24 h had herniated the bowel again into the right thorax. The horse was euthanatized. One horse died 72 h after surgery, and a necropsy was not performed.

Six horses were discharged from the hospital. One horse had a second exploratory celiotomy at 30 days because of abdominal discomfort and transthoracic ultrasound examination of the right thorax. The horse had had the defect in the diaphragm repaired by direct suturing along with mesh closure. During the second surgery, the apex of the cecum was strangulated, and the apex was resected. The defect in the diaphragm was smaller than noted previously and was closed using suture and mesh. A second horse presented 84 days after having a left-sided hernia repaired using direct suture for severe abdominal pain. An exploratory celiotomy revealed abdominal adhesions involving the small intestine and between the liver and diaphragm. The horse was euthanized because of the potential for chronic abdominal pain. Five horse are presently still alive and doing well. The five horses are successful brood mares.

4. Discussion

Diaphragmatic hernias are rare in the horse. Most cases are acquired, often secondary to trauma, parturition (dystocia) and recent strenuous activity. Congenital defects have been reported, the youngest in a foal several hours after birth. There does not seem to be an age, breed, or sex predisposition. Although multiple abdominal organs can enter the diaphragmatic defect, the small intestine seems to be the most commonly reported. The larger the defect, the more severe the potential dyspnea and compromise to the respiratory system, both pre- and intra-operatively, but the smaller the likelihood of vascular compromise to entrapped intestine.

Radiography and ultrasonography can aid a preoperative diagnosis, allowing the surgeon to perform a more cranially positioned celiotomy, thus aiding visualization and positioning.

Small defects were enlarged manually, and repositioning in some cases was aided by the creation of a second incision made more ventrally parallel to the diaphragmatic muscle fibers using scissors.

Successful repairs of diaphragmatic hernias have been described in both foals and adults. In this report, 12 cases (3 foals and 9 adults) were immediately euthanized or died on the surgical table. Thirteen cases had the defect repaired, and seven horses (one foal and six adults) survived long term. Numerous factors can influence the outcome in cases having a diaphragmatic hernia, with an overall outcome of 24% of horses surviving long term.

References and Footnotes