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Original Research

Evaluation of *Tenckhoff* Catheter Use and Ceftriaxone Intraperitoneal Administration in Horses

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ABSTRACT

Peritonitis in horses persists with high incidence and mortality, requiring more innovative and effective therapeutic strategies. The aim of this study was to evaluate *Tenckhoff* catheters and intraperitoneal use of ceftriaxone in horses. Ten healthy, male horses, with an average age of 5 years, were used and divided into two groups of five animals each. A *Tenckhoff* catheter was implanted in both groups. The intraperitoneal group received 25 mg/kg of ceftriaxone diluted in 1 L of 0.9% saline solution (SS) intraperitoneally via the *Tenckhoff* catheter, and the intravenous group received 25 mg/kg of ceftriaxone intravenously and 1 L of SS intraperitoneally. In both groups, the dosing interval was every 24 hours for 5 days. The animals were evaluated clinically and with laboratory tests through a blood count and plasma fibrinogen assay. A macroscopic, physical-chemical, and cytological evaluation of the peritoneal fluid and an abdominal sonographic evaluation were conducted before the catheter implantation and at 1, 3, 5, 7, and 10 days after the implantation and ceftriaxone administration. Seven days after the catheter insertion and the beginning of the intraperitoneal treatment, a laparoscopic evaluation was performed. The *Tenckhoff* catheter proved to be an appropriate route for intraperitoneal solution administration; however, it promoted a moderate inflammatory response in the abdomen. No differences in inflammatory reaction was observed between groups, suggesting that the intraperitoneal administration of the drug did not trigger a local or systemic inflammatory process, amplifying the possibilities of intraperitoneal route utilization in the treatment of peritonitis.

1. Introduction

Peritonitis in horses has a varied etiology, being it possible to be primary or secondary. Most cases tend to be secondary, acute, diffuse, and septic [1]. Mortality rates associated with this disease vary according to the underlying cause. Secondary peritonitis, related to intestinal rupture and postoperative colic presents mortality rates above 60% [2]. In contrast, primary peritonitis has survival rates that can reach 86% [3].

Established therapy for peritonitis in horses is based on supportive care and the combination of antimicrobials that provide coverage against gram-negative, gram-positive, and anaerobic bacteria. The most common association is penicillin, gentamicin, and metronidazole [2,4]. Despite the

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use of this therapeutic strategy, secondary peritonitis persists with high mortality rates necessitating the investigation of procedures and drugs for peritonitis treatment to increase the survival rate of affected animals [5–8].

Abdominal drainage and lavage should have beneficial effects, such as removal of bacteria and cellular debris in the peritoneal cavity and decrease abdominal adhesions [7]. The intraperitoneal route promotes high antibiotic concentrations in the peritoneum and adjacent cells in the peritoneal cavity [8]; however, it is used without scientific confirmation of efficiency and has been poorly studied as only a single study in horses described the use of intraperitoneal antibiotics in the operative period [6].

Ceftriaxone is a third generation cephalosporin with established clinical efficacy, that is often used for primary peritonitis treatment [9] or associated with other agents for secondary peritonitis in humans [10]. Among the third generation cephalosporins, it has the highest antibacterial spectrum, acting against gram-positive, gram-negative, and anaerobic bacteria [11–15].

Tenckhoff catheters are traditionally used in humans for peritoneal dialysis and are considered a safe and reliable method of abdominal cavity access [16–18]. They are made of silicone and are straight or curve shape with additional holes to the lumen as well as two cuffs that, after deployment, are housed in the abdominal parietal muscles and subcutaneous tissue [17–19]. Despite the widespread use in humans, there are no reports of the *Tenckhoff* catheter use in horses.

The aim of this study was to evaluate the technical feasibility and safety of *Tenckhoff* catheter implantation and intraperitoneal administration of ceftriaxone in horses through clinical, laboratory, ultrasound, and laparoscopy evaluations.

2. Materials and Methods

2.1. Animals

Ten healthy male horses were used, six mixed breed and four Arabian horses, with an average age of 5.1 ± 1.3 years old and a mean body weight of 317.6 ± 26.9 kg. The animals were housed in stalls, received coast cross hay and water *ad libitum*. Before the beginning of the study, the horses were subjected to a medical evaluation through clinical and laboratory tests.

The experiment was conducted in compliance with the Ethics Principles in Animal Experimentation, and it was approved by the Ethics Committee on Animal Experimentation (CEUA; Protocol #105/2013).

2.2. Constitution of Groups

The animals were randomly divided into two groups of five animals with a homogeneous distribution of breeds between the groups. Therefore, each group was composed of three mixed breed and two Arabian horses. The intraperitoneal group (IPG) received 25 mg/kg of ceftriaxone (Ceftriaxona sódica; Eurofarma, São Paulo, Brazil) diluted in 1 L of saline solution (SS) intraperitoneally via a *Tenckhoff* catheter every 24 hours for 5 days. The intravenous group (IVG) received 25 mg/kg of ceftriaxone intravenously every 24 hours for 5 days and 1 L of SS intraperitoneally for the same time and interval of administration. If the horses presented with clinical signs of local, abdominal, or signs of discomfort they would receive flunixin meglumine (1.1 mg/kg IV).

2.3. Peritoneal Catheter Implantation

The *Tenckhoff* dialysis catheter (Silmag Brasil; GMI, São Paulo, Brazil) is made of 100% silicone, 42 cm long, and has a 15 Fr diameter. It has a radiopaque line, a straight configuration, two Dacron cuffs, multiple additional holes to the lumen in its abdominal portion, and an extender 10 cm long with a Luer Lock connector (Fig. 1).

After 12 hours of fasting, the horses were restrained in stocks and sedated with detomidine hydrochloride (Dormium V-Agener União Ltda, Brazil) (bolus 5 μg/kg followed by continuous infusion of 20 μg/kg/h). The skin in the left flank region was clipped and aseptically prepared with chlorhexidine. The surgical site was infused with lidocaine 2% (Xylestesin-Cristália, produtos químicos e farmacêuticos Ltda, Brazil) for local anesthesia.

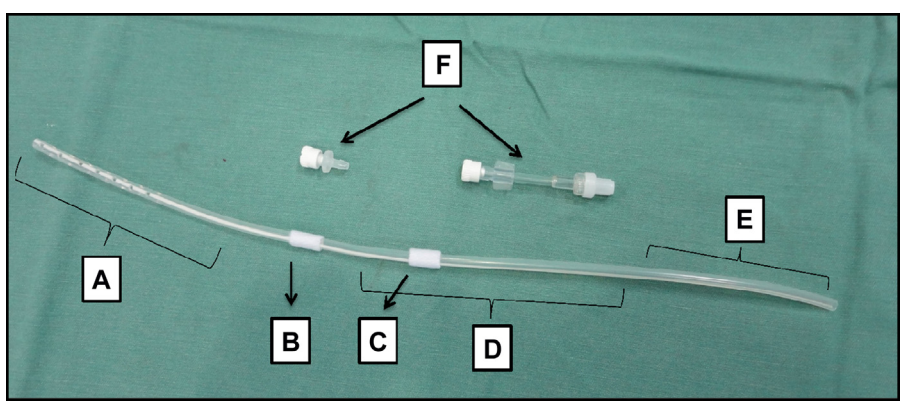

Fig. 1. *Tenckhoff* catheter. (A) Abdominal portion with multiple additional holes; (B) Muscular cuff; (C) Subcutaneous cuff; (D) Subcutaneous region; (E) External portion; (F) Extensor connectors.