Minimally invasive total splenectomy in dogs: A clinical report

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Abstract

Cases of minimally-invasive surgery are gaining acceptance among surgeons and animal owners. One type of minimally-invasive surgery is total splenectomy, which is indicated for splenic tumors, trauma, torsions, and for dogs that require blood transfusion. To assess the safety of the technique, experimental laparoscopic splenectomies were performed in dogs for the first time in Iran. Three adult male mixed-breed dogs were placed in dorsal recumbency at a 45° angle in the right lateral position, under aseptic condition and general anesthesia. Three trocars were placed; at the umbilicus, 3 cm cranial to the umbilicus and in the right caudolateral abdomen. The spleen was rotated 90° laterally and thermal coagulation of the blood vessels was performed by bipolar electrocautery. The pedicles were checked to ensure hemostasis. The spleen was morcellated and removed from the umbilical port using a retrieval bag. The mean surgery time was 42 minutes, and all dogs survived the surgery without complications. Laparoscopic splenectomy via three portals was found to be easy and safe.

Introduction

Minimally-invasive surgery is becoming more widely-accepted among surgeons. The advantages of laparoscopy over open surgery in terms of morbidity, post-operative pain, cosmetic appearance and recovery of patients to normal activity are well recognized. Many abdominal surgeries, including splenectomy, have been found to be safe when performed laparoscopically. The surgical removal of the spleen is indicated for splenic tumors, trauma and torsions and, most importantly, in blood donor dogs to prevent transmission of hemobartonella infection (Freeman and Potter, 1999). The usual technique for total splenectomy involves individual ligation of the short splenic branches of the splenic artery and vein, preserving the left gastroepiploic artery and short gastric arteries (Hosgood *et al*., 1989).

Since the first laparoscopic splenectomy (Delaitre *et al*., 1991), various studies have investigated the feasibility and possible complications of this procedure (Brodsky *et al.,* 2002; Anthony *et al*., 1999). Since laparoscopic splenectomy has been confirmed to be safe, it is considered the first choice of treatment for most patients requiring splenectomy (Tan *et al*., 2003). Although splenectomy is commonly performed in dogs, the veterinary literature lacks details of some anatomical and technical factors that can influence the outcome. To introduce and observe the safety of the technique, the first experimental laparoscopic splenectomy in Iran was performed in three dogs at the Small Animal Teaching Hospital, in the University of Tehran.

Materials and Methods

Three adult male mixed-breed dogs weighing 14-16 kg were selected for this surgery after ethical approval was gained from The Research Committee of the University of Tehran. Food was restricted for 12 hours before surgery and Cefazolin (20 mg/kg) was administered intravenously (IV) as a preoperative prophylaxis. After general anesthesia (10 mg/kg thiopental Na IV for induction, maintained by inhalation of halothane 1.6%) and aseptic preparation of the abdomen, the dog was placed in dorsal recumbency at a 45° degree in the right lateral position. The surgeon and camera operator both stood on the right hand side of the dog and the monitor was placed on the opposite side. Three trocars were placed; at the umbilicus, 3 cm cranial to the umbilicus and in the right caudolateral abdomen. A 10 mm skin incision was made and the subcutis was prepared until the linea alba was revealed. The skin was cut precisely for trocar insertion to the abdomen under direct vision. The primary camera trocar was inserted while the ventral abdominal wall was pulled up to avoid trauma to visceral organs. The pneumoperitoneum was introduced by CO_2 infusion through the umbilicus

without the use of a Veress needle. An automatic high-flow CO_2 insufflator (Wolf, Germany) was connected to the laparoscopic cannula at a pressure of 12 mm/Hg. A 0° rigid telescope 10 mm in diameter and 29 cm long (Wolf, Germany) was connected to a light source and inserted into the peritoneal cavity from the umbilicus.

An abdominal scan was then performed to locate the position of the spleen, from which the other two portals were located. The second trocar was placed into the abdominal cavity in the left caudal abdomen through a 5 mm skin incision, under direct vision. The third trocar was placed 3 cm above the umbilicus and served as an insertion point for a pair of 5 mm laparoscopic forceps (Figure 1) together with the second trocar. To raise the spleen near the abdominal wall, 1 ml of 1/10000 adrenaline was injected via a 30-mm, 22-gauge needle into the parenchyma of the spleen, via a transabdominal approach. The tip of the needle was then guided by the camera until it reached the spleen (Figure 2), which was then rotated 90° laterally. Thermal coagulation of the blood vessels and mesenteric attachments was performed using bipolar electrocoagulator forceps introduced via the left caudal abdominal trocar. The coagulated tissues were cut using 5 mm endoscopic scissors (Figure 3) and resected along the spleen up to the cranial end. Following the completion of the splenectomy, the pedicles were checked to ensure hemostasis. A retrieval bag was inserted into the abdomen, in which the spleen was morcellated and removed via the 10 mm umbilical port (Figure 4). Finally, all trocar sites were closed routinely. All surgeries were performed by the same surgeon and were recorded on video. The surgical time was noted and any intra- or post-operative complications were recorded. Two weeks post-surgery, a 360° scan of the abdomen was performed laparoscopically in all dogs to evaluate splenectomised site for adhesion or any other complication.

Results

Dogs survived the surgery and recovered from anesthesia without complications. The mean surgical time was 42 minutes. Although there were no serious intra-operative complications, damage to the spleen in one dog during the insertion of the first portal led to minor hemorrhage. Also, inadequate sealing of vessels during electrocoagulation resulted in minor bleeds, but these were controlled immediately. There was no pedicle hemorrhage following removal of the spleen, and laparoscopic evaluation of the abdomen two weeks after surgery showed no adhesion between the omentum and other organs. No hematoma, hernia, infection or other wound complication was observed at the portal sites.

Figure 1: Portal placement for performing laparoscopic splenectomy.

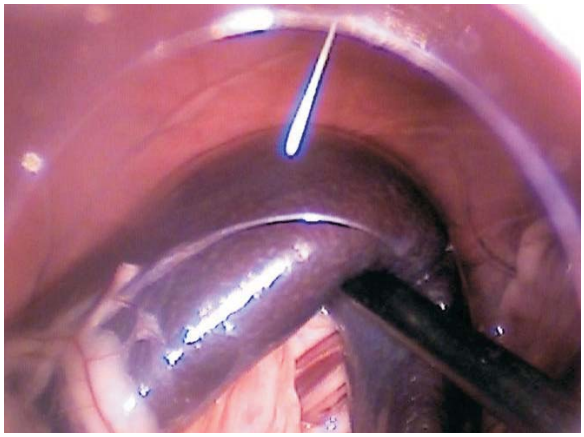

Figure 2: Inserting a 30-mm needle to inject adrenaline into the parenchyma of the spleen while it is brought up toward the abdominal wall.

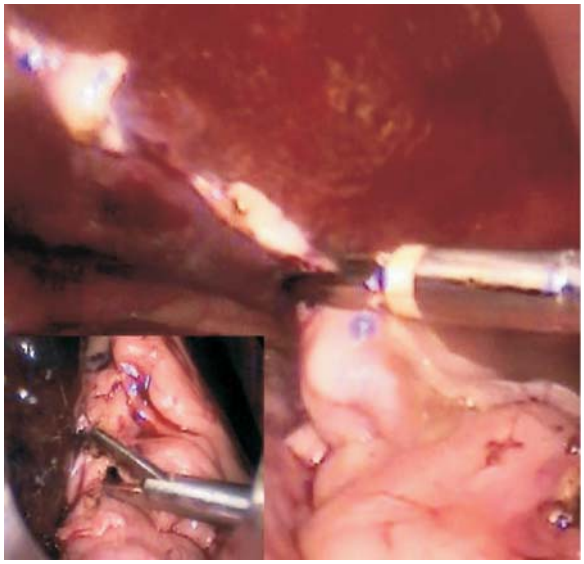

Figure 3: Blood vessels entering the spleen were thermally coagulated by a bipolar electrocauter (main picture), followed by cutting with laparoscopic scissors (inset).

Figure 4: The spleen was removed from the abdomen via a retrieval bag following splenectomy.

Discussion

With the advancement of laparoscopic instruments, minimally-invasive surgery is now an appropriate alternative to open techniques. The advantages of laparoscopic splenectomy include a more cosmetically-acceptable incision and a more rapid return to normal activity compared to open splenectomy (Richardson *et al.*, 1997). Similar results have been found during partial splenectomy by laparascopic means in children and dogs (Hery *et al.*, 2007; Hassan *et al*., 2009; Britenstein *et al*., 2007; Petroianu and Berindoague, 2006). The right lateral position of the dogs created better visualization of the hilum of the spleen and its vessels for precise electrocoagulation. Because the hilum vessels are located in the ventral portion of spleen, coagulation and sealing is facilitated by a 45° inclination to the right (Stedile *et al*., 2009). Due to the large size of spleen, abdominal maneuver of the camera can be difficult, and therefore its size was reduced using ml of 1/10000 adrenaline. This injection has been previously recommended by several authors, since it does not carry side effects (Shaw and Clark, 2005; Palmar, 2002). The location of the portals is strongly dependent on the size of the spleen and the location of its cranial and caudal end. Once the camera is placed, the surgeon should evaluate the position of the organ before determining placement of the other portals to optimize the ergonomics of the surgical procedure. Usually, three portals are adequate for performing laparoscopic splenectomy although sometimes a fourth is used (Freeman *et al.*, 1999). Care should be taken to avoid inadvertent injury to the splenic parenchyma or pedicle during the procedure, since this may leads to serious hemorrhage. If this does occur, immediate cauterization of the vessels is required to facilitate visualization of the surgical field, unless completion of the surgery seems very unlikely. The placing of the spleen into the retrieval bag is a time-consuming stage of the surgery due to the large size of the spleen and fragility of the capsule. During the insertion of the spleen into the bag, fragmentation of the spleen should be avoided and therefore it must be handled gently. The mean surgical time was reasonable and similar to previously-reported times, and may be reduced with experience (Stedile *et al*., 2009).

In conclusion, laparoscopic three-portal splenectomy was performed successfully in three dogs for the first time in Iran. The technique is easy, safe and feasible.

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