Botulism in Foals: A Survivable Disease

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Botulism in foals less than 6 mo of age is readily treated, and the survival rate is more than 95% in foals receiving appropriate treatment. Nursing care, IV fluid support, nasogastric or nasoesophageal tube feeding, broad-spectrum antimicrobial coverage (excluding aminoglycoside and tetracycline classes), oxygen therapy, and the administration of botulism antitoxin are important therapies. Approximately 33% of affected foals may require positive pressure mechanical ventilation. Authors' address: Graham French Neonatal Intensive Care Unit, University of Pennsylvania, School of Veterinary Medicine, New Bolton Center, Kennett Square, PA 19348.© 2002 AAEP.

1. Introduction

Botulism toxin causes a widely recognized potentially fatal disease of horses. Botulinum toxin has three primary means of entering the horse: intestinal toxoinfection, ingestion of preformed toxin, and absorption of toxin from wounds infected with Clostridium botulinum. The toxin affects the neuromuscular junction and results in weakness that progresses to flaccid paralysis. The initial manifestation in foals and adults is generally dysphagia, with increased muscular trembling and recumbency occurring with larger doses of the toxin. Progression of the disease can result in respiratory failure caused by respiratory muscle weakness. The diagnosis of botulism is primarily clinical, after exclusion of other causes of generalized flaccid paralysis and dysphagia in horses. Affected animals will have poor tongue, anal, tail and eyelid tone, dysphagia, and decreased pupillary reflexes. Attempts at isolation of the toxin from blood and feces can confirm the clinical diagnosis but may be negative. The prognosis for adults is guarded to poor for horses that become recumbent, even if appropriate antitoxin therapy and supportive care measures are initiated. There are no large retrospective studies evaluating the outcome of appropriately treated botulism in foals. The objective of this study was to retrospectively evaluate the outcome in foals less than 6 mo of age presenting to the Graham French Neonatal Intensive Care Unit between the years 1989 and 2001 and having a final diagnosis of botulism.

2. Materials and Methods

The Medical Records System at New Bolton Center, University of Pennsylvania School of Veterinary Medicine was searched for all cases with a final diagnosis of botulism in horses less than 1 yr of age. The medical records were retrieved and all horses older than 6 mo of age were eliminated. Data from the case records were then entered into a statistics program (Minitab, version 12.1) for descriptive (continuous data) and summary (categorical data) investigation. Student's t tests were employed to evaluate differences between groups where applicable.
3. Results

Twenty-eight cases with complete medical records were recovered. The age at presentation was 1.92 ± 0.29 mo (mean ± SE). The age distribution was bimodal, however, with 16 foals presenting at 1.5 mo of age or less and 8 foals presenting between 2.5 and 3.0 mo of age. Three foals presented at 5.0 mo of age. There was no apparent sex bias with 13 males and 15 females presenting. There were 10 Thoroughbred foals, 8 Standardbred, 3 Arabian, 2 Warmblood, 2 Quarter Horses, and 1 each of Appaloosa, Morgan, and Paint breeds. Foals weighed 232 ± 20 lbs at presentation. Five cases were identified where the dam had been vaccinated against botulism; in 20 cases the dam had not been vaccinated and a vaccination history was not recorded in 3 cases. Twenty-five foals survived to discharge, one foal died while being treated, and two foals were euthanatized shortly after admission for economic reasons. Length of hospitalization was 15.3 ± 1.5 days, with euthanatized foals being hospitalized for less than 1 day. Temperature (100.7 ± 0.2°F) and heart rate (86 ± 4 bpm) were generally within normal limits. Respiratory rate was significantly increased at admission (52 ± 11 bpm).

Sixteen foals were treated with intra-nasal insufflation of oxygen for 4.4 ± 1.0 days. Nine foals were treated with mechanical ventilation, average duration 7.4 ± 1.4 days. Eight foals treated with intra-nasal oxygen insufflation also received mechanical ventilation. Ten foals did not receive either intra-nasal oxygen insufflation or mechanical ventilation. PaO2 at admission was not significantly different between foals receiving intra-nasal oxygen therapy at some point during hospitalization (75.7 ± 6.7 mm Hg) and those not placed on intra-nasal oxygen therapy (72.4 ± 7.6 mm Hg). However, in five cases, the initial arterial blood gas was obtained with the foal already receiving intra-nasal oxygen insufflation. PaO2 in these 5 cases was 103.3 ± 14.9 mm Hg at admission, whereas average PaO2 in the 16 cases not receiving oxygen at the time the initial blood gas was obtained was 64.6 ± 4.4 mm Hg. In seven cases the initial respiratory management was not recorded. PaCO2 was increased at admission (56.6 ± 2.8 mm Hg) and tended to be larger in foals receiving oxygen therapy (58.4 ± 3.2 mm Hg) than in those not receiving oxygen therapy (52.6 ± 5.5), although the difference was not statistically significant (p = 0.36). Foals requiring mechanical ventilation had significantly greater (p = 0.009) PaCO2 values at admission (67.4 ± 5.2 mm Hg) than foals not requiring mechanical ventilation (49.7 ± 1.3 mm Hg). PaO2 tended to be less in foals requiring mechanical ventilation (64.4 ± 5.8 mm Hg) than in those not requiring mechanical ventilation (79.1 ± 5.8 mm Hg), although this difference was not statistically significant (p = 0.26). Foals requiring ventilation were significantly (p = 0.011) more acidic (7.25 ± 0.04) than foals not requiring ventilation (7.39 ± 0.01). No other significant abnormalities were consistently present on hematology or serum clinical chemistry evaluation. One foal presenting at 7 days of age had partial failure of passive transfer (serum IgG < 800 mg/dl).

Additional therapies provided included intravenous fluid support (24 of 28), nasogastric or nasoesophageal tube feedings (25 of 28), and broad-spectrum antimicrobial therapy (28 of 28). Twenty-five of 28 foals survived; all surviving foals were treated with botulism antitoxin shortly after arrival. One foal died while receiving therapy because of respiratory, and subsequent cardiac, arrest. Two foals were euthanatized for purely economic reasons, and treatment was minimal in these cases, usually aimed at stabilization for initial diagnosis.

4. Discussion

Botulism has been supposed by some authors to be an almost uniformly fatal problem of the young foal.1 Our experience has been different, and this study was undertaken to show the efficacy of rapid institution of appropriate therapy for this potentially fatal disease. Foals affected by botulism can be found dead in the field, can present initially as colic, or can present with the classic “Shaker Foal” signs of muscular trembling and weakness.2-5 Our study identified at least five cases where the dam had been vaccinated against botulinum toxin, one of which had failure of passive transfer. The bimodal distribution of age at presentation suggests that younger foals are at increased risk if they are born to unvaccinated dams or fail to ingest sufficient colostrum from the vaccinated dam. Foals presenting at greater age seem to be most at risk before their own vaccination, when maternal antibody is waning. Type B botulism is most common in this geographic area.

Standard therapy at our hospital includes administration of botulism antitoxin as soon as possible after diagnosis, nutritional support, antimicrobial coverage, IV fluid administration as necessary, scrupulous nursing care, and ventilatory management. Ventilatory management generally falls into one of three categories: doing nothing specific but monitoring arterial blood gas parameters, administration of oxygen by intra-nasal insufflation, and mechanical ventilation. Approximately one-third of foals with botulism in our case population received mechanical ventilation at some point during their disease course. Tracheal intubation, with or without mechanical ventilation, is frequently part of the management of botulism in humans, particularly in infants where airway protection is important.6 Acute respiratory failure (defined for our purposes as PaCO2 > 50 mm Hg with HCO3 < 28 mEq/l and some degree of hypoxemia) is commonly reported in human infants and adults with botulism6-8 and was present in 13 of the foals included in this report. Not all foals with increased PaCO2...
received mechanical ventilation, and these cases were managed more conservatively.

Outcome was uniformly excellent in treated foals, and length of hospitalization was less than that reported for human infants and adults.6,7 There were no reported long-term or career-limiting problems. Recognition of the severity of respiratory compromise is essential for appropriate management of these cases and requires the ability to obtain reliable arterial blood gas data. The degree of respiratory distress and respiratory effort is an unreliable indicator of respiratory compromise in this group of patients, given that muscular weakness and paralysis prevent the usual responses. The availability of “bedside” blood-gas monitors should allow the practitioner to manage many of these cases in field situations, given the ability to administer botulism antitoxin, to provide supplemental oxygen by intra-nasal insufflation, and to recognize when respiratory failure is severe enough to warrant referral and more extensive respiratory therapy.

Botulism in foals less than 6 mo of age is readily treated, and the survival rate is more than 95% in foals receiving appropriate treatment. Nursing care, IV fluid support, nasogastric or nasoesophageal tube feeding, broad-spectrum antimicrobial coverage (excluding aminoglycoside and tetracycline classes), oxygen therapy, and the administration of botulism antitoxin are important therapies. Approximately 33% of affected foals may require positive pressure mechanical ventilation, whereas the majority may require supplemental oxygen therapy. Cost for treatment depends on length of hospitalization and required therapies and will, of course, vary by institution or referral facility. Foals requiring parenteral nutrition or mechanical ventilation will be significantly more expensive to treat. The cost of treatment with antitoxin is less in these patients than in adults because of their smaller body size.

References and Footnote


a Polyvalent botulism antiserum. Dr. R H Whitlock, University of Pennsylvania, New Bolton Center, Kennett Square, PA 19348.