

学位論文要旨

Studies for reduction of surgical invasion

(especially on laparoscopic surgery and reduction of bleeding volume)

手術侵襲軽減のための研究

(特に腹腔鏡下手術および出血量減少に関して)

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Introduction: Surgical invasion is a major cause of postoperative complications. Intraoperative blood loss is an inevitable complication of surgical invasion. Therefore, reducing blood loss during surgery is important for preventing postoperative complications. Furthermore, tissue trauma due to surgical invasion also contributes to such complications. Several surgical techniques have been used to reduce intraoperative blood loss, such as pharmacologic tool, electrocautery, and minimally invasive surgery (MIS).

Currently, MIS involving laparoscopic is widely used in the veterinarian field, as it has various advantages, e.g., it reduces intraoperative blood loss and is associated with small surgical wound, less postoperative pain, shorter hospital stays, and less surgical stress compared with the conventional surgery. This study was carried out to examine whether laparoscopic surgery reduced intraoperative bleeding, tissue invasion and inflammatory reactions in dogs.

Chapter 1. Comparison of the postoperative outcomes of laparotomic ovariohysterectomy with circumcostral gastropexy, laparoscopic-assisted ovariohysterectomy with incision gastropexy and total laparoscopic ovariectomy with gastropexy in dogs: Gastric dilation-volvulus (GDV) syndrome is a life-threatening condition caused by sudden stomach dilation or torsion, which often occurs in large dog breeds. Gastropexy can be used to prevent the occurrence or recurrence of GDV. Neutering is one of the most common surgical procedures performed in dogs, and it is recommended that it should be carried out in combination with gastropexy in order to reduce the associated complications. In order to reduce surgical invasion, laparoscopic surgery can be employed.

This study compared the postoperative pain and inflammatory reactions that occurred after neutering combined with prophylactic gastropexy among dogs that underwent laparotomic ovariohysterectomy with circumcostral gastropexy (OOVHG), laparoscopic-assisted ovariohysterectomy with incision gastropexy (LAOVHG) and total laparoscopic ovariectomy

with gastropexy (LOVEG). Fifteen healthy adult female dogs were selected and assigned to the OOVHG, LAOVHG or LOVEG group. The operation time, incision length, and University of Melbourne Pain Scale score were used to assess postoperative pain. The white blood cell count and lymphocyte count were used as indices of inflammatory reactions. In addition, the blood concentrations of interleukin-6, C-reactive protein, cortisol, and blood glucose were employed as indices of surgical stress. The operation time and the surgical wound size were significantly shorter in the LOVEG group than in the other groups. The surgical stress indices were significantly higher in the OOVHG group.

The results of this study suggested that the dogs underwent LOVEG experienced less severe postoperative pain, weaker inflammatory reactions, and less surgical stress than the dogs that underwent the other surgical procedures. In the future, it is feasible that the LOVEG technique, which safe and easy to perform, could be applied to clinical cases involving dogs that are at high risk of developing GDV.

Chapter 2. Investigating the response of the spleen and hemodynamic changes after direct administration of epinephrine: Stimulating sympathetic nerve using endogenous catecholamines, such as epinephrine, can cause splenic contraction. Contraction of the spleen causes the spleen to expel its contents into the circulatory system, resulting in a smaller spleen and increased venous hematocrit levels. Therefore, reducing the size of the spleen before splenectomy might help to ameliorate the blood loss and anemia caused by the procedure.

However, epinephrine can have adverse effects on the hemodynamic system. Therefore, in the present study the response of the spleen and the hemodynamic changes that occurred after the direct administration of epinephrine onto the spleen were examined. We used computed tomography to measure the splenic volume, and heart rate, arterial pressure, pulmonary artery pressure, renal blood flow, and cardiac output were recorded as hemodynamic parameters

before and at 5, 10, and 15 minutes after the dropwise administration of epinephrine onto the spleen. We divided the dogs into 2 groups, which were administered 10 µg/kg (EP10) or 100 µg/kg (EP100). Laparotomy was performed in both groups, and splenic volume was measured on CT before and after the dropwise administration of epinephrine onto the splenic surface. Compared with the baseline, mean reductions in splenic volume of 46.1% and 84.8% were observed in the EP10 and EP100 groups, respectively. The hemodynamic data indicated that marked reductions in RBF occurred in the EP100 group, whereas CI and SV increased.

The results of this study demonstrated that directly administering 100 µg/kg epinephrine onto the spleen causes greater contraction of the spleen and has stronger hemodynamic effects than administering 10 µg/kg epinephrine. This study suggests that directly administering 10 µg/kg epinephrine onto the spleen is a feasible way of reducing splenic volume while minimizing adverse hemodynamic effects during splenectomy in dogs with hematological disorders.

Chapter 3. Comparison of postoperative outcomes of laparotomic and laparoscopic splenectomy in dogs: Splenectomy can be used to treat splenic complications, such as splenic tumor or hematologic disorders. Since, the spleen plays an important role as a blood reservoir in animals, splenectomy can cause massive hemorrhage in the perioperative or postoperative period. To reduce such complications and minimize tissue invasion, MIS, such as laparoscopic surgery, can be performed.

In the current study, we compared the outcomes of laparotomic and laparoscopic splenectomy in dogs. The animals were divided into 2 groups. Group 1: laparotomic splenectomy group (OS) and group 2: laparoscopic splenectomy (LS) group. In the LS group, we administered 10 µg/kg of epinephrine onto the splenic surface via the transabdominal approach. The results of this study indicated that the spleen and the surgical wound were

smaller in the LS group than in the OS group. Bleeding indices (the red blood cell count, platelet count, and hematocrit) were lower in the LS group than in the OS group. A higher surgical stress index (the cortisol concentration) was observed in the OS group than in the LS group.

In conclusion, our results suggested that laparoscopic splenectomy combined with directly administering 10 µg/kg of epinephrine onto the spleen is feasible; results in less surgical stress and intraoperative blood loss; minimize tissue invasion; and reduces the risk of postoperative complications, such as anemia.

Chapter 4. Influence of the duration of ischemia due to the laparoscopic Pringle maneuver on hemodynamics and postoperative blood test results in dogs: Massive hemorrhage is considered to be a general complication of hepatectomy. One of the methods used to reduce intraoperative blood loss during hepatectomy is to induce hepatic ischemia by temporarily blocking blood flow into the liver, such as via the Pringle maneuver. However, hepatic ischemia can induce irreversible hepatocyte damage, and ischemia due to the Pringle maneuver can affect the remnant liver after hepatectomy. In dogs, intermittent blocking blood flow to the liver for 10-15 minutes before allowing 5-10 minutes of blood flow is considered to be feasible. However, blocking blood flow to the liver for ≥ 10 minutes can have marked effects on hemodynamics, and the optimal duration of the ischemic period during hepatectomy is unclear. Furthermore, retrograde hemorrhaging from the hepatic vein can be prevented by increasing intra-abdominal pressure via pneumoperitoneum during laparoscopic surgery. In order to reduce the invasiveness of such surgery, laparoscopic surgery can be combined with the Pringle maneuver.

In this study, the effects of the duration of the period of ischemia caused by the laparoscopic Pringle maneuver were investigated in dogs. The dogs were divided into 2 groups,

which underwent three 10-minute ischemic periods or six 5-minute ischemic periods, and the duration of each reperfusion period was set at 5 minutes. Increase in HR and reductions in blood pressure and CO were seen after blood flow to the liver was blocked, but they returned to baseline levels after blood flow was restored. Liver enzyme levels transiently increased. No significant difference was noted in any measurement between the 2 groups. The duration of the ischemic period had no influence on hemodynamics, and it was suggested that blocking of blood flow to the liver for 30 minutes does not markedly influence postoperative liver function.

Conclusion: In this study, we examined the effects of several surgical techniques on intraoperative blood loss and the risk of postoperative complications in dogs. Laparoscopic surgical techniques reduce tissue invasion. Such techniques can be combined with various other surgical techniques to improve the effectiveness of surgery. We conclude that the laparoscopic techniques examined in this study were effective; i.e., they minimized tissue invasion and reduced postoperative pain and inflammatory reactions. This study involved experimental animals, and we expect that in future the technique examined in this study will be improved and become suitable for clinical use.