Evaluation of sodium carboxymethylcellulose for prevention of adhesion in intestinal anastomosis in dogs

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Abstract: Adhesions are the most common postoperative complication in intestinal surgery in dogs. This study was aimed at verifying the efficacy of sodium carboxymethylcellulose (SCMC) in the adhesion prevention during healing of intestinal anastomosis. Twenty-three healthy dogs were taken with an average age of 4.17 years and weight of 5.68 kg and divided into four groups. The dogs of group III and IV, a pedicle of greater omentum was wrapped around the suture line. In the animals of group II and IV, 1% SCMC was infused (5 ml/kg, IP) at just before closure of the abdominal cavity. Two weeks after surgery, animals were reoperated and the adhesions were evaluated and graded. We found various degrees of intra-abdominal adhesions in all the groups. The significantly (P < 0.05) lower adhesion score was observed in group IV than that of other groups. Nevertheless, varying intra-peritoneal adhesions, healing of anastomotic site was normal in all groups. It could be concluded that intra-peritoneal administration of SCMC solution reduces postoperative adhesions without any adverse effects on healing, and a synergistic beneficial effect can be obtained by supplementation with omental graft for intestinal anastomosis.

Key words: adhesions, dog, intestinal anastomosis, sodium carboxymethylcellulose

Introduction

Intestinal anastomosis is one of the most common surgical procedures performed in abdominal affliction; removing ischemic, necrotic, neoplastic, irreducible intussusceptions and fungal-infected segments of intestine. The primary goal of the intestinal anastomosis is to produce a rapid return to normal function of intestine, to maintain proper tissue alignment, optimal tissue healing and adequate stoma diameter [1-4, 8-13, 22, 29, 32]. Intra-abdominal adhesion is the deteriorating factor in the normal activity of the bowel. Fibrous adhesions following previous surgical intervention is a major cause of intestinal obstruction and intra-peritoneal adhesions in human. Indeed an autopsy study of 752 patients who had undergone previous abdominal surgery revealed an adhesion rate of 67% [29]. McKenzie and Ellis reported that intra-abdominal adhesions occur in 93% of previously operated patients. Also, it can be considered in small animal surgery [11, 32]. Various attempts have been made to prevent or reduce adhesion formation following abdominal surgery. Antibiotics, progestins, antihistamines, corticosteroids, anticoagulants, Dextran 70, anti-inflammatory drugs and fibrinolytic agents have been used in attempts to prevent postoperative adhesion formation, but none of them has been found to be consistently efficacious [5, 7, 17, 20, 21, 23, 26, 30, 31, 33]. More recently, promising results have been obtained with the use of sodium carboxymethylcellulose (SCMC), that may create a flotation bath, thus separating the serosal and peritoneal surfaces, that blocks formation of adhesions during the period of epithelial regeneration, thus reducing the fibroblast activities or proliferation and preventing fibrin deposition on the serosal surfaces of the injury [6, 14-16, 18, 24, 25, 27, 28]. The purpose of this study was to assess the efficacy of SCMC in...
intestinal anastomosis in reducing post-operative adhesions in dogs.

Materials and Methods

Preparation of SCMC
A 1% solution of SCMC was prepared by boiling 200 ml of sterile water and adding 10 g of SCMC powder while stirring. After the SCMC was in solution, additional sterile water was added, to make the total volume 1 L. The SCMC solution was then transferred into 500 ml glass bottles and autoclaved at 121°C for 20 minutes.

Experimental animals
Twenty-three healthy mongrel adult dogs of both sexes, weighing between 3-10 kg were used. The dogs were confirmed healthy through physical, hematobiochemical and radiographic examinations. The dogs were randomly divided into 4 groups; group I, II and III comprised of 5 dogs whereas group-IV comprised of 8 dogs. The dogs were maintained in the cages with adequate food and water ad libitum. But food was withheld for 24 hours before surgery. Rectal temperature, heart rate, respiratory rate and viability were monitored in all the dogs one hour before surgery.

Premedication and anesthesia
Each animal received butorphanol as analgesics (Butophan; Myungmoon Pharm, Korea, 0.4 mg/kg, IV) and atropine sulfate (Atrophine sulfate; Jeil Pharm, 0.05 mg/kg, IM). For the induction, thiopental sodium (Thionyl; Daehan Pharm, Korea, 12 mg/kg, IV) was administered and surgical anesthesia was maintained with isoflurane in 100% oxygen. Prophylactic antibiotics (Cephradine; Schnell Pharm, Korea, 20 mg/kg, IV) was infused. Lactated Ringer’s solution (Hartmann’s Dex. Inj; Daehan Pharm, Korea, 10 ml/kg/hr, IV) was administered during the surgical procedure.

Surgical technique
Through ventral midline celiotomy the intestine was brought out from the abdominal cavity. The viability of the intestine was examined by observing the color and peristaltic movement, and mesentery artery pulse. Intestinal segment of 10 cm proximal to ileocecal orifice was exteriorized and it’s inner content was squeezed out by second and third fingers. The bowel was held by two Doyen intestinal forceps at a distance of 4 to 5 cm from the proposed resection site. Mesenteric and arcadial vessels were double ligated at the area of intestinal resection. The bowel was transected outside of the clamps and the mesentery was incised. End-to-end intestinal anastomosis was performed in all the dogs. In addition, a pedicle of greater omentum was wrapped around the anastomotic site and fixed by interrupted sutures on each side of the bowel in group III and IV. Abdominal lavage was performed with warm saline solution in all the animal. Additionally the animals of group II and IV received an intraperitoneal infusion of 1% SCMC at the dose rate of 5 ml/kg. The peritoneum, muscles and subcutaneous tissues were closed with 3-0 polyglycolic acid and the skin was closed with 3-0 nylon. Two weeks later the same surgical means were also employed to observed any adhesion at the anastomosis sites.

Postoperative management
Food was withheld and lactated Ringer’s solution was administered (3 ml/kg/hr, IV) for 3 days. After recovery, dogs were allowed water ad libitum and food and they returned to full feed over the next 3 days. Antibiotics (Cephradine 20 mg/kg, IV) was administered for 7 days. All the animals were monitored incisional swelling, appetite, activity, defecation, micturation and rectal temperature during the period of experiment.

The evaluation of adhesions
Results indicating status of adhesion were measured by scoring. The adhesion scores were graded as shown in Table 1.

Statistical analysis
The data obtained from the present study were

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<td>Postoperative adhesion score</td>
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