

**COMPARATIVE STUDY BETWEEN TWO METHODS
OF END-TO-END OBLIQUE INTESTINAL ANASTOMOSIS IN DOGS.**

F.M. Mohammed

Department of Surgery and Obstetrics, College of Veterinary Medicine,
University of Mosul. Mosul-Iraq.

(Received: December 3, 2006; Accepted: April 2, 2007)

ABSTRACT

The current study was conducted to compare between two methods of small intestinal anastomosis in dogs after obliquely resected and anastomosed by using simple interrupted and cross mattress sutures technique. The results revealed that the oblique technique of intestinal anastomosis was successful in all operative animals with few complications and without mortality rate postoperatively. The postmortem examination revealed that the cross mattress technique was associated with minimal adhesion as compare to simple interrupted technique which was associated with sever adhesion. The radiographic study revealed that no significant differences in mean degree of stenosis between two methods of this study. Also the radiographic pictures revealed that, the mean degree of stenosis which associated with cross mattress pattern was less than accompanied with simple interrupted pattern at thirty days after operation. The histopathological examination shown minute foci of tissue reaction with thick and mature fibrous tissue at the site of operation after 30 days in cross mattress anastomosis, whereas the anastomosis with the simple interrupted suture accompanied by sever inflammation and destruction of the serosal layer of intestine at 30 days after operation. We concluded that simple interrupted and cross mattress patterns can be used for anastomosis of oblique intestinal resection.

دراسة مقارنة طريقتين لمفاغرة الأمعاء المائلة نهاية-نهاية في الكلاب

فؤاد مؤيد محمد

فرع الجراحة والتوليد، كلية الطب البيطري، جامعة الموصل.
موصل – العراق.

الخلاصة

أجريت الدراسة للمقارنة بين طريقتين لمفاغرة الأمعاء بعد قطعها بشكل مائل حيث تم مفاغرتها بالخياطة المتقطعة البسيطة والمتصالبة. أظهرت النتائج نجاح طريقة مفاغرة الأمعاء المائلة في كل الحيوانات المعاملة وبمضاعفات بسيطة وعدم حصول هلاكات مابعد العملية. أظهرت نتائج فحص الجثة إن طريقة الخياطة المتصالبة رافقها التصاقات طفيفة مقارنة بطريقة الخياطة المتقطعة والتي كانت مترافقة بالتصاقات غزيرة وكذلك أثبتت نتائج الفحص أشعاعي عدم وجود اختلاف معنوي في درجة التضيق في تجويف الأمعاء بين كلتا الطريقتين المستخدمة حيث أظهرت طريقة التقمم بالخياطة

المتصالبة درجة تضيق واطئه نسبيا مقارنة مع درجة التضيق باستخدام المفاغرة بالطريقة المتقطعة البسيطة بعد 30 يوما من التقمم. بينت نتائج الفحص النسجي المرضي وجود بؤر دقيقة لتفاعلات النسيج مع نسيج ليفي حول موضع التقمم بعد 30 يوما من إجراء التقمم بالطريقة المتصالبة بينما ترافقت التقنية المائلة بطريقة الخياطة البسيطة المتقطعة وجود التهاب شديد وتحطم للطبقة المصلية للأمعاء خلال نفس الفترة. من خلال النتائج نستنتج إمكانية استخدام الخياطة بالتقنية البسيطة المتقطعة والمتصالبة بعد القطع المائل والتقمم للأمعاء.

INTRODUCTION

Intestinal resection and anastomosis is an enterectomy with re-establishment of continuity between the divided ends (1). They are recommended for removing ischemic, necrotic, neoplastic, and fungal and obstruction which resulted from strangulation loop of gut due to herniation, volvulus and irreducible intussusceptions. Developed for veterinary students as a psychomotor skills practice device, the canine intestinal anastomosis simulator is suitable as an introductory model for anastomosis and enterotomy technique (2). The main problems and complications of the intestinal surgery are shock, leakage, wound dehiscence, perforation, peritonitis, stenosis, inadequate healing and finally death (3). Many techniques, materials and devices have been investigated to overcome these problems as laparoscopic intestinal anastomosis by cauterizing laparoscopic linear stapler, intestinal sleeve anastomosis, biofragmentable anastomosis ring and a modified anastomosis technique (4, 5, 6 and 7). Commonly the anastomosis was performed either by eversion, inversion and apposition techniques by using absorbable or non absorbable suture materials (8, 9, 10 and 11) and the invagination technique was a rare used for anastomosis of intestinal resection (12). Therefore the main criteria used in successful any anastomosis technique includes absence of leakage, minimal occlusion of lumen and minimal formation of adhesion and rate of healing (13). Recent studies were proven that the using of cross mattress suture for intestinal anastomosis of oblique intestinal resection result in delay healing process and increase severity of adhesion as compare of transverse technique (14). Hence the aim of this trail was to estimate the results of using cross mattress suture for intestinal anastomosis of oblique intestinal resection as compare to simple interrupted suture.

MATREIALS AND METHODS

Twelve adults local breed dogs of both sexes, their weight and age ranged between 1.4 ± 0.4 year, 15 ± 1.4 kg, respectively were used in this study. Animals divided into two main groups, six animals for each, the animals were kept under same conditions of housing and feeding during operation: Preoperatively animals premedicated with atropine sulphate intramuscularly at a dose of (0.04 mg/ kg B.W), followed 10 minutes later by a mixture of Xylazine 2% and Ketamine 5% intramuscularly at a dose of (3 mg/ kg BW, 15 mg/ kg BW), respectively to induce general anesthesia at the surgical level. The areas from xiphoid cartilage to the pubic symphesis were prepared aseptically. The jejunum was exteriorized, double ligation were made to all mesenteric blood vessels which supply the portion of intestine that will be resected. Then the intestinal content at the site of resection milked carefully, four straight intestinal forceps were placed, two at

each side of the proposed surgical site .The proposed portion of intestine was sharply obliquely transected at about 45 degree angle in between the two intestinal clamps of each side. Then the resecting pieces of intestine were removed and the two ends of intestine were anastomosed with chromic catgut (3-0) as the followings:

Group 1: oblique intestinal anastomosis (Figure, 1-A) by using single layer of simple interrupted suture technique.

Group 2: oblique intestinal anastomosis (Figure, 1-B) by using single layer of cross mattress suture technique. After complete anastomosis the cleft of mesentery was closed with same thread using simple continues suture technique. The exteriorized jejunum was rinsed with warm saline and replaced into the abdominal cavity .The abdominal incision was closed by the routine manner. Post-operative care by using penicillin –streptomycin intramuscularly at a dose of (10,000 IU,10 mg /kg B.W) respectively for 3 consecutive days. And soft food and fluid therapy (glucose 5% intravenously at a dose of 10 ml/kg BW) were given for two days after operation. After, 15 and 30 days of operation, pieces of about 15 centimeter in length of intestine were taken, which included the anastomosis site. The intestinal pieces washed with normal saline and barium sulphate suspension injected into the tied intestinal lumen until it expanded, then radiographs were taken by using 70 Kv and 60 mAs .The percentage of lumen stenosis were calculated by the formula $100[1-2A/(B+C)]$ (15). ,where A ,width of intestine at anastomosis site, B and C for the width of the intestine 2 cm proximal and 2 cm distal to the anastomosis site, respectively .The results were statistically, analyzed using ANOVA and Duncan test at the level of ($P<0.05$). The tissue specimens or biopsy from the anastomosis site were prepared as a routine manner and staining with Hematoxyline and Eosins for histopathological examination (16).

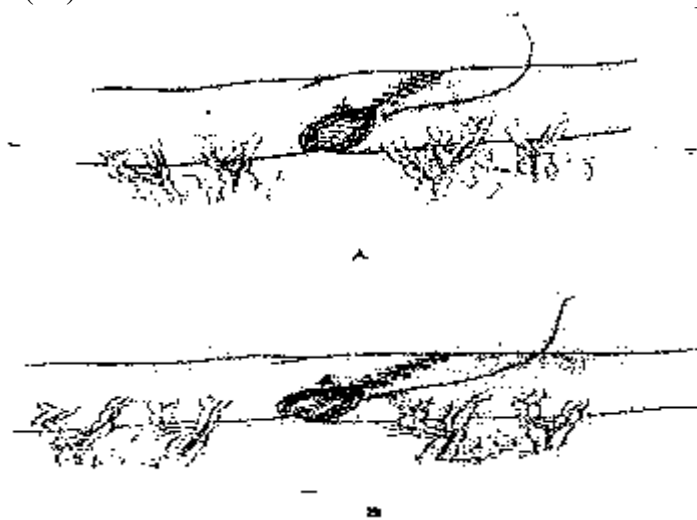


Figure 1: Shows oblique simple interrupted (A) and cross mattress (B) sutures.

RESULTS

Clinical observation revealed that the two oblique intestinal anastomosis techniques were successful in all animals. The postoperative findings demonstrate normal defecation, urination but appetite less than the normal. The gross

observation of the anastomotic site before biopsy collection at 15 days postoperatively was revealed presence signs of redness, swelling, oedematous and remnants of the suture material in two groups .And in 30 days postoperatively, healing occurred and there were no documented leaks and during palpation of each anastomosis sites in all pieces revealed a mild firm consistency fibrous tissue nodule especially with the simple interrupted technique as compare with cross mattress suture technique (Figure, 2 and 3).The postoperative adhesion was invariably observed in the mesentery and around the suture line regardless of the technique of anastomosis. The severity of adhesion was greatest in simple interrupted pattern, which involve the sites of anastomosis and extended into adjacent loop of intestine as well as in some cases extended into abdominal wall, while in cross mattress pattern the adhesion extended from the sites of anastomosis into adjacent mesentery.

The results of contrast radiographic examination exhibited no significant differences in the mean degree of stenosis between group one and group two at 15 and 30 days (Figure 4, 5, 6 and 7), but there was significant differences in mean degree of stenosis within group two after 15 and 30 days $(42.66\%)\pm 7.68$ and $(36.0\%)\pm 4.16$, respectively and within group one, after 15 and 30 days $(45.33\%)\pm 2.66$ and $(38.33\%)\pm 3.33$, respectively (Table, 1). The minimal degree of anastomotic stenosis was seen in group two at 30 days was (36.00%) , whereas more degree of stenosis was seen in group one, at 15 days was (45.33%) . In group one histoathologically, the anastomotic sites exhibited tissue destruction and infiltration of mononuclear inflammatory cells particularly around remnants of suture material at 15 days (Figurers 8 and 9). At 30 days more extensive infiltration of mononuclear inflammatory cell, and tissue destruction in the serosa of intestine (Figures 10 and 11). In group two at 15 days, tissue destruction and infiltration of mononuclear inflammatory cells were seen but they were of a lower degree as compared to group one(Figs., 12and13). At the 30 days the histopathological changes were in the form of presence a thick mature fibrous tissue and minute foci of tissue reaction and presence of remnants of suture material at the site of anastomosis (Figures 14 and 15).

Table 1: The percentage of degree and mean of anastomotic stenosis of G1 and G2.

Groups	No. of animals	Percentage of degree of anastomotic stenosis (AS) 15 days	Mean of (AS) 15 days	No. of animals	Percentage of degree (AS) 30 days	Mean of (AS) 30days
G-1*	1	40%	$45.33\%\pm 2.66$	1	45%	$38.33\%\pm 3.33$
	2	48%		2	35%	
	3	48%		3	35%	
G-2**	1	58%	$42.66\%\pm 7.68$	1	38%	$36.\%\pm 4.16$
	2	34%		2	28%	
	3	36%		3	42%	

No significant difference between G-1 and G-2; a significant difference at $p<0.05$ within G-1 and G-2;

*: simple interrupted suture technique; **: cross mattress suture technique.



Figure 2: Gross pathology at the anastomotic site after 30 days in G.1. showing the presence of fibrous tissue nodules in the subserosal layer.



Figure 3: Gross pathology at the anastomotic site after 30 days in G.2. Note the absence of fibrous tissue nodules in the subserosal layer

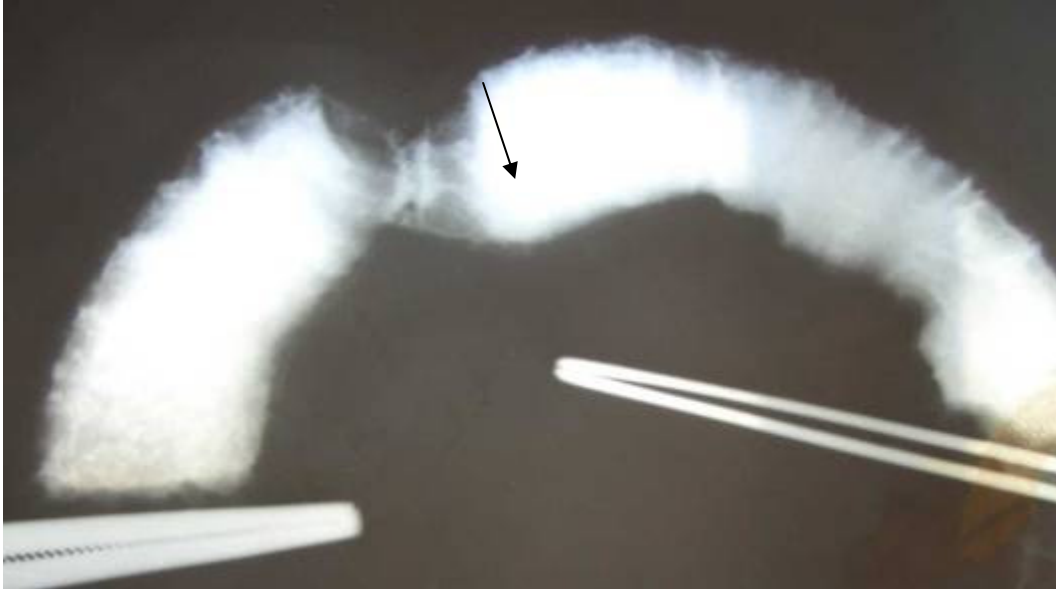


Figure 4: Radiographic image showing stenosis at the anastomatic site after 15 days in group one (arrow).



Figure 5: Radiographic image showing stenosis at the anastomatic site after 30 days in group one (arrow).



Figure 6: Radiographic image showing stenosis at the anastomotic site after 15 days in group two (arrow).

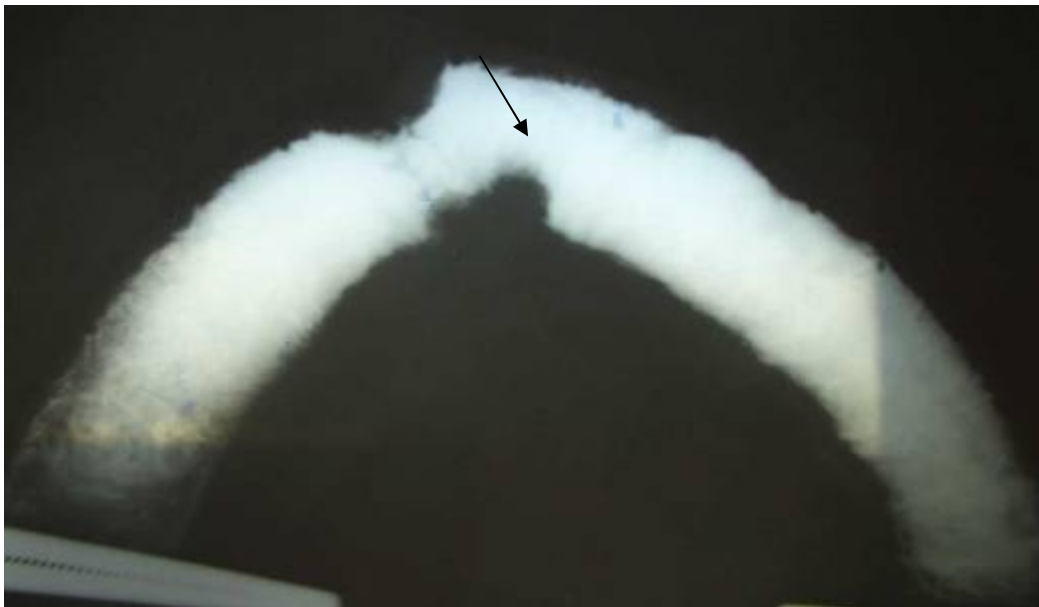


Figure 7: Radiographic image showing stenosis at the anastomotic site after 30 days in group two (arrow).

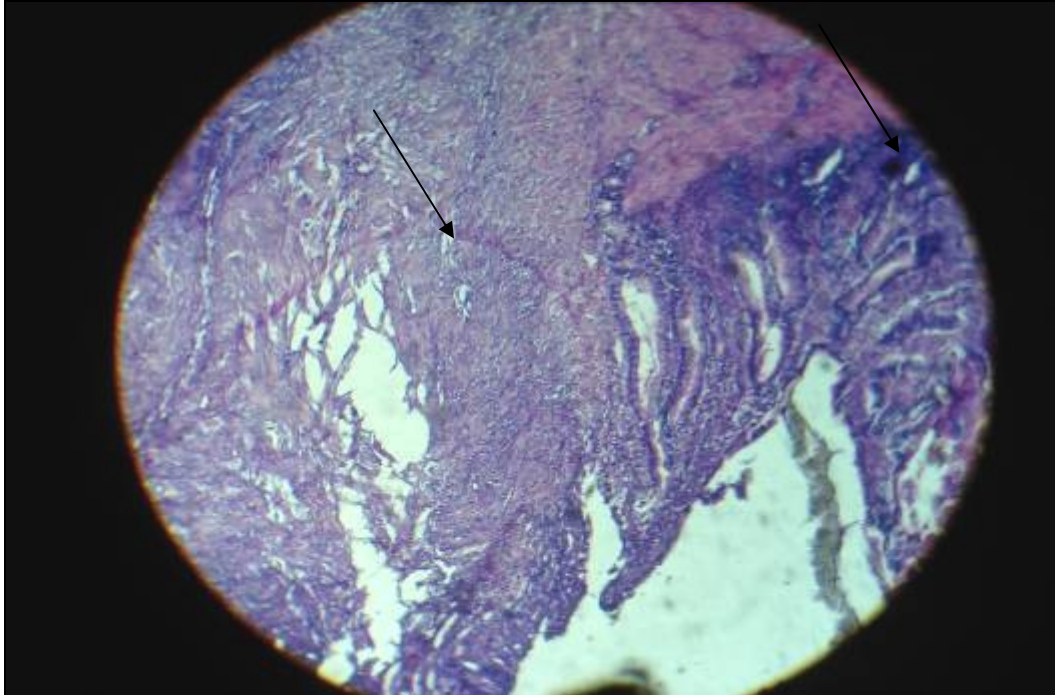


Figure 8: photomicrograph of anastomotic site of the intestine at 15 days post-operative days in G-1. Tissue destruction (arrows) and infiltration of mononuclear cells could be seen (arrows) H & E. X. 75

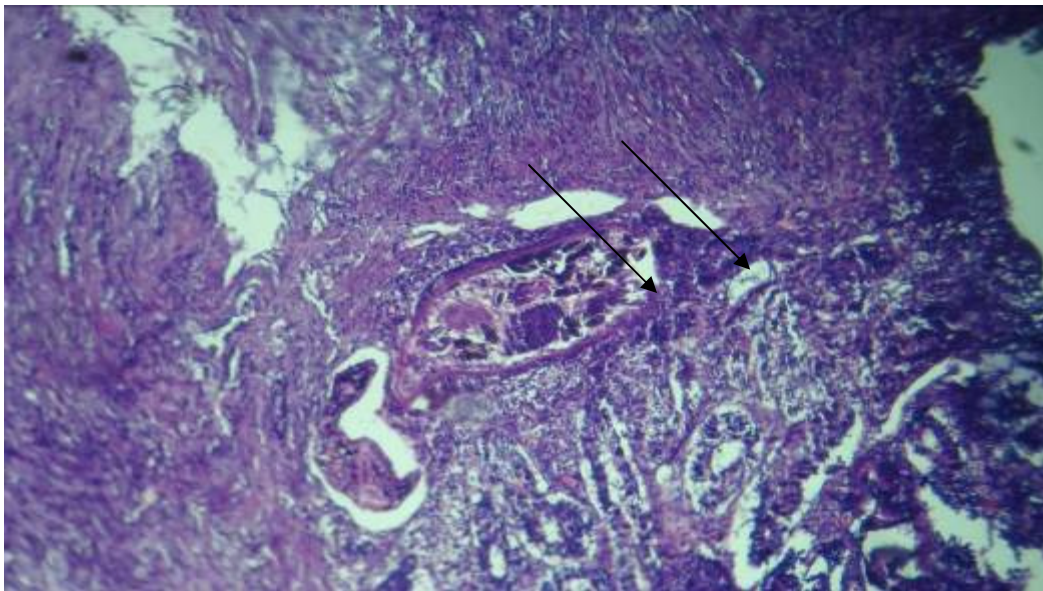


Figure 9: photomicrograph of anastomotic site of the intestine at 15 days post-operative days in G-1, remnants of suture material are evident (arrows). H & E. X. 90

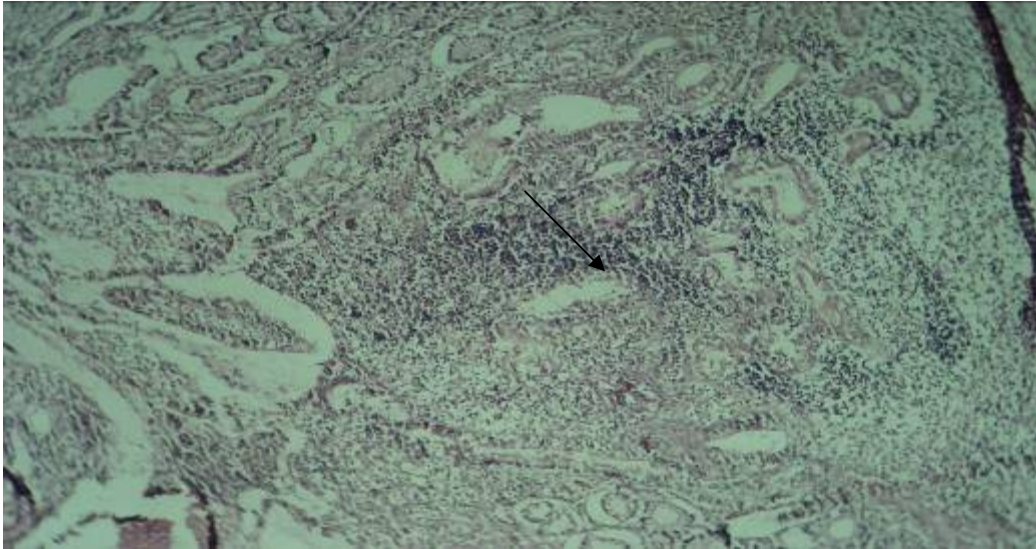


Figure 10: photomicrograph of anastomotic site of the intestine at 30 days post-operative days in G-1, note the diffuse infiltration inflammatory mononuclear cell (arrow). . H & E. X. 90

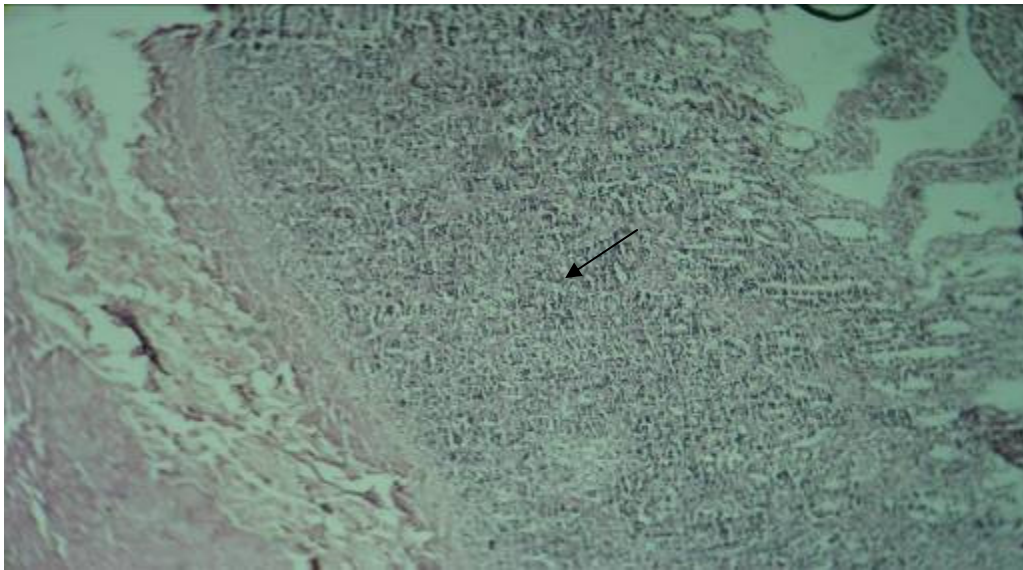


Figure 11: photomicrograph of anastomotic site of the intestine at 30 days post-operative days in G-1, infiltration of inflammatory mononuclear cell in the serosa (arrow). . H & E. X. 90

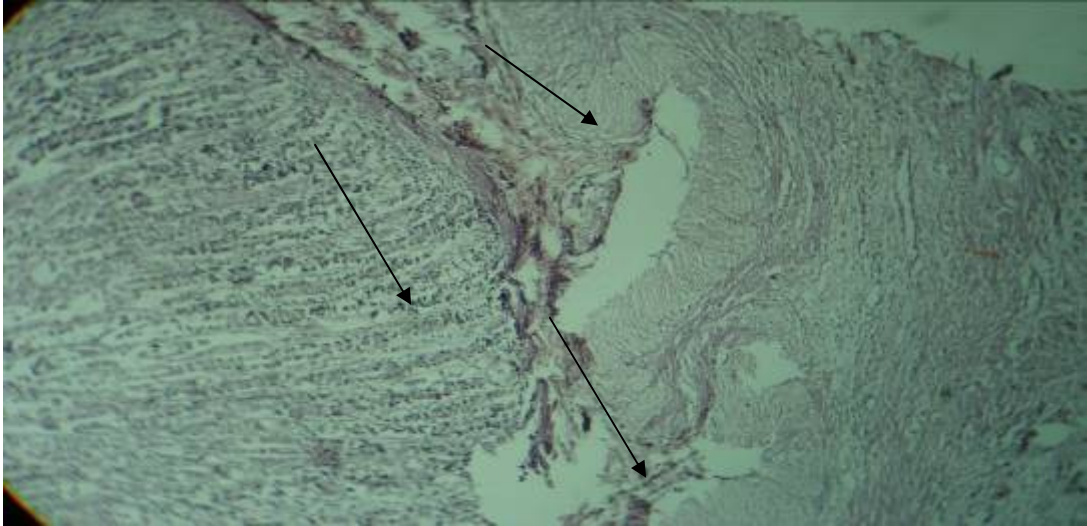


Figure 12: photomicrograph of anastomotic site of the intestine at 15 days post-operative days in G-2, showing infiltration inflammatory mononuclear and suture remnants (arrow). H & E. X. 90

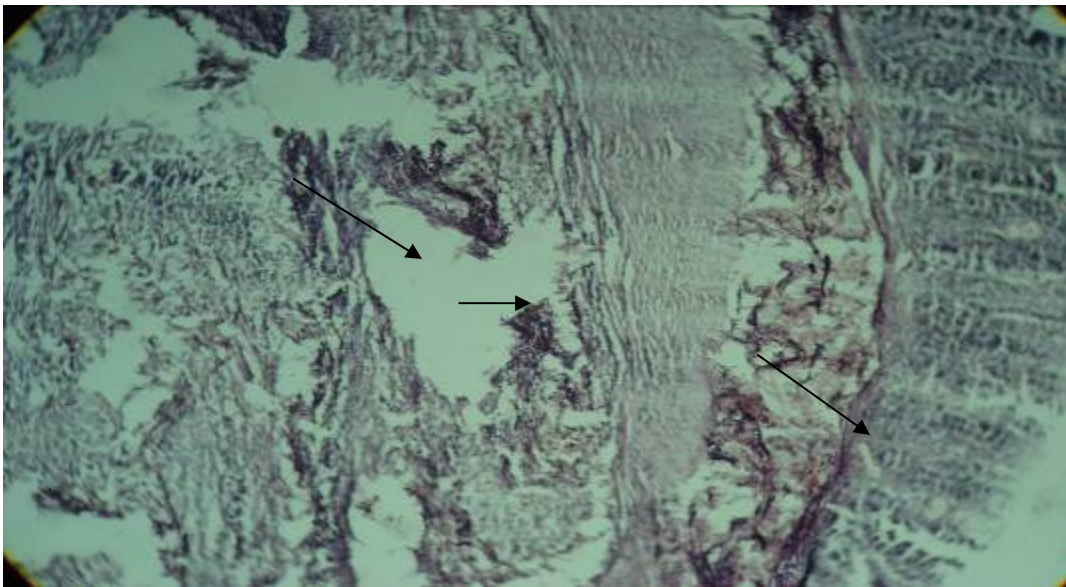


Figure 13: photomicrograph of anastomotic site of the intestine at 15 days post-operative days in G-2, showing tissue destruction and suture remnants at the serosal and submucosal layer (arrow). H & E. X. 90

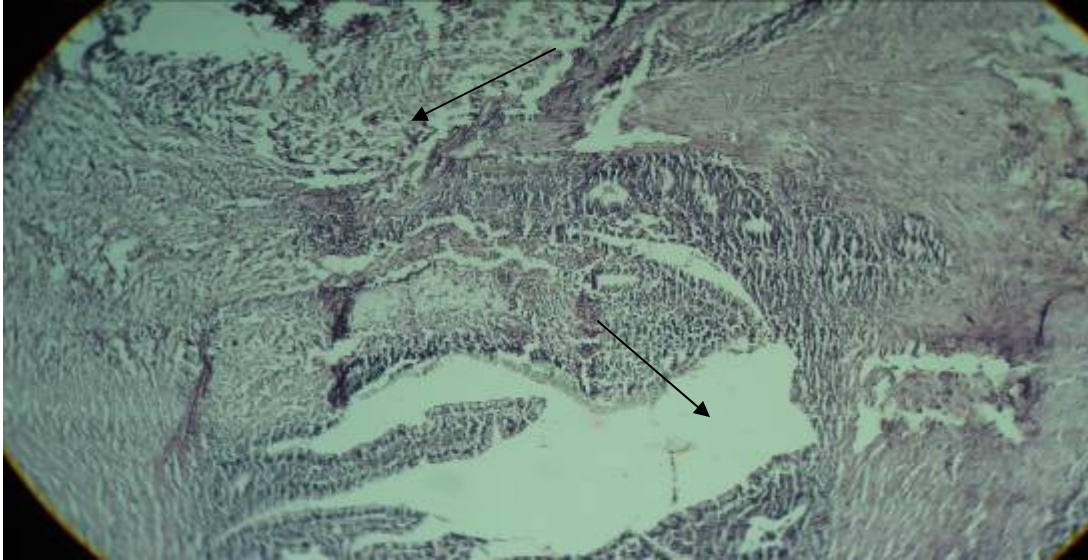


Figure 14: photomicrograph of anastomotic site of the intestine at 15 days post-operative days in G-2, showing extensive tissue destruction at the serosal and submucosal layer (arrow). H & E. X. 75

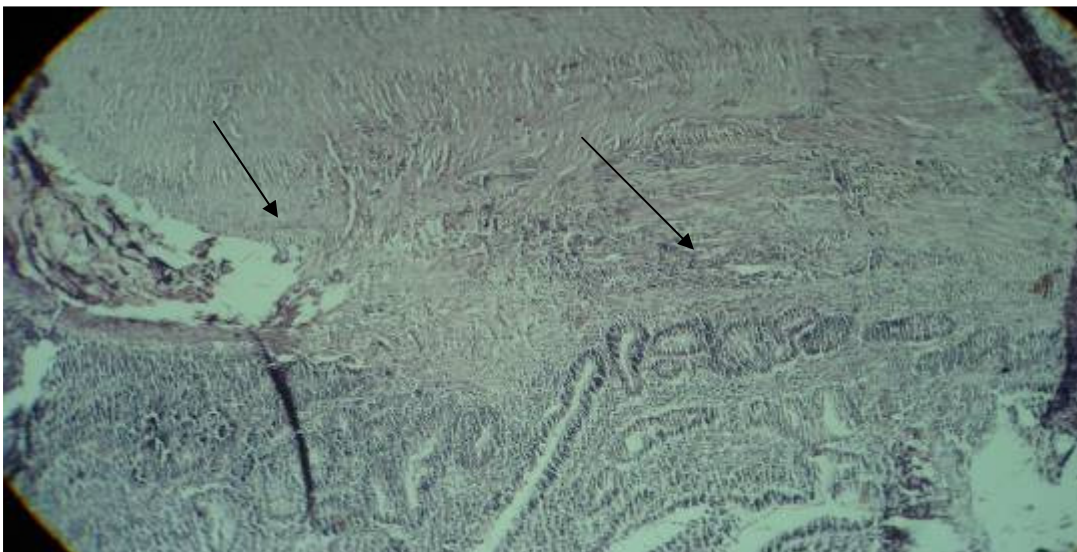


Figure 15: photomicrograph of anastomotic site of the intestine at 30 days post-operative days in G-2, showing thick and mature fibrous tissue with minute foci of mononuclear inflammatory cells (arrow). H & E. X. 75

DISCUSSION

In the present study, the two intestinal anastomosis techniques by using interrupted and cross mattress suture technique were associated with adhesion at the suture line, but their severity was comparatively more in simple interrupted suture than in cross mattress suture. This may be due to more amount of thread and multiple knots as well as association with repeat manipulation as contrast with cross mattress suture that associated with fewer amounts of thread and little

number of knots with decrease of manipulation. On other hands other worker (17) said that, the adhesion occur due to increase in the area of reaction in oblique anastomosis. While others (18, 19 and 20), said that the appositional suture in transverse anastomosis was accompanied by simple inflammation as in simple continuous and modified Gambee techniques. The severity of adhesion was diminished with time in two groups, which exhibited by some histopathological changes such as increase in collagen fiber, fibrous tissue and inflammatory cell at the site of anastomosis .So that, this reaction may effect the degree of anastomatic stenosis in group one and group two at 15 days (45.33%, 42.66%), respectively, when compared with 30 days in group one (38.33%) and in group two (36.0%), (Table-1). The increase of adhesion means more amount of fibrous tissue formation, this may be lead to narrowing of the lumen at the anastomosis site finally stenosis increased, these phenomena may be the main causes of high incidence of stenosis in group one and group two at 15 days as contrast to lower incidence of stenosis that occurs in same groups at 30 days .This results carried by other workers (21). The radiographic study revealed no significant differences in mean degree of stenosis between group one and group two at 15 days and 30 days after operation, this may be due to apposition the intestinal layers in two methods, this consider agree with other workers (22). but there was significant differences in mean degree of stenosis at the level of ($P < 0.05$) within group one and group two after 15 and 30 days, respectively and this may be due to increase metabolism and absorption rate of catgut at 30 days as compared with 15 days which was led to removal of purse string effect that induced by two suture techniques and finally results in increase luminal diameter of intestine at 30 postoperative days.

The results of histopathological examination in group one , represented with extensive tissue damage and inflammation , the damage may be due to more presence of suture material and heavy manipulation of intestine and ischemia ,this disagreement with other workers (20 and 21).Who said that the apposition technique in transverse cutting which resulted in rapped healing. Enteritis occurs due to increase the area of inflammatory reaction at the site of anastomosis this carried with (14).Where as in group two the thick and mature fibrous tissue which appeared in histopathological examination may be resulted in firm of anastomatic site. As well as, this study exhibited that at elapse of time the fibrous tissues became less in amount and the mean degree of stenosis also decrease and this may be related with amount of fibrous tissues. The increase of inflammatory reaction at the site of anastomosis was observed, this may be due to increase the area of anastomosis, and this coincides with other workers (14).

In conclusion, the results of this trail indicated that the use of simple interrupted and cross mattress patterns for anastomosis of oblique intestinal resection are successful in intestinal anastomosis, particularly the cross mattress pattern which exhibited by less degree of stenosis, when compare with simple interrupted pattern.

AKNOWLEDGMENT

The author wish to thanks Prof. Dr. H.I. Alsaadi, for his help in the histopathological part of this study.

REFERENCES

1. Fossum TW. Surgery of digestive system. Chapter 21: Small Animals Surgery. 2nd ed. Mosby 2002; pp: 369-384.
2. Krahwinkel DJ, Richardson DC. Intestine, In: Bojrab MJ (editor). Current technique in small animal surgery 2nd ed. Lea and febiger, Philadelphia 1983; pp: 162-173.
3. Singh AP, Singh GR, Bhargara AK, Somvanshi R. An experimental comparison of single layer suture patterns for intestinal anastomosis in cow and calves. Indian J Vet Surg 1980; 1(2): 47-53.
4. Hardacre JM, Mario M-S, Murata MD, Kazunori AB, Talamini MA. Use of a cauterizing laparoscopic linear stapler in intestinal anastomosis. Surg Laparosc Endosc Percutan Tech 2000; 10(3): 2-8.
5. Fracs RN, Slaven JL, FRCPA KJ, FRACS MJ. Intestinal sleeve anastomosis: A comparative study with End -to -End anastomosis. J Surg Res 1999; 81: 170-173.
6. Maney JW, Katz AR, Pace WG, Hardy TG . Biofragmentable bowel anastomosis ring: comparative efficacy studies in dogs. Surg 1988; 103: 56-62.
7. Allawi AH. Modified suture technique for end-to-end Intestinal anastomosis in dogs. Iraqi J of Vet Sci 2005; 19(2): 123-133.
8. Najafi HA, Altaee A, Alhabbal Z. Alpha loop colostomy. Annals of the College of Med Mosul 2004; 30: 11-13.
9. Francis R, Fress MD. The french connection: An extra mucosal bowel anastomosis technique. Gastrointestinal Surgery 2001; 301: 1426-1429.
10. Hasan NJ. Comparative study of three methods of End-to-End Intestinal anastomosis in dogs. MSc Thesis 2000, College Vet Med, University of Mosul.
11. Ricardo M, Ordorica -Flores, Eduardo B-B. Intestinal anastomosis in children: A comparative study between two different techniques. J Pedia Surg 1998; 33(12): 1757-1759.
12. Al-Hasan AM. Comparative study of three techniques of intestinal anastomosis in horse. MSc thesis 1988, College Vet Med, University of Baghdad.
13. Larsen L and Ballenger GR. Stomach and small intestine In: Archibald J (editor). Canine Surgery .2nd Ed. American Veterinary Publication INC 1974; pp: 555-596.
14. Eesa MJ, Allawi AH. Comparison between transverse and oblique methods of end-to-end Intestinal anastomosis in dogs. Iraqi J Vet Sci 2003; 17(2): 167-175.
15. McAdams AT, Meikle G, Medina R. An experimental comparison of inversion and eversion colonic anastomosis. Disease of colon and rectum, 1969; 12; 1-6.
16. Luna LG. Manual of histological staining methods .3rd ed. McGraw-Hill book Co. New York 1968; pp: 3, 17, and 39.
17. Southwood LL and Baxter GM. Current concepts in management of abdominal adhesion. Vet Clin North Am Equine Pract 1997; 13-417.
18. Dean P and Robertson J. Comparison between three suture techniques for intestinal anastomosis of small intestine in horse. Am J Vet Res 1985; 46: 1282.

19. Ducharme N, Horey F and Baired J. Extensive large colon resection in the pony. In: Surgical procedure and clinical results. *Can Vet Res J* 1987; 51: 66.
20. Ducharme N, Freeman D, Stecke R. Principle of intestinal surgery. In: Auer J (editor). *Equine Surgery*. 1st ed .W.B. Saunders Co, Philadelphia 1992; pp: 325.
21. Reinertson E.A Comparison between three suture techniques for intestinal anastomosis in equidae. *JAVMA* 1976; 169: 208.
22. Rackard S. A review of the techniques and material used in intestinal surgery in small animals. *Irish Vet J* 1994; 74: 262-266.