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## Small intestinal epiploic foramen entrapment in a seven-month pregnant Thoroughbred mare: a case report

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### Abstract

A seven-month pregnant four-year-old Thoroughbred mare with colic weighing 600 kg was referred to the Jeju National University Equine Hospital. A physical examination and ultrasound suggested epiploic foramen entrapment. The patient underwent ileum resection and end-to-side jejunocecostomy. After surgery, the horse showed a consistent pain when introduced to feeding. A repeat laparotomy was performed to enlarge the stoma size with side-to-side jejunocecostomy. The repeat laparotomy was successful, and the mare gave birth uneventfully. This report describes a case of small intestinal epiploic foramen entrapment and the clinical outcomes of the 2 consecutive laparotomies a Thoroughbred mare in late gestation.

**Keywords:** epiploic foramen entrapment; jejunocecostomy; a pregnant Thoroughbred mare; repeat laparotomy; case report

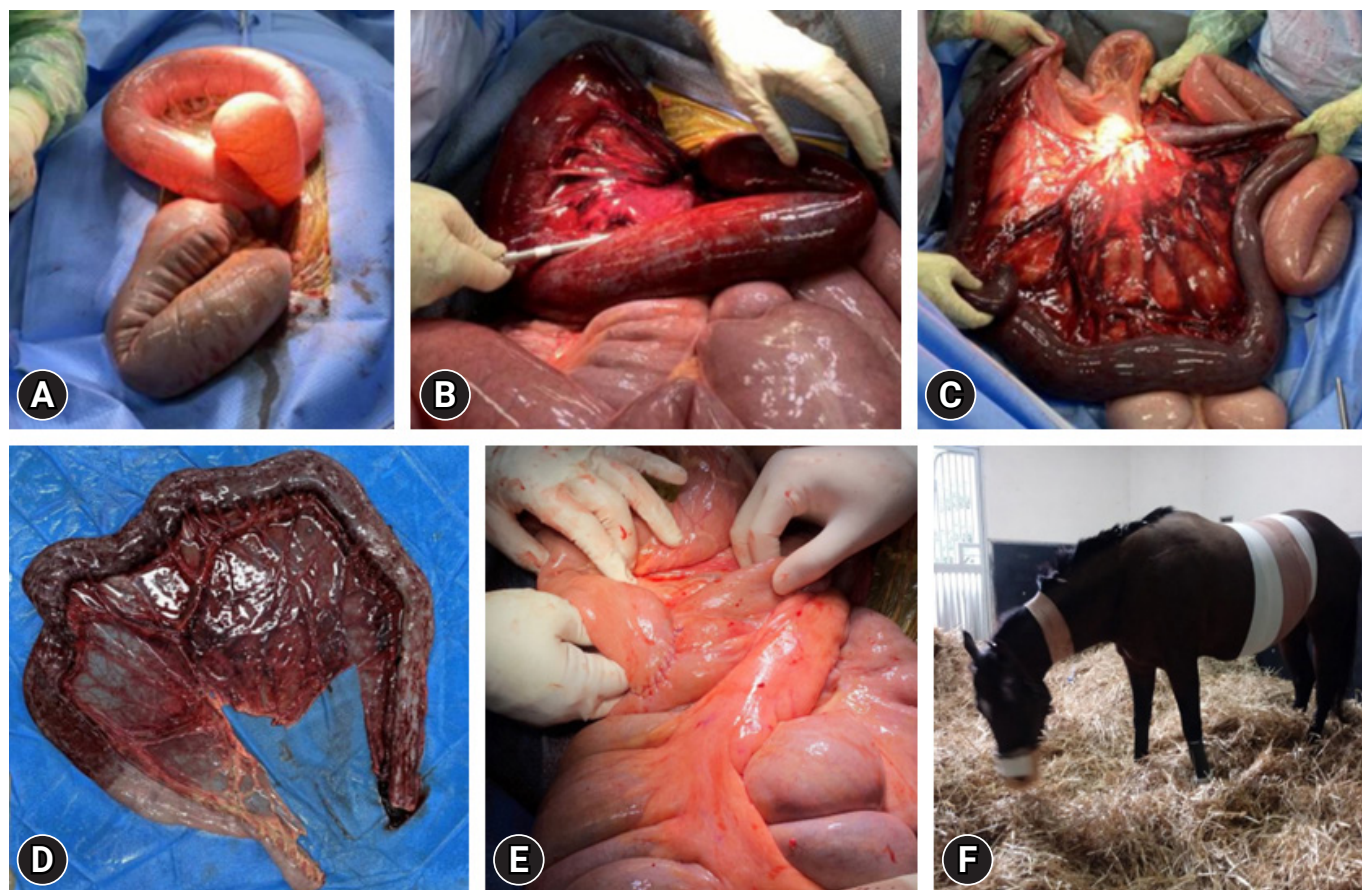
Colic is one of the most common causes of mortality in the horse industry, and in many cases, it needs to be treated immediately [1,2]. In horses, intestinal herniation through the epiploic foramen is called epiploic foramen entrapment (EFE) [3]. EFE is a major cause of small intestine strangulation requiring emergency surgical intervention, which may result in the death of the patients, although the reported incidence is low [2,4]. The clinical findings of EFE can be confusing, which makes a timely diagnosis of the disease difficult thereby causing a tremendous economic loss among horse owners. In addition, it is overwhelming to decide on the laparotomy in pregnant patients especially in late gestation for both clinicians and horse owners considering the risk of losing fetus. This report describes a case of EFE in a seven-month pregnant Thoroughbred mare, including the clinical signs, diagnosis, 2 consecutive laparotomies, and clinical results.

A seven-month pregnant four-year-old Thoroughbred mare weighing 600 kg with colic symptoms was referred to the Jeju National University Equine Hospital. The mare had been given fluid therapy owing to severe abdominal pain before referral. The body temperature was 36.3°C, the heart rate was 60 beats/min, and the respiratory rate was 60 times/min. The mucous membrane was pale pink, and the capillary refilling time was less than 3 seconds. Complete blood cell count showed mild lymphopenia (Supplementary Table 1). The serum chemistry results revealed increased creatine kinase, glucose, and total bilirubin with mild hypocalcemia (Supplementary Table 2). The blood lactate was 3.8 mmol/L. The ultrasound

showed the edematous loops of the small intestine at the right ventral portion (Fig. 1). A nasogastric intubation yielded 2 buckets of reflux. The rectal examination confirmed the fetal movement. The patient was tentatively diagnosed with small intestinal EFE based on the results of various examinations. An emergency laparotomy was performed. The patient was provided with preanesthetic drugs, including detomidine (Detomidin; Provet, Turkey), diazepam (Diazepam; Samjin, Korea), and butorphanol tartrate (Butorphan; Myungmoon, Korea). Anesthesia was induced with ketamine (Ketamin; Yuhan, Korea) and maintained with isoflurane (Ifrane; Hana, Korea). An abdominal median incision exposed gas-filled small intestine (Fig. 2A). A left-to-right small intestinal EFE was confirmed. The strangulated bowel was carefully decompressed and tracked (Fig. 2B). A visual viability assessment on the affected intestine was evaluated as nonviable. Therefore, a 1.5 m long ileum was resected (Fig. 2B–D). Considering the time passed for traction and re-



**Fig. 1.** Transabdominal sonogram of the small intestine of the patient at initial presentation. Note the thickened wall and the distended lumen of the small intestine (arrow). The diameter of the lumen of the small intestine was distended to 5.5 to 6.0 cm, and the wall of the small intestine was thickened to 5 to 6 mm.



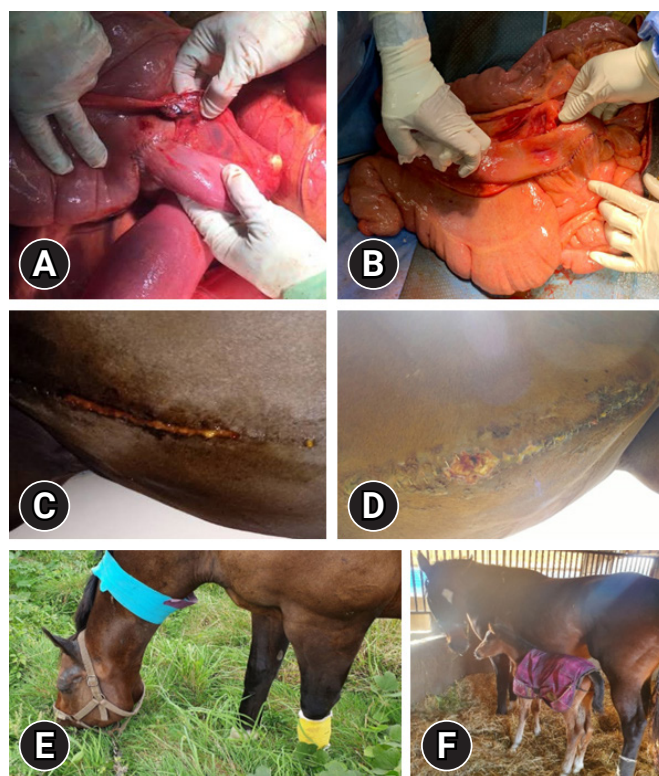
**Fig. 2.** Photographs from the initial laparotomy. (A) the small intestine filled with gas and fluid exposed upon the abdominal wall incision. (B) Note the necrotized ileum being recovered during the traction. (C) The incarcerated and strangulated portion of the ileum recovered after careful decompression and traction from the epiploic foramen. (D) Approximately 1.5 m of ileum was resected. (E) Image of the end-to-side jejunocostomy being irrigated and checked for leakage upon completion of the procedure. (F) The patient, one day after the initial laparotomy, sought feed while fasting with a muzzle.

section, the end-to-side jejunocecal anastomosis was selected over side-to-side jejunocecal anastomosis to minimize the effects of the lengthy anesthesia on the patient and the fetus. The stoma in the size of 3 cm was produced between the dorsal and the medial tenia of the cecum and connected to the jejunum with the size 2-0 polyglactin 910 (Vicryl; Ethicon, UK) (Fig 2E, 3A). The abdominal wall was closed with the size 2 polyglactin 910 (Vicryl), and the skin incision was stapled (Appose; Covidien, UK). The patient recovered uneventfully from anesthesia. The postoperative care included medications including antibiotics (PPS; Daesung, Korea) at 0.05 mL/kg consisting of 5,000 IU/kg of penicillin G benzathine hydrate, 7,500 IU/kg of penicillin G procaine, and 10 mg/kg of dihydrostreptomycin sulfate, gentamicin at 6.6 mg/kg (Gentamicin; Daesung) and a non-steroidal anti-inflammatory drug, flunixin meglumine (Fortis; Dongbang, Korea) at 1.1 mg/kg. The patient was fasted until day 3 (Fig. 2F). On day 3, the patient was reintroduced to feeding, ensuring no postoperative ileus, but the patient started to show consistent abdominal pain when fed. A close patient monitoring for the following 2 days suggested that the size of the stoma was too small necessitating a repeat laparotomy on day 6. A new stoma was created using side-to-side jejunocostomy at the repeat laparotomy. The stoma was approximately 9 cm in size, 3 times larger than the old one (Fig. 3B). The patient recovered uneventfully from anesthesia. There was a local infection on the abdominal wall, but it eventually healed with appropriate wound management (Fig. 3C, D). The patient regained appetite with no signs of pain after repeat surgery (Fig. 3E). The patient was continued on the same treatment regimen until discharged. The horse recovered uneventfully and was discharged after 24 days of hospitalization in total. The five-month follow-up revealed that the patient was clinically healthy, and gave birth successfully (Fig. 3F).

Although the exact cause of EFE is unknown, there are some reports on the predisposing factors of EFE. Horses of all ages can be affected with a similar age distribution to horses with other causes of small intestinal strangulation [5]. Thoroughbred and crossbreed horses are more likely to suffer from EFE than other breeds [6]. The impact of gender is controversial, but in many studies, geldings and stallions comprise a higher proportion of the EFE group [6]. Crib-biting/ wind-sucking has been one of the predisposing factors to EFE by increasing the intra-abdominal pressure by 35 times compared to non-cribbing horses [7]. In some studies, EFE is usually seen between October and March, suggesting that EFE may be associated with the stabling [6,8]. In this case, the patient was four-year-old and seven-month pregnant Thoroughbred mare without any history

of cribbing previously residing in the stable. Although there is no direct evidence that pregnancy is related to the occurrence of EFE in horses, it may be suspected that the enlarged abdominal space had attributed to the development of EFE along with the patient's edacious eating habits in a hurry and lack of exercise in the stable. Further study on the causes or risk factors in pregnant mares would be needed on a larger scale.

Establishing a definitive diagnosis of EFE based on physical examination may be difficult because the clinical signs may not be specific and vary widely [4,9]. However, the signs of acute obstruction of the small intestine are easy to notice enabling clinicians to establish a tentative diagnosis of EFE [4]. The patient showed the clinical signs of consistent abdominal pain, hypothermia, tachycardia, and tachypnea, which were not limited to EFE but distinctive signs observed with small intestinal ob-



**Fig. 3.** (A) Image of the anastomosed intestine via end-to-side jejunocostomy at repeat laparotomy 5 days after the initial laparotomy. Note that the stoma size is approximately 3 cm in diameter. There was no kinking or adhesion formed. (B) Image of the side-to-side jejunocostomy being irrigated and checked for leakage upon completion of the procedure. The size of the stoma was enlarged to 9 cm in diameter. (C) The local infection was observed on the incision wound of the abdominal wall. (D) The wound infection was successfully managed and healed. (E) The patient recovered the appetite after a repeat laparotomy. (F) The patient was discharged after 24 days of hospitalization and gave birth to a healthy foal.

struction. Transabdominal ultrasonography provided typical images of distended and edematous small intestines implying the possibility of EFE, and was useful for the tentative diagnosis of EFE [3,10].

A key to the successful management of EFE in this case was a timely diagnosis and quick decision-making on laparotomy and repeat laparotomy. The success of small intestinal surgery in horses relies on identification and correction of the primary problem, intraoperative decompression of distended small intestine, resection of all nonviable intestines, preservation of anatomic and physiological continuity of the mesentery and intestine, quick completion of the procedure with minimal damage, early return of intestine to normal function and appropriate postoperative care including repeat laparotomy when indicated as EFE has a higher risk of repeat laparotomy than other types of colic [9,11]. For the initial surgery, decompression and traction took a long time. Therefore, end-to-side jejunocostomy was selected instead of side-to-side jejunocostomy, which necessitated repeat laparotomy eventually. Close patient monitoring enabled quick decision-making on repeat laparotomy to enlarge the stoma size. Both end-to-side and side-to-side jejunocostomy techniques are used widely for jejunocecal anastomosis [12]. However, side-to-side jejunocostomy was more effective than end-to-side jejunocostomy for the present case providing more promising results due to the larger stoma size.

Anesthesia was challenging because the patient was in late gestation. Anesthesia can cause systemic hypotension and reduced cardiac output. In pregnant mares, these changes will reduce uterine blood flow and compromise blood flow to the fetus, which may result in the death of the fetus, abortion, or premature delivery of the foal [13]. However, the patient and the fetus tolerated 2 consecutive general anesthesia 5 days apart without anesthesia-related complications under thorough monitoring of the ventilation and circulation. It is relatively common to give up on colic patients in late gestation who need to undergo general anesthesia in horse industry. Nevertheless, patients in late gestation may tolerate general anesthesia well as seen in this case.

Regarding short-term survival of the EFE patients, the percentage of all horses that underwent general anesthesia and walked out of the anesthetic recovery room was 84.9%, and those that survived until discharge was 66.7% in a multicenter, international study [14]. The long-term survival was challenging to compare because different studies have differences in the follow-up period and the definition of survival. Of all horses that walked out of the recovery box, the percentage that survived until discharge, to one year, and to 2 years was 78.5%,

50.6%, and 34.3%, respectively [14]. In this study, the patient maintained health and gave birth at the five-month follow-up.

In summary, a Thoroughbred mare in late gestation with small intestinal EFE was treated successfully with 2 consecutive laparotomies tolerating general anesthesia. Despite the 2 surgeries, the mare recovered uneventfully and was discharged after 24 days of hospitalization. According to the five-month follow-up, the mare was clinically healthy and gave birth uneventfully. The authors expect that clinicians will find this report helpful when dealing with EFE cases, particularly in patients in late gestation.

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## Supplementary Materials

Supplementary data are available at <https://doi.org/10.14405/kjvr.20230014>.

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