

## **Radiographic and Macroscopic Findings after One Layer Vs Two layer Laparoscopic Gastrojejunostomy in Dogs.**

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### **Abstract**

**Objectives-** To evaluate radiographic changes and macroscopic findings in handsewn laparoscopic gastrojejunostomy in dogs.

**Study Design-** Elective experimental study

**Animals-** Eighteen mix-breed healthy male and female dogs.

**Methods-** Animals were divided in two equal groups randomly. Two layers handsewn laparoscopic side to side gastrojejunostomy was performed in the control group and one layer in the treatment group. Cases were monitored for four weeks. Contrast radiographs were taken in the first and last week of the study. Cases were sacrificed after four weeks and macroscopic findings were evaluated at the anastomotic site and its diameter was measured.

**Results-** There was no evidence of stricture, stenosis or organ displacement radiographically. No infection, stricture, fistulae formation, abscess, ischemia or gross granulation tissue was seen, but several adhesions were found in the abdominal cavity macroscopically. The most frequent adhesion was between omentum and the anastomotic site which was reported in all cases. There were no statistically significant difference between the anastomotic diameter in both groups ( $P>0.05$ ).

**Conclusion and clinical relevance-** One layer laparoscopic handsewn gastrojejunostomy is a safe and feasible technique without serious complication with no statistically significant difference with the conventional two-layer technique.

**Keywords-** Laparoscopy, Gastrojejunostomy, Radiography

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## **Introduction**

Laparoscopic surgeries in gastrointestinal tract have several advantages. The most important advantage of the technique is reduction in the period of postoperative intestinal paralysis so that gastrointestinal function returns more rapidly to normal status following minimally invasive surgery<sup>1</sup>. It also elicits a reduced immune response compared with open surgery<sup>2</sup>. This technique not only results reduced tissue desiccation and foreign body contamination but also fewer intra-abdominal adhesions<sup>3</sup>. It has gained wide clinical acceptance in surgical practice. There are some reports of performing laparoscopic gastrointestinal anastomosis which were summarized successively<sup>4,5,6</sup>. Surgeons agreed that the laparoscopic gastrointestinal anastomosis is superior to open technique because of faster recovery, less pain and better cosmetic appearance<sup>7</sup>. The feasibility and safety of laparoscopic Billroth 2 gastrectomy in canine model was reported by Soper et al<sup>8</sup> in 1994.

## **Materials and Methods**

### *Animals:*

Eighteen mixed breed dogs, weighing 15-20 (mean  $17.5 \pm 2.2$  Kg), from both sexes were studied. Dogs were randomly divided into two groups (control and treatment), of eight dogs. They were considered healthy based on clinical examination and result of complete blood count and serum analysis.

### *Experimental design:*

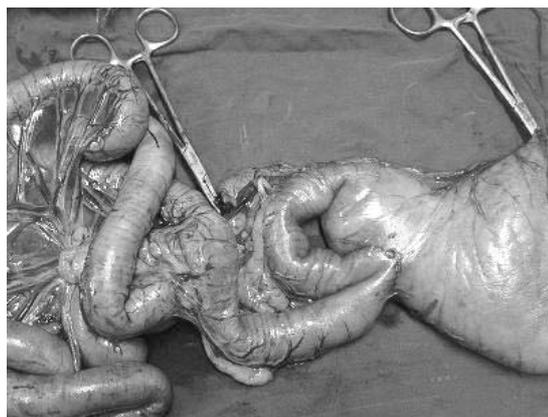
Under general anesthesia (Na Thiopental [8 mg/kg, IV] for induction and Halothane [1.5-2 % MAC] for maintenance) side to side handsewn laparoscopic gastrojejunostomy was performed in all cases, using two layer anastomosis in the control and one layer anastomosis in the treatment group. The cases were monitored for four weeks to evaluate any complication during and after the surgery. Contrast radiographs were taken in the first and last week after operation (fig.1). The animals were sacrificed four weeks after operation and necropsy findings were recorded precisely. The stomach was then separated from the esophageal junction and jejunum was separated from the rest of the intestinal tract and brought out from the abdominal cavity and the healing status was macroscopically evaluated in both serosal and mucosal side. The patency of the anastomotic site was checked and the diameter was measured (figs.2-4).

### *Statistical analysis:*

Statistical analysis and comparisons was performed by using Mann-Whitney. The P value less than 0.05 were considered statistically significant.



**Fig.1: Contrast radiograph in the first week after operation shows patency of the anastomotic site.**



**Fig.2: Stomach and the intestine showing anastomotic site potency.**



**Fig.3: Measuring the diameter of the anastomotic Site.**



**Fig. 4: Adhesion between omentum and anastomotic site.**

## Results

All animals of both groups with side to side laparoscopic gastrojejunostomy tolerated the operation except one which died due to peritonitis resulted from leakage 5 days after operation. Radiographs were taken in the first and last week after operation. There was no delay in initial gastric emptying time and total gastric emptying time in both groups. No stricture, stenosis or organ displacement were reported in contrast radiographs and all anastomotic sites were patent (fig.1). In necropsy findings there was no gross inflammation, hemorrhage, infection, ischemia or apparent granulation tissue, abscess or fistulae formation. There were no evidences of anastomotic leakage or stricture and all anastomotic sites were patent (fig.2). The mean diameter of the anastomotic sites was 17 mm in the control group which was insignificantly less than the treatment one (18 mm) (fig. 3). Several adhesion

formations were found in abdomen with higher incidence in the control group. There were no evidences of hydroperitoneum or presence of serous or fibrinous exudates in the abdominal cavity. The position of all organs within the abdominal cavity were normal. The adhesions were observed in macroscopic evaluations between subcutaneous tissue and the site of trocar of the camera in one case of the control group, between falciform ligament and the site of trocar of the camera in two cases of the control group and one case of the treatment group, between omentum and the site of trocar of the camera in one case of the control group, between omentum and aponeurotic part of the diaphragm in one case of the control group, between omentum and anastomotic site in all cases of the both group (fig4), between anastomotic site and falciform ligament in one case of the control group and two cases of the treatment group, between anastomotic site and right medial lobe of liver in one case of the treatment group.

Mesenteric lymph node enlargement was found in two cases of the control group.

There was no evidence of gall bladder impaction or common bile duct stenosis. Healing process was complete in all cases of both groups.

## **Discussion**

In macroscopic evaluations there was no report of hernia in portal sites and all sites were healed normally just one adhesion was seen at the site of trocar insertion in hilus. According to previous studies, the incidence of hernia at the trocar site is around 1% in abdominal laparoscopic procedures which were due to application of 10-mm-diameter trocars. There are some reports of a few cases which were affected with hernia, hematoma, subcutaneous hemorrhage or infection at the trocar site<sup>9,10,11</sup>. Other risk factors related to incidence of hernia are long time operations and insufficient emptying of pneumoperitoneum<sup>12</sup>. There was no evidences of organ displacement in the abdominal cavity, which was observed radiographically before necropsy. Several adhesions were formed in the abdominal cavity which did not result in organ displacement that is why that was not apparent in radiographs. Adhesion formation was happened mostly between anastomotic site and omentum which was seen in all cases. This was in the ventral site of anastomosis which was covered with omentum after completing the operation to reduce the risk of leakage, better sealing and localizing the possible peritonitis. This method has been recommended by many surgeons for it is easy and reported to give a better result in reducing the risk of leakage from the gastrointestinal anastomosis<sup>13,14</sup>. Although there were no statistical difference between the rate of adhesion in two groups, incidence of adhesion was higher in the control group than the treatment group which can be attributed to more manipulation of tissues, trauma and injuries from the laparoscopic tools during performing anastomosis in the control group. Soper has reported local adhesion formations in laparoscopic gastrojejunostomy. There was no adhesion reported in laparoscopic gastrjejunostomy in pigs by the application of stapler which is one of the advantages of using this instrument<sup>15</sup>.

Overdistention of gall bladder was not observed in any cases. There is one report of higher incidence of gall stone formation in gastroduodenostomy rather than gastrojejunostomy in human<sup>16</sup>. There was no gross inflammation, hemorrhage, infection, ischemia or apparent granulation tissue, abscess or fistulae formation. We observed only one peritonitis because of anastomotic leakage. The reason was hypoalbuminemia and hypoproteinemia due to chronic parasitic infection. The most important complication of anastomosis is leakage and despite all improvements in non invasive surgeries leakage still remains a serious problem with high mortality<sup>14,17,18</sup>. There are different reports of leakage rate in gastrointestinal anastomosis.

Factors such as sufficient blood supply, lack of tension and well-apposed tissues at the anastomotic site are important issues of the successful anastomosis. Several factors have been mentioned as a predisposing factor for leakage at the gastrointestinal anastomotic site like sex (male more affected than female), nutritional defects, presence of peritonitis before surgery, trauma, concurrent infections, malignancies, diabeteses, corticosteroids, azotemia, hypoproteinemia and hypoalbuminemia<sup>17,19,20</sup>. Also, it has been proved that 3 to 5 days postoperation, due to fibrinolysis and collagen decomposition, the anastomotic site is in the loosest and most crucial period<sup>10</sup>. In the missing case hypoalbuminemia, hypoproteinemia, long surgical time because of the application of two layer suture pattern, and also passage of food two days after operation that made tension on anastomotic site, leads to leakage and peritonitis. Raplh in 2003 has reviewed 115 gastrointestinal anastomotic cases and reported 14% anastomotic leakage which 85% of them were died despite of treatments<sup>21</sup>. Soper reported no anastomotic leakage in his experimental laparoscopic gastrojejunostomy<sup>8</sup>. Although training and following laparoscopic principle techniques are important issues in preventing complications like leakage, the study of 200 laparoscopic gastrojejunostomy cases in 2006 showed that even high experience of the surgeons may not be an index to eliminate the incidence of leakage<sup>22,23</sup>. In 2005 Fujiura et al reported statistically significant lower incidence of gastrointestinal leakage in application of laparoscopic technique in comparison to open technique for gastric cancer<sup>24</sup>. In this study, the anastomotic passage was checked radiographically and macroscopically, which were patent and showed no stricture in all cases. This finding is the same as what Soper reported in laparoscopic gastrojejunostomy in dogs<sup>8</sup>. But the anastomotic diameter was decreased in comparison with the diameter of the stoma we created at the time of surgery which was due to contractive phase of wound healing. There was no significant difference between the anastomosis diameters in two groups. The ideal diameter of the anastomotic site in gastrojejunostomy has been reported 20 mm in large breed dogs in veterinary literature, which is consistent with our findings<sup>25</sup>. Incidence of stricture or stenosis in laparoscopic technique were reported from 0 to 3 percent<sup>9,10,26</sup>. Mesentric lymph node enlargement in two cases of the control group was probably because of more manipulation and trauma during the surgery and the presence of more suture material that works as foreign body in the anastomotic site.

In conclusion, all radiographic and macroscopic data revealed well established healing at the anastomotic site without any complication like stenosis, stricture, gross granulation tissue, infection or ischemia. Although adhesions were formed in different parts of abdominal cavity, no organ displacement was observed radiographically. Laparoscopic gastrojejunostomy is safe and feasible without serious complication.

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