

MODEFIED SUTURE TECHNIQUE FOR END –TO– END INTESTINAL ANASTOMOSIS IN DOGS

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ABSTRACT

The present experiment was conducted to study the possibility for using single layer of modified suture technique and to compare it with interrupted horizontal mattress suture technique. Clinical, radiographical and histopathological studies of anastomotic site have been made, 15 and 30 postoperative days in two groups. Results showed that the intestinal anastomosis with modified technique was associated with minimum adhesion, less degree of stenosis, healing by formation of granulation tissue and complete formation of villi at 30 days. While, intestinal anastomosis with interrupted horizontal mattress suture was associated with sever adhesion , major luminal stenosis, healing by increase formation of fibrous tissue, thinning of epithelium layer and the mucosa was not complete at 30 days.

**تقنية محورة لمفاغرة الأمعاء نهاية – نهاية في الكلاب
أسماء حسين علاوي**

فرع الجراحة والتوليد، كلية الطب البيطري، جامعة الموصل، الموصل، العراق

صممت هذه التجربة لدراسة إمكانية استخدام تقنية خياطة محورة وبصف واحد لمفاغرة الأمعاء نهاية – نهاية ومقارنتها مع خياطة المنجد الأفقية المتقطعة في الكلاب. تم دراسة عملية سير الالتئام في المجموعتين من الناحية السريرية والشعاعية والنسيجية بعد مرور ١٥ و ٣٠ يوماً من إجراء العملية . أظهرت النتائج ان مفاغرة الأمعاء باستخدام التقنية المحورة كانت مصحوبة بقلّة الالتصاقات وقلّة درجة التضيق المفاغري وحصول الالتئام من خلال تكوين النسيج الحبيبي الغزير بالأوعية الدموية واكتمال تكوين الطبقة المخاطية والزغابات خلال ٣٠ يوماً مقارنة مع طريقة المنجد الأفقية المتقطعة التي تميزت بكثرة الالتصاقات وزيادة درجة التضيق المفاغري وحصول الالتئام من خلال زيادة النسيج الليفي ونحافة الطبقة الظهارية وعدم اكتمال تكون الطبقة المخاطية خلال ٣٠ يوماً.

INTRODUCTION

Intestinal resection and anastomosis is a routine procedure for treatment of many lesions in the intestine such as gangrene of the intestine due to loss of blood supply as in strangulation, intestinal obstruction, irreducible intussusceptions, neoplasm, intestinal torsion, mesenteric parasite and intestinal rupture (1, 2). Many methods, materials and devices have been used for intestinal anastomosis such as biofragmentable anastomosis ring, anastomosis by using eversion, inversion and

apposition suture pattern by using absorbable and non absorbable suture material and also using invagination methods (3 , 4 , and 5)

Inadequate healing, stenosis, adhesions and consequent leakage from bowel anastomosis are the main complications and significant causes of post operative morbidity and mortality (6). Therefore the main criteria used in assessing any technique of anastomosis include absence of leakage, minimal occlusion of lumen, and minimal formation of adhesion and rate of healing (7). Considering these criteria, a report appeared advocated a single layer continuous anastomosis using monofilament suture material (8). This anastomosis is a secure way on connecting any two pieces of bowel because it requires less time to fashion , costs less than any other methods and may have a lower risk of leakage . In addition to that the single layer technique achieved less luminal reduction , less tissue strangulation , greater anastomosis strength and better mucosal and muscle realignment and healing (9,10) .The aim of this study is to evaluate the efficacy of modified suture technique for intestinal anastomosis.

MATERIALS AND METHODS

Twelve adult local breed dogs weighing 13 –20 kg were used in this study .The animals were kept under similar management and feeding conditions through out the experiment . The animals were divided equally into two main groups (6 animals of each) .

Anaesthesia was induced by atropine sulfate at a dose (0.04 mg/kg B.W.) intramuscularly as a premedication followed 10 minutes later by a mixture of ketamine 5% (15mg/kg BW) and xylazine 2% (3 mg/kg BW) intramuscularly. Under aseptic conditions the abdomen was entered through linea alba in between xyphoid cartilage and umbilical area. The jejunum was exteriorized , double ligation were made to the mesenteric blood vessels which supply the pieces of the intestine that will be removed , the contents of the loop was milked and four straight intestinal forceps were placed , two on either side of the proposed surgical site . The intestine was then sharply transected transversely in between the two intestinal forceps for each side , the anastomosis were achieved as follows:

Group (1): Single layer suture method was used for intestinal anastomosis represented by using interrupted horizontal mattress suture technique .

Group (2): Single layer of modified technique was used for intestinal anastomosis . This method represented by inserting the needle to all layer of intestine from serosa to mucosa in the first side (about 6 mm from the incision line) , at the same distance in the opposite side the needle was introduced to all layer of intestine from mucosa to serosa. After that the needle was returned to first side and inserted (about 3mm from incision line) from serosa to muscularis and then the needle was introduced to opposite side from muscularis to serosa (a bout 3mm from incision line). The beginning and end of thread were tied lightly, The second stitch was applied at a distance 3 – 4 mm from the first stitch (Fig. 1) .Anastomosis in two groups was performed with No. 3-0 chromic catgut. After complete anastomosis the cleft of mesentery was closed with the same thread using simple continuous suture technique. The exteriorized jejunum was rinsed with warm saline solution and replaced into abdominal cavity. The abdominal incision was closed in the routine manner.

The animals were given glucose 5% intravenously at a dose (10 ml /Kg B.W.) twice a day for two days after operation. After that they were allowed to take soft food . Postoperative medication comprised parental administration of penicillin and streptomycin intramuscularly at the dose of 10000 I.U. /kg B.W. , 10m g/kg B.W. respectively for four days. Evaluation of clinical status included the observation and measurement of defecation , urination and general condition of the animals throughout the period after operation .

Three animals from each group at 15 and 30 days after operation were anaesthetized. A piece of 15 cm of intestine including anastomotic site was removed and kept in normal saline for further studies. These pieces were tied tightly and barium sulphate suspension was infused into the lumen until it expanded . The radiographs were taken using 70kv and 6 mAs. The percentages of lumen stenosis was calculated by the formula $100 [1 - 2A / (B + C)]$, where; A, width of intestine at anastomotic site, B and C for the width of intestine 2 cm proximal and 2 cm distal to the anastomotic site respectively. The results were statistically analyzed using ANOVA and Duncan test. The level of significant was at ($P < 0.05$).

Tissue specimens from anastomotic site were collected and fixed in 10% neutral buffered formalin for 48 hours. The specimens were dehydrated, cleared , embedded in paraffin wax , sectioned at 5 μ m thickness and stained with hematoxylin and eosin stain (11).

A

B

Fig. 1: Shows interrupted horizontal mattress suture (A) and modified suture (B) techniques
b: serosa , a: muscularis , s: submucosa , m: mucosa

RESULTS

The time (in minutes) for anastomosis by the modified suture technique (G2) was significantly ($P < 0.05$) longer than interrupted horizontal mattress suture technique (G1) . It ranged from 9- 12 min (mean 10.5 ± 0.8).The mean anastomosis time for horizontal mattress suture technique was ($5 \text{ min} \pm 0.4$).

Clinical observations revealed that the two anastomotic techniques were successful. The postoperative findings demonstrate normal defecation , urination and appetite less than normal . Examination of the anastomotic site before biopsy revealed that there were no documented leaks. The amount of adhesion formation was greatest with the horizontal mattress suture technique and it was extended from anastomotic site to the adjacent mesentery, jejunal serosa and in some animals to the omentum . While, the adhesion in G2 was least and extended from anastomotic site to the adjacent mesentery , in some animals the adhesion was a strip – like.

Result of contrast radiographic study revealed that there was significant difference in degree of stenosis between G₁ and G₂ at 15 and 30 days (Fig. 2 & Fig. 3). The mean stenotic was significant ($P < 0.05$) in between group one after 15 & 30 days (55.733 % , 42.93% , respectively) and group two after 15 & 30 days (30.16% , 16.96%, respectively), also in between group 1 , at 15 and 30 days and in between group 2 at 15 and 30 days (Table 1). The smallest degree of anastomotic stenosis was seen in G 2 at 30 days (16.96%). The largest degree of anastomotic stenosis was seen in G₁ at 15 days (55.733%).

The main histopathologic observation of the anastomotic site in G₁ at 15 days was sloughing and necrosis in the epithelium layer of the intestine (Fig.4). A thick layer of collagen fiber and large amounts of fibrous tissue with proliferation of fibroblast, blood vessels in the most area of intestine specially lamina propria and submucosa were also seen (Fig.5). Catgut thread was surrounded by collagen fiber infiltrated with mononuclear cells especially macrophage cells, beginning of regeneration of villi in some area of anastomosis site was seen . In 30 days sloughing and necrosis were more in this period , regeneration of mucosal layer by formation of villi was more at this period and thinning of epithelium layer of intestine was seen . Small pieces of catgut which was surrounded by fibrous tissue were seen , increase formation of fibrous tissue in this period as compared with 15 days period (Fig.6).

The 15 days of group two revealed regeneration of mucosal layer was represented by simple formation of villi and intestinal gland . In 30 days the formation of mucosal layer was complete (Fig.7). Big pieces of catgut which were rounded by collagen fiber and mononuclear cells were observed at 15 days (Fig.8). while , at 30 days very small pieces of it were seen. There was increase in the amount of collagen fiber infiltrated with a little amounts of mononuclear cells especially in lamina propria and submucosal layer, proliferation of fibroblast and formation of new blood vessels were evident at 15 days, more progress at 30 days. In 15 days there were proliferation of muscular fibers in muscular layer and hyperplasia in the epithelium layer cells of villi . At 30 days there were an increase in amount of muscular fiber and decrease of hyperplasia for epithelium layer cell of villi (Fig.9).

Table (1): the Percentage of degree of anastomotic stenosis and the mean of degree of anastomotic Stenosis for G₁ and G₂

Group	No. of animals	Percentage of degree of anastomotic stenosis at 15 days	Mean of degree of anastomotic stenosis at 15 days	No. of animals	Percentage of degree of anastomotic stenosis at 30 days	Mean of degree of anastomotic stenosis at 30 days
One	1	50.7%	55.733 %	1	44.8%	42.93%
	2	57.8%	A	2	42.3%	B
	3	60.1%	1.625 ±	3	41.7%	2.731 ±
Two	1	26%	30.16%	1	10.3%	16.96%
	2	34.7%	C	2	17.2%	D
	3	30.8%	2.122 ±	3	23.4%	1.069 ±

Significant at P < 0.05 between: A & B, C & D, A & C, B & D, A & D, and C & B

Fig. 2: Radiographic image showing stenosis at the anastomosis site (a) after 30 days in group one.

Fig. 3: Radiographic image showing stenosis at the anastomosis site (a) after 30 days in group two.

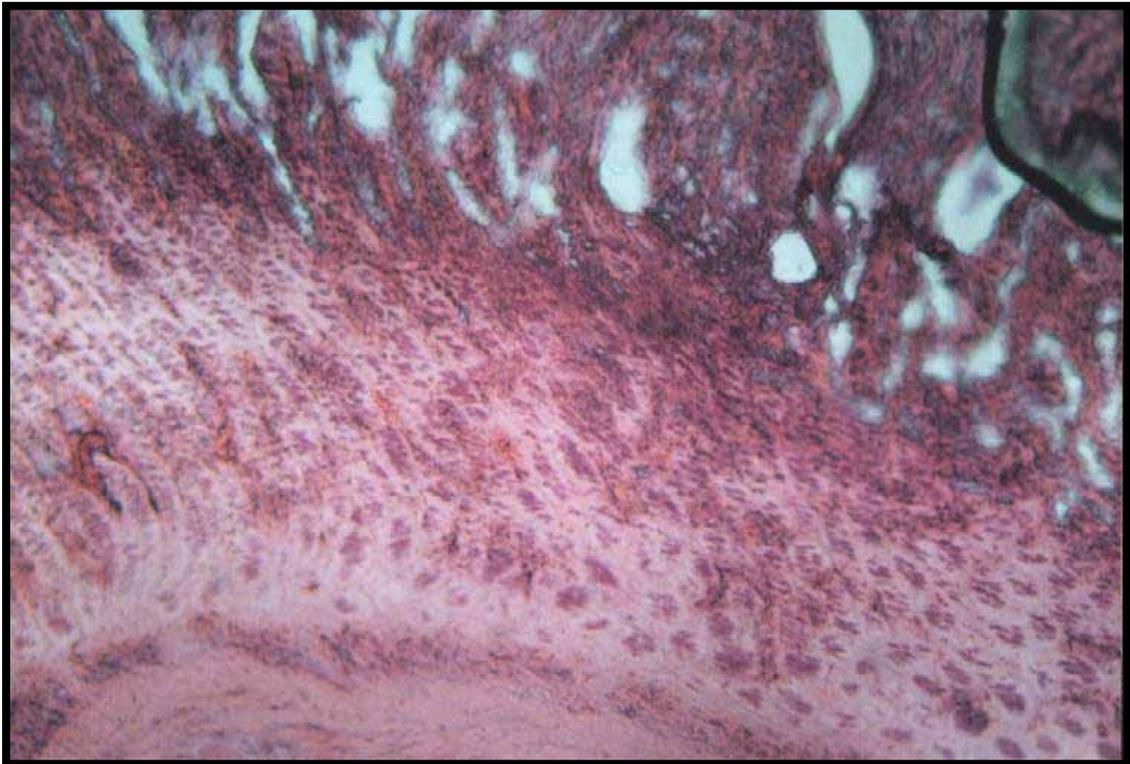


Figure 4: Histopathology of group one 15 days after operation shows necrosis and sloughing of mucosa at the site of anastomosis. H & E X10.



Figure 5: Histology of group one 15 days after operation shows necrosis and sloughing of mucosa at the site of anastomosis H&E X10

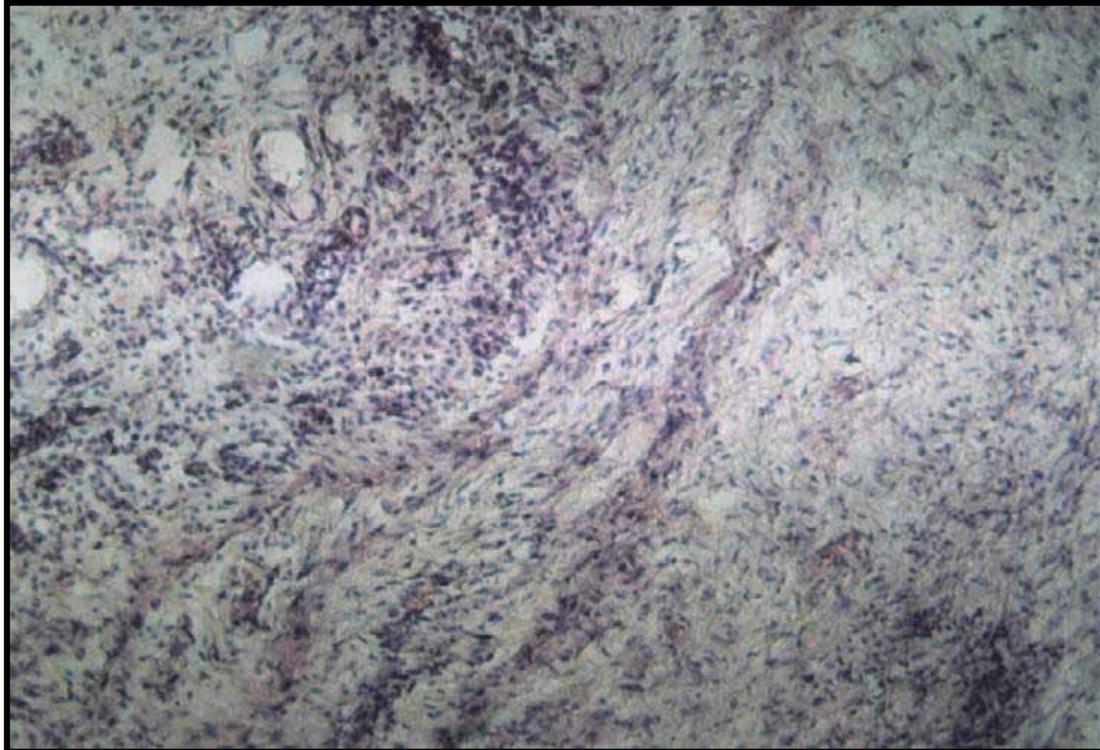


Fig. 6: Histopathology of group one 30 days after operation shows increase formation of fibrous tissue as compared with the period 15 days after operation H&E X10

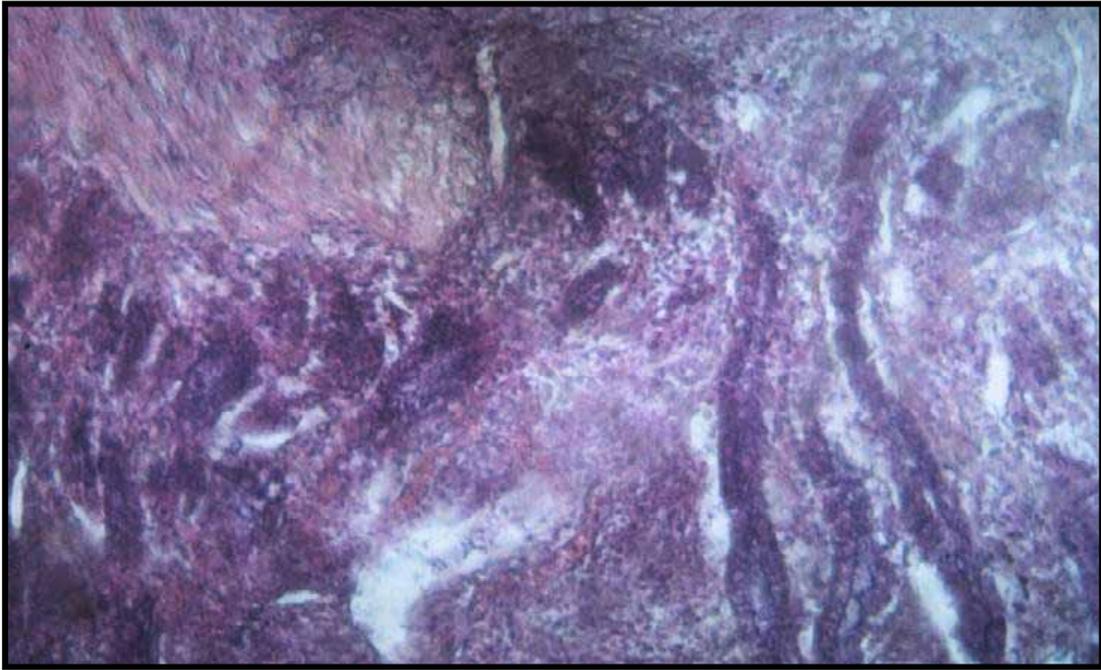


Fig.7: Histopathology of group two 30 days after operation shows mucosal layer formation with villi H & E X10.

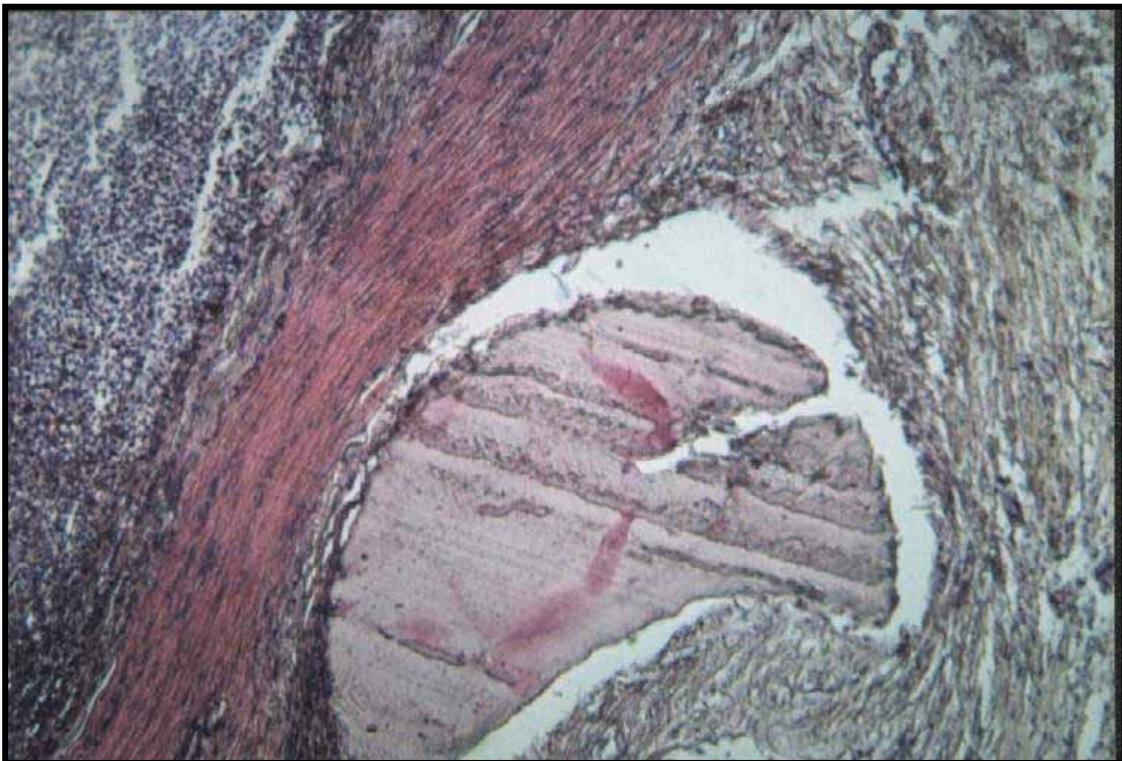


Fig. 8: Histopathology of group two 15 days after operation shows catgut rounded by collagen fibers. H& E X10.

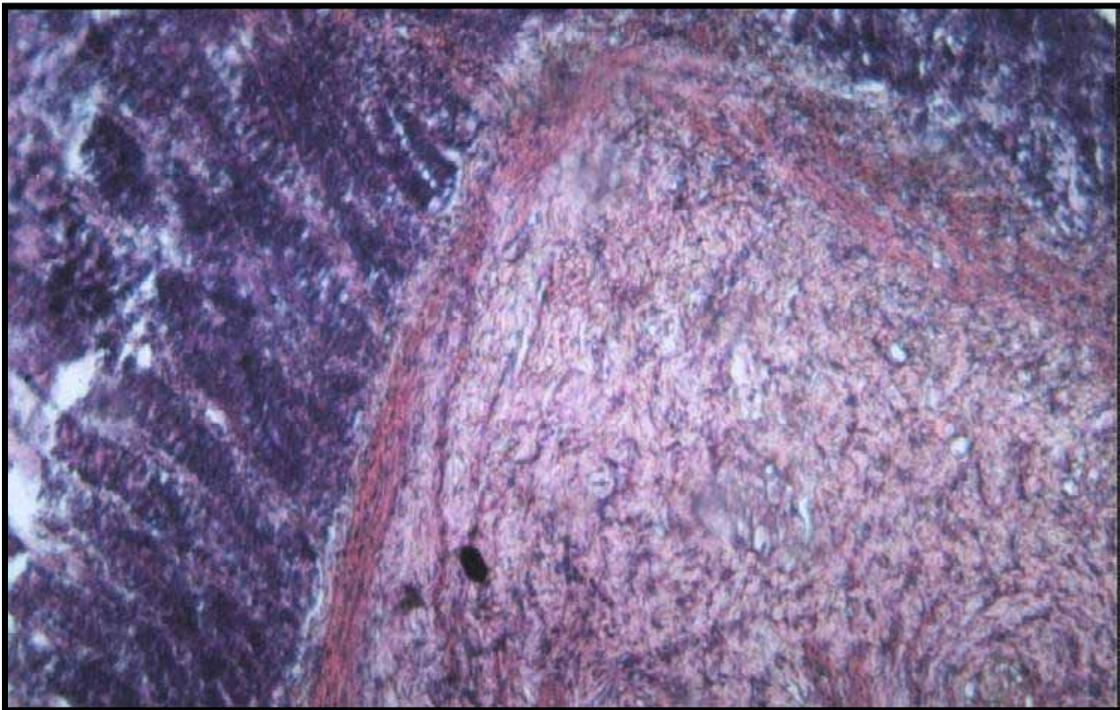


Fig. 9: Histopathology of group two 15 days after operation shows increase formation of muscle fibers with infiltration of mononuclear cell and hyperplasia of the epithelia

DISCUSSION

In the present study, the results of the modified technique for connecting bowel compared with horizontal mattress suture which used routinely in intestinal anastomosis, were successful according to clinical, radiographical and histopathological findings.

The adhesion around the anastomotic site was sever in G_1 and extended to mesentery, intestine loops and omentum. While, in G_2 the adhesion was less in severity, this may be due to the differences in the type of suture techniques. In G_1 the suture technique resulted in eversion of intestinal layer and led to exposure of mucosal layer to abdominal cavity and these results in infection which led to increase inflammatory reaction & severe adhesion. This phenomenon is in an agreement with other workers (12). While, in G_2 suture technique the apposition of intestinal layers specially the mucosal and muscular layers without exposure of mucosal layer to abdominal cavity, resulted in occurrence of least inflammatory reaction. This phenomena was observed by other worker (13) who said that the simple inflammatory reaction associated with apposition technique. Increase adhesion which means large amount of fibrous tissue formation, leads to the limitation of the dilation of anastomosis area and finally the increase of stenosis, these results may explain the high stenosis in G_1 when compared with lower stenosis in G_2 . This Phenomena was observed by other worker (14) who studied the intestinal anastomosis by using other technique.

The radiographic study revealed that the major luminal stenosis was observed in G_1 (60,1%) at 15 days postoperative and minor in G_2 (10.3%) at 30 days postoperative table (1) . The greater percentage of lumen stenosis in G_1 may be due to extensive adhesion which may intern not allow the expansion of lumen at the suture line , this result coincides with other worker (14). While, minor stenosis in G_2

may be due to the type of suture technique used which was led to apposition of intestinal layer and result in low amount of adhesion and finally minimum luminal stenosis. This phenomena coincides with other worker (15) who said that the apposition technique result in minimum luminal stenosis . However decreased luminal stenosis in G₁ and G₂ at 30 days as compare with 15 days postoperative (table 1) may be due to increase metabolism and absorption degree of catgut at 30 days as compared with 15 days which was led to removal of purse – string effect that induced by this suture material and finally result in increase luminal diameter of intestine at 30 postoperative days.

The histopathologic study of anastiomotic site revealed that the anastomosis in G₁ characterized by necrosis and sloughing of epithelium layer and thinning of epithelium layer with slow healing, this may be due to ischemia induced by using horizontal mattress suture this phenomena was similar to those described in the literature (14) , also necrosis and sloughing was led to slow healing because increase number of granulocytes that is play important role for analysis of collagen fiber, therefore in result slow healing occur with this technique (16). While, in G₂ the anastomosis was characterized by least amount of fibrous tissue, high proliferation of new blood vessels and rapid healing represented by the formation of mucosa and villi this coincides with that others (17), who said that the apposition technique results in rapid healing . There was no evidence of leakage or abscess formation in G₁ and G₂ .

Thus, it could be stated that anastomosis by using horizontal mattress suture and modified suture technique have lead to good results but the modified suture technique was superior to horizontal mattress suture technique and the similar results have been reported by other workers using apposition technique for intestinal anastomosis (13, 14 , 17).

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