Available online at www.sciencedirect.com
ScienceDirect
Research in Veterinary Science 84 (2008) 305–310
www.elsevier.com/locate/rvsc

Evaluation of equine cecal motility by ausculation, ultrasonography and electrointestinography after jejunocecostomy

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Accepted 16 April 2007

Abstract

Objective: Horses often suffer reduced intestinal motility after jejunocecostomy. Therefore, accurate evaluation of intestinal motility is important for the prevention, diagnosis and treatment of this condition. The purpose of this study was to evaluate intestinal motility in horses after jejunocecostomy using three different methods, i.e. auscultation, ultrasonography and electrointestinography.

Animals: Six healthy thoroughbreds were used in this study. They were subjected to jejunocecostomy.

Procedure: Bowel sounds in the right paralumbar fossa were assigned a score of 0–3 for intestinal motility evaluation by auscultation, and the number of cecal contractions during a 3-min period were counted by ultrasonography. Electrointestinography (EIG) was used to measure percutaneous potential of the cecum.

Results: We identified three specific postoperative periods: the period of reduced intestinal motility (postoperative day 1 to day 2), in which intestinal motility declined, the unstable period (day 3 to day 7), in which intestinal motility partially recovered, and the full recovery period (day 8 to day 31), in which intestinal motility returned to preoperative state. Careful management was found to be especially important during the period of reduced intestinal motility and the unstable period. We found that, in healthy horses that underwent jejunocecostomy, it takes approximately one month for the cecum to return to normal motility patterns observed before surgery.

Conclusion: We have shown in this study that evaluation of intestinal motility after jejunocecostomy in horses by EIG is more objective and provides more details than evaluation by auscultation or ultrasonography.

Keywords: Electrointestinography; Horse; Intestinal motility; Jejunocecostomy; Postoperative ileus

1. Introduction

Many gastrointestinal lesions in horses cause acute colic that requires laparotomy for definitive diagnosis and treatment. Jejunocecostomy is performed to by pass the ileum in patients who suffer ileal impaction, strangulation, volvulus, intussusception or stenosis of the distal jejunum or ileum. However, reduced intestinal motility remains a major problem in patients with jejunocecostomy (Embertson et al., 1985; Fleckenstein et al., 1982). Thus, it is important to accurately and continuously evaluate intestinal motility after jejunocecostomy to appropriately prevent, diagnose, and treat this condition.

Until recently, intestinal motility has been evaluated by auscultation (Milne et al., 1996; Ragle et al., 1989) and ultrasonography (Edens et al., 1996; Freeman and England, 2001; Jones and Davis, 2003; Klohnen et al., 1996). However, continuous evaluation of intestinal motility with these methods is unpractical and considered to be insufficient for accuracy. On the other hand, electrointestinography (EIG), in which changes in intestinal motility are recorded continuously (Smout et al., 1980), is considered to be a more accurate and objective method for evaluating intestinal motility than either auscultation or ultrasonography. Although EIG is used to evaluate motility in the small

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0034-5288/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.rvsc.2007.04.009

intestine, cecum, right ventral colon and right dorsal colon (Sasaki et al., 2004; Sasaki et al., 1998), it has never been used to investigate reduced intestinal motility after jejunocecostomy in horses.

The purpose of the present study was to evaluate intestinal motility after experimental jejunocecostomy in six healthy horses by auscultation, ultrasonography and electrointestinography.

2. Materials and methods

2.1. Horses

Six healthy thoroughbreds (4 mares, 1 gelding, and 1 stallion) were used in this study. The horses mean age was 13.8 ± 5.0 (mean ± SD) years, and their mean weight was 514.5 ± 61.2 kg. All horses were fed on an ordinary two-meal diet (0.9 kg oats, 0.3 kg bran and 3.5 kg dried grass per meal) with unrestricted water intake. Housing and care of the horses as well as the study protocol were approved by Obihiro University Institutional Animal Care and Use Committee.

2.2. Surgical procedure

All food was withheld for 12 h before the surgical procedure. At 8 h before surgery, each horse was intravenously treated with 4000 ml of lactated Ringer's solution (Solulact, Terumo Co., Tokyo, Japan), and 2000 ml of mineral oil (Liquid Paraffin, Kanto Chemical Co., Tokyo, Japan) given via a nasogastric tube. Immediately prior to the surgical procedure, the horse was intramuscularly treated with 20,000 IU/kg of procaine penicillin *G* for veterinary use (Meiji Seika Kaisha, Ltd., Tokyo, Japan) and intravenously given 1.1 mg/kg of flunixin meglumine (Banamine 5%, Dainippon Pharmaceutical Co., Osaka, Japan).

Anesthesia: Each horse was intravenously injected with 4 μg/kg of medetomidine (Domitor, 0.1%, Orion Co., Espoo, Finland) and 25–50 mg/kg of Guaifenesin (Kyoto Pharmaceutical Industries, Kyoto, Japan) was infused rapidly until the horse became ataxic. Anesthesia was then induced by intravenous injection of 0.03 mg/kg diazepam (Horizon 10 mg, 0.5%, Yamanouchi Pharmaceutical Co., Ltd., Tokyo, Japan) and 2.2 mg/kg ketamine (Veterinary Ketalar 50, Sankyo Yell Yakuhin Co., Ltd., Tokyo, Japan). Next, the trachea was intubated and the horse was held on a surgical table in dorsal recumbency. Anesthesia was maintained by inhalation of halothane and oxygen. Twenty min after the beginning of anesthesia, dobutamine (Retamex, 2%, Sankyo)was intermittently administered at 1–5 μg/kg/min to maintain a mean arterial blood pressure of approximately 70 mmHg.

The surgical area was aseptically prepared and a ventral midline celiotomy was performed. The cecum was brought out through the ventral midline incision, and the apex was pulled caudad to expose the dorsal band of the cecum. Jejunocecal anastomosis was performed as previously described (Ross, 1989; Sasaki et al., 1998). In brief, the ileum was resected in the position proximal (approximately 50 cm) to the ileocecal junction, and the jejunum was transected in the position proximal (approximately 200 cm) to the ileocecal junction. After the mesenteric vessels were triple-ligated with polyglactin 910 size 3 metric (Vicryl, Ethicon), the mesentery and its vessels were resected, and the ileal stump was closed by Parker–Kerr suture using the same suture material (Ross, 1989; Sasaki et al., 1998). The long axis of the jejunum was made perpendicular to the dorsal bands of the cecum, and the jejunum was anastomosed to the cecum in an end-to-side fashion. The seromuscular layer of the jejunum on the side adjacent to the cecum was attached to the cecum in a continuous Lembert pattern using polyglactin 910 suture material. An incision was then made in the cecum alongside the suture line, and the mucosa of the jejunum and cecum were apposed in a continuous approximating suture pattern around the entire circumference. The mesentery of the jejunum was attached to the ileocecal fold and the dorsal band of the cecum. The linea alba was closed with a far–near–near–far suture pattern using polyglactin 910 The skin was closed with a simple interrupted suture pattern using nonabsorbable suture material (Ethilon Nylon Suture, Ethicon, Inc., USA).

After surgery, each horse was treated with 20,000 IU/kg of penicillin *G* procaine, given intramuscularly, once a day for 3 days, 1.1 mg/kg of flunixin meglumine, given intravenously, twice a day for 3 days, and 10,000 ml of lactated Ringer's solution, given intravenously, twice a day for 4 days. Additionally, 2000 ml of mineral oil was administered to the horse via a nasogastric tube at 22, 37, and 46 h after surgery. Incisions were sterilized and bandaged as necessary. The horses started to be watered at 13 h after surgery and to be fed on a meal diet (0.7 kg alfalfa softened by hot water) at 37 h after operation. Horses were returned to their normal diet 1 week after the surgical operation.

2.3. Evaluation of intestinal motility

2.3.1. Auscultation

Auscultation was performed with a stethoscope for 3 min in the right paralumbar fossa, and bowel sound was assigned a score of 0–3. Score 0 indicated no borborygmi. Score 1 indicated that the period of no borborygmi was longer than the period of peristaltic sound. Score 2 indicated that the period of peristaltic sound was longer than the period of no borborygmi. Score 3 indicated constant peristaltic sound (example, normal activity).

2.3.2. Ultrasonography

An ultrasound system (SonoSite 180II, SonoSite, Inc., Bothell, WA, USA) and a transducer (C15/4-2, Microconvex 2–4 MHz, SonoSite, Inc., Bothell, WA, USA) were used to evaluate intestinal motility. Hair was removed from the right paralumbar fossa and an ultrasonography gel was applied. A longitudinal section of the cecum was described