

COMPARATIVE STUDY OF TRANSVERSE AND OBLIQUE PARTIAL RESECTION OF ESOPHAGUS IN DOG

***Mohammad J. Eesa *E'atela A. Al-Mutheffer *Areeg K. Mahdi**

Department of Surgery and Obstetric, Collage of Veterinary Medicine, Baghdad University, Iraq

(Received 8 December 2009 , Accepted 2 March 2010)

Key words: transverse, oblique, resection, esophagus.

ABSTRACT

This study has been done to evaluate the effect of transverse and oblique anastomosis on esophageal healing. Partial esophagectomy were performed on sixteen adult dogs, animals were divided into two equal groups ,in the group one a transverse anastomosis ,while in group two oblique anastomosis were done . Two layers of simple interrupted pattern were used to closed the anastomosis site, the first layer was oppose the mucosa and submucosa by simple interrupted suture with the knots tided inside the lumen and the second layer was appose muscularis and adventitia by simple interrupted suture using catgut (2.0). The results of histopathological and radiological were revealed that ,the healing of group two was faster than group one ,which manifested by collagen fiber formation with complete mucosal formation in a shorter time compared with group one . In addition to that the mean degree of stenosis was less in second group at 30 days post operation(14.24 ± 0.21), in spite of no significance difference between two groups at the level of $p \leq 0.05$.

INTRODUCTION

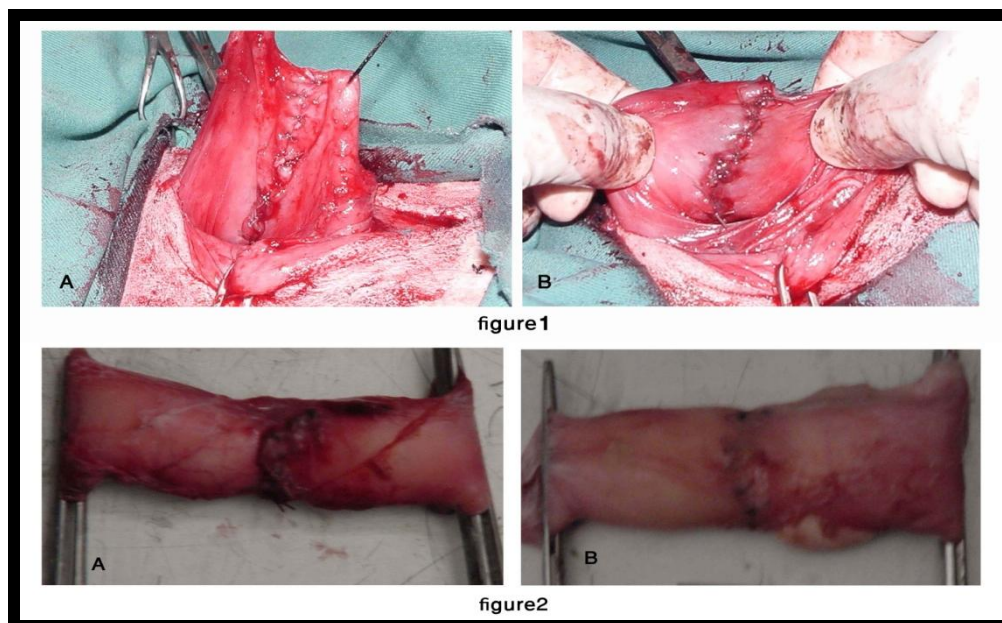
Esophagectomy is an acceptable treatment option for esophageal cancer ,various end stage of benign esophageal complications, and esophageal foreign bodies which are a common clinical problem in dogs and can become life threaten(1,2).The approach to the esophagus include transthoracic esophageal resection through a right or left thoracotomy , transhiatal blunt esophageal resection by labarotomy(3)or cervical technique(4).The hole stomach, gastric tube(5), jejunum(5) ,colon(7),and autologous muscle tissue(8), may be used as substitutes for the resected esophagus. Since esophageal surgery has historically been associated with greater risk of incision dehiscence than surgery on other portions of the alimentary tract(9) .The anastomosis technique had been developed but still the leakage and stenosis were the most important complications(1). Such complications were causes of postoperative morbidity and mortality after esophagectomy (10), stricture also was an important complication after esophagus surgery and greatly affected swallowing and quality of life (11). The lack of serosa necessitate more careful apposition of esophagus to prevent

dehiscence (12).The ideal protocol would be a resection of esophagus injury followed by anastomosis of remaining segment, without tension (13). Less vascularity and excessive tension at suture line appear to be the major reason offer the healing problem (14). The objective of this study was to evaluate the degree of healing and complications of transverse and oblique esophageal anastomosis in dogs.

MATERIALS AND METHODS

Sixteen adult healthy cross breed dogs of both sexes weighing between 15-20kg and aged, between 1.5 – 4 years were used. The animals were divided into two equal groups. The dogs were given prophylactic antibiotic consisting penicillin and streptomycin at a dose of 10,000 IU and 20 mg/kg BW, intramuscular respectively before one hour of operation. The animals were given atropine sulphate in a dose of 0.04 mg /kg B W as premedication followed 15 minutes later by a mixture of ketamine hydrochloride 15 mg /kg B W and xylazine hydrochloride 5mg/kg B W intramuscular. Under aseptic technique, ventral midline cervical incision was made after positioned the dog in dorsal recumbency.The esophagus was exposed by blunt dissection in between trachea and sternomandibularis muscle at the left side ,and a curved artery forceps was used to lift a part of esophagus, then 1cm of it was resected transversely in group one and obliquely in group two. In both groups two layers of simple interrupted closure was used for anastomosis by 2-0 chromic catgut, the first layer appose the mucosa and submucosa with the knots tied inside the lumen ,and the second layer apposes the muscularis and adventitia also by simple interrupted suture but the knots tied at the surface of the esophagus , (15,16) (Fig.1). Fluid therapy of dextrose 5% in a dose 20 ml / kg(17) for two days post operation, soft food was provided for one week and later the animals were reintroduced to solid food gradually after 2 week. Except one case in group one which was suffered from regurgitation of food and fluid this case was maintained by milk and soft food for several days until the regurgitation was disappear. The specimens were taken after 15 and 30 days after surgery(four animals of each period), immediately after euthanasia of animals, the segments of esophagus were harvested, one end of the resected esophagus was claimed and filled with Barium sulphate (25%) then closed the second end to prepared for radiographic evidence(Fig.2), The degree of stenosis was determined by using the formula [Stenosis index % = $100(1-2A/B+C)$] A: diameter in centimeters at anastomosis site, B and C: diameter in centimeters at two centimeters above and below the anastomosis site (18). Then biopsies were taken from the site of anastomosis and kept in 10% buffer formalin solution for routine histopathology. Statistical analysis of variance and L.S.D. at the level of $p \leq 0.05$ was

used to determine the difference between two groups at a period of 15 and 30 days after operation.



(Figure 1): Suture the esophagus A:-The first layer opposes the mucosa and submucosa by simple interrupted suture with the knot tied inside the lumen B:-the second layer appose the muscularis and adventitia by simple interrupted suture in group one.

(Figure2): The anastomotic site after filling with barium sulphate on two animal in group one after 15 days (A) and 30 days (B).

RESULTS

The surgical procedures were succeeded in all dogs ,except one dog in group one which suffered from dysphagia ,regurgitation of food and fluid for the first week and swelling in the neck, this swelling was disappeared gradually after several days. At postmortem findings were exhibited that simple adhesion between the site of anastomosis and surrounding tissue in most of experimental animals. The mean degree of stenosis of two groups during 15 and 30 days after operation were revealed that the low degree of stenosis was recorded in group two after 30 days of operation 14.24 ± 0.21 at the level of $p \leq 0.05$ and higher degree of stenosis recorded in group two after 15 days of operation $15,43 \pm 0.47$ at the level of $p \leq 0.05$ table (1). The L.S.D. =2 this revealed that there was no significant differences between the two groups at the level of $p \leq 0.05$.

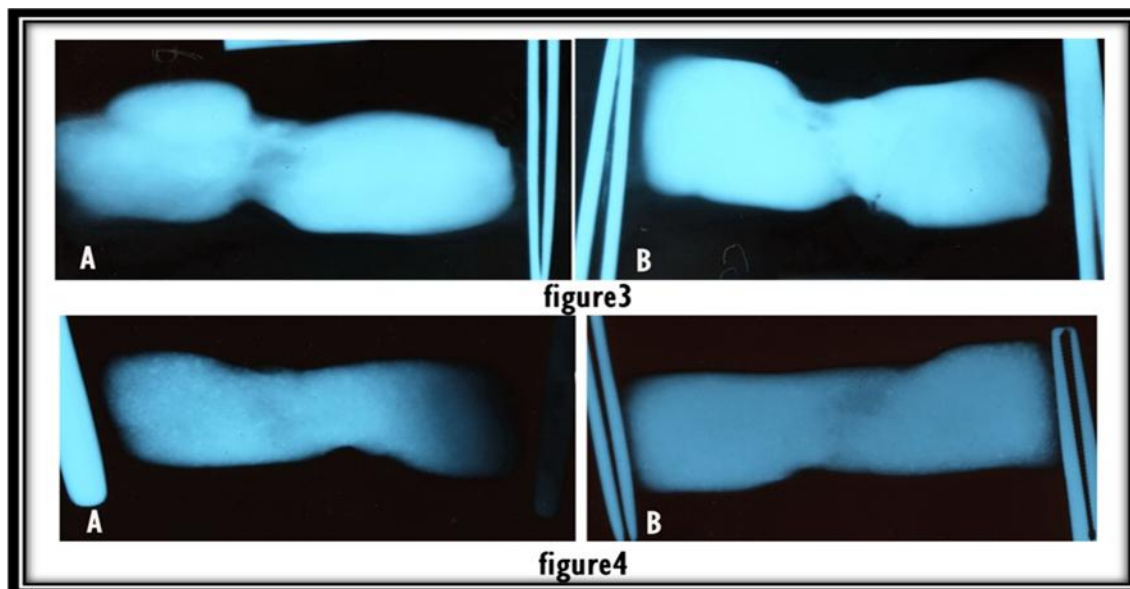
groups	Mean degree of stenosis at the day 15	Mean degree of stenosis at the day 30
one	14.78±0.74	15.12±1.6
two	15.43±0.47	14.24±0.21

(Table, 1):

The mean

degree of stenosis at the anastomosis site in two groups.

The radiographic pictures show the anastomotic site after 15 and 30 days of operation in two animals of group one (Fig.3) and two animals of group two (fig.4)



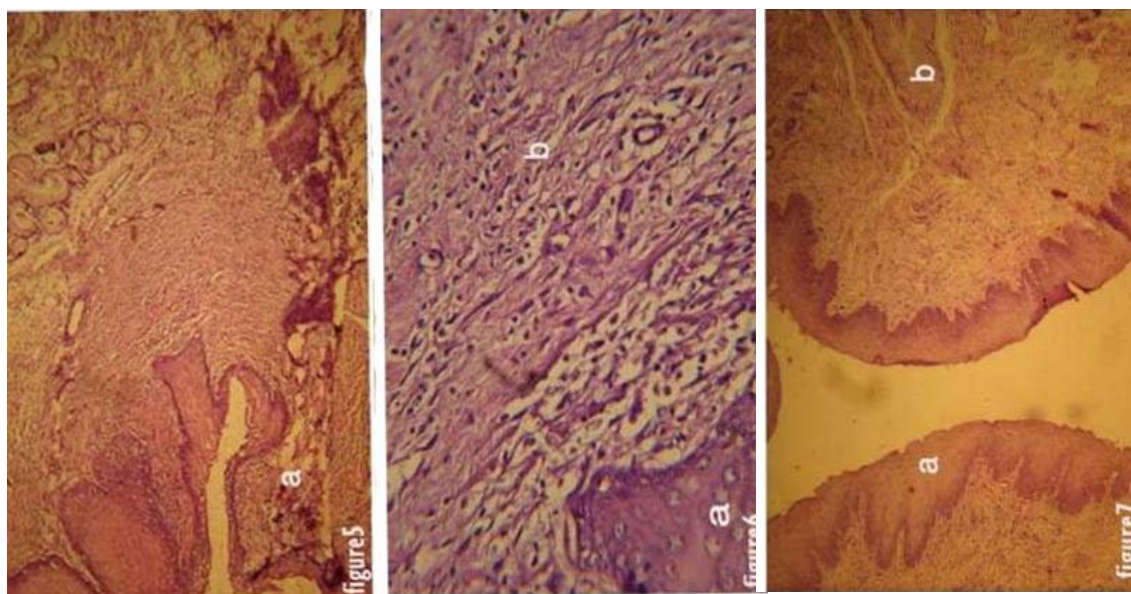
(Figure,3):The anastomotic site after 15 days A and 30 days B, in two animals of group one .

(Figure,4): The anastomotic site after 15 days A and 30 days B, in two animals of group two.

The histopathological examination at 15 days of operation on group one was appeared that multiple layers of stratified squamous epithelial cells at the region of the site of anastemosis, which was completed in some areas and incomplete in the others. Increase thickness of lamina propria which was made up of granulation tissue and infiltration with mononuclear inflammatory cells.The loose connective tissue containing angioblast proliferation with formation of blood vessels in the submucosal layer and hyperplasia of the mucus glands, hyaline degeneration of the muscle fibers near the site of anastemosis, (Fig. 5 and 6). The fragmentation of suture material was surrounded by granulation tissue and infiltration with inflammatory cells, also showed thick layer of adventitia which consists of a loose connective tissue containing blood vessels. At the 30 days post operation was observed the multiple layer of stratified squamous epithelial cells in the anastomotic site was appeared

semi-complete at the region of anastomosis, thick granulation tissue in lamina propria of mucosa similar to core invagination in between the mucus glands in submucosa, and numerous mucus glands surrounding by granulation tissue .Small fragments of suture material which infiltrated by mononuclear cells. Anew blood vessels were distributed in between granulation tissue. The histopathological section exhibited that mature fibrous connective tissue contact the muscular layer and filled the gap of the incision in submucosa (Fig.7).

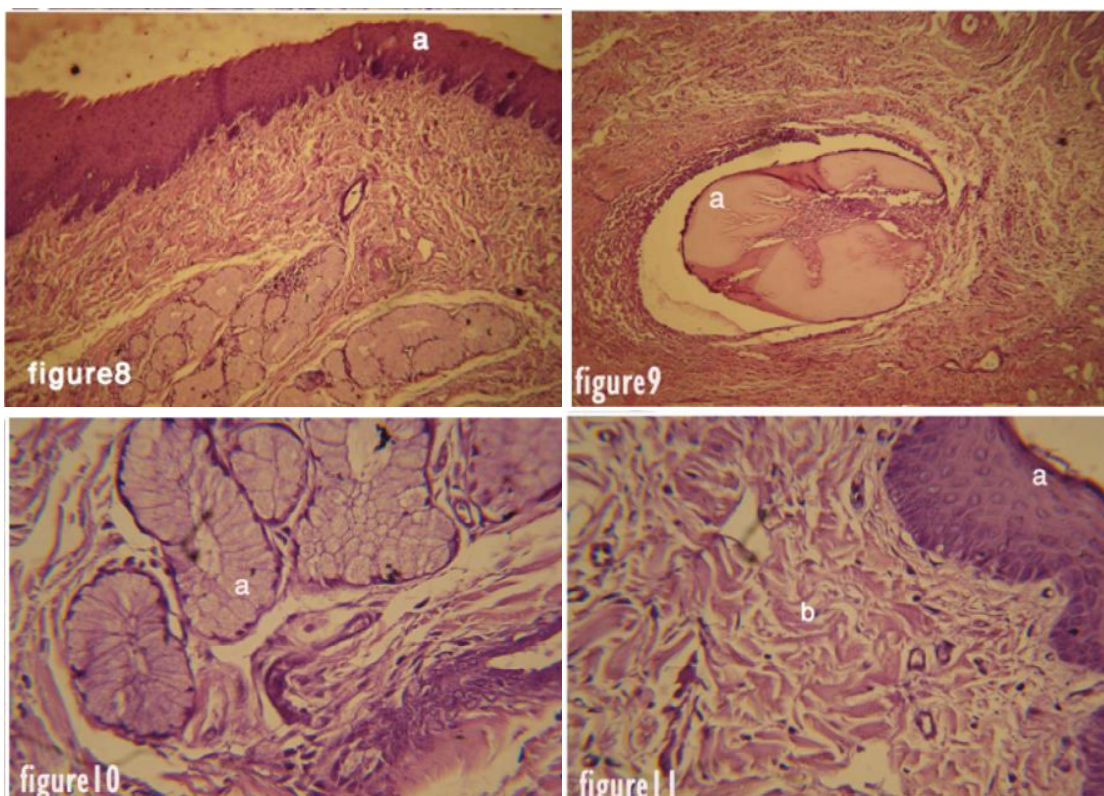
In group two at the 15 days of operation multiple layers of stratified squamous epithelial cells in the region of anastomosis .There are inflammatory cells between muscular layers with immature fibrous connective tissue in the incision with cellular debris in another site. The gap between the two ends of incision filled with cellular fibrous connective tissue, which infiltrated with mononuclear cells and epithelial lying cells proliferation from the adjacent end and extend over fibrous connective tissue (Fig. 8).Fragmentation of suture material, surrounding by granulation tissue and infiltration with inflammatory cells (fig. 9). While at 30 days after operation, there is mature fibrous connective tissue, and less cellular with high condense collagen fiber with regulate direction attach the muscular layer, and numerous mucus glands. Complete epithelial layer over the mature fibrous tissue (fig.10 and11).The fragment of suture material still present and surrounding by inflammatory cells.



(Figure,5) :Histopathological section , show the anastomosis site (a) incomplete stratified squamous epithelial cells 15 days post-operation in group one H&E X 40 .

(Figure,6) : Multiple layers of stratified squamous epithelial cells (a) and connective tissue (b) 15 days post operation in group one . H&E X 40 .

(Figure,7) : Multiple layers of stratified squamous epithelial cells (a) mucus gland (b)fibrous connective tissue at 30 days post- operation in group one . H&EX 10



(figure,8):Complete multiple layers of stratified squamous epithelial (a) at 15 days post-operation in group two. H&EX 10

(Figure,9):Fragment of suture material surrounding by granulation tissue and infiltration with inflammatory cells (a) at 15 days post-operation in group two. H &EX 40

(Figure,10):Hyperplasia of mucus glands(a) 30 days post- operation in group two. H&E X10

(Figure,11):Complete formation of stratified squamous epithelial cells(a) and high condense collagen fibrous (b) at 30 days post operation in group two .H&EX40

DISCUSSION

In spite of advanced surgical techniques and improved preoperative and postoperative care for esophagus anastomosis ,but the complications were stilled present such as leak and stricture of anastomosis site .This may be due to the esophagus of cervical has incomplete serosal covering ,thus the fibrin seal help to decrease leakage ,in most of other organs may be un available in esophagus. One animal of group one ,suffer from doughy swelling at the site of operation ,with dysphagia and regurgitation of food ,this may be due to partial stenosis with accumulation of food above the anastomosis site after starting of given solid food ,this

agree with the other workers (19). In both groups there was no evidence of leak or fistula at the anastomosis site, this may be related to the uses of double layers of hand sewn simple interrupted suture pattern. This coincide with (16), whom said that, the healing was superior histologically with the double layer closure in dogs. The healing of anastomosis site on group two is better than group one, this may be due to the blood supply of the obliquely resection more than the transverse resection and also may be related with increasing the length of oblique line which crossing with new blood vessels originated from surrounding blood vessels of the adjacent anastomosis line. This phenomena confirms by other workers, whom said that the segmental esophageal blood supply may be a factor in poor healing following esophageal anastomosis (20). In addition to that, the outer longitudinal layer and inner circular layer of esophageal muscles may be play an important role in perform tension at anastomosis site. It was believed that the tension of obliquely line were distributed on a larger area when compare with tension of transverse line which limited at the vertical line with the long axis of esophagus. This technique may be contributed the healing of obliquely resection more than transverse resection. These our results were confirmed by other worker, that said, tension and motion at suture line are factors that contributes to leakage or dehiscence of esophageal repaid (21).

The histopathological study at a period of 15 days post operation in group two were revealed that semi complete of stratified squamous epithelial cells and the gap filled with immature fibrous connective tissue, that means the blood supply was good and new blood vessels formation between connective tissue. While in the group one at the same period, the layer of mucosa was incomplete. The results at a period 30 days post operation in group two showed mature fibrous connective tissue and high condense collagen fibers with regulate direction attach the muscular layer and complete epithelial layer over the mature fibrous tissue. But in group one, less degree of healing when compared with group two. This may be related to the amount of blood supply to the oblique and transverse incision (21), who said that the blood supply are important roles to enhance healing through increase formation of granulation tissue with early angioblast proliferation and provides nutrition to the site of anastomosis and balance H⁺ that leads to speed the healing process.

Radiological findings exhibited that, in group two the mean degree of stenosis decrease at 30 days after operation (14.24 ± 0.21) as compared with 15 days (15.43 ± 0.47). This phenomena indicated that the healing was completed and faster than group one. The results confirmed by histopathological findings, which indicate that mature fibrous connective tissue in group two, while immature fibrous tissue in group one this finding agreed with other

authors(22, 23,24),that said continued and formation of fibrous tissue was indicated incomplete healing .

In conclusion of this study indicated that the healing of group two is faster than group one, characterized by mature fibrous tissue and collagen fiber which manifested by decrease mean degree of stenosis when compared with group one.

دراسة مقارنة للتفهم المائل والمستعرض للقطع الجزئي للمرئ في الكلاب

*محمد جواد عيسى *انتلاف عبد الامير المظفر *اريج كامل مهدي
*فرع الجراحة والتوليد- كلية الطب البيطري- جامعة بغداد - بغداد - العراق

الخلاصة

تهدف هذه الدراسة الى تقييم تأثير التفهم المائل والمستعرض على التئام المرئ؛اجريت الدراسة على ستة عشر كلبا بالغاً حيث قسمت حيوانات التجربة الى مجموعتين متساويتين، المجموعة الاولى استعملت طريقة التفهم المستعرض بينما استعملت طريقة التفهم المائل في المجموعة الثانية اظهرت نتائج الفحص الشعاعي والنسجي حصول الالتئام في المجموعة الثانية بصورة اسرع مما عليه في المجموعة الاولى والذي يتميز بتكون الياف الكولاجين مع تكوين الكامل للمخاطية في وقت اقصر مقارنة مع المجموعة الاولى، بالاضافة لذلك كان معدل درجة التضيق اقل مما هو عليه في المجموعة الثانية عند اليوم 30 بعد العملية (14.24 ± 0.21) بالرغم من عدم وجود فروقات معنوية بين كلا المجموعتين عند المستوى ($p \leq 0.05$).

REFERENCES

- 1- Houlton J F, Herrtage M E ,Taylor P M ,et al..Thoracic esophageal foreign bodies in the dog: a review of ninety cases. J Small Anim Pract 1985;26:521-536.
- 2- Kyles A E. Surgical diseases of the esophagus. In: Slatter DH. ed.*Textbook of Small Animal Surgery* .3rd ed Philadelphia :W B Saunders Co. 2003 :573-591.
- 3- Orringer M B ,Marshall B ,and Iannettoni MD. Transhiatal esophagectomy for treatment of benign and malignant esophageal disease.World J Surg 2001;25:196.
- 4- Parker N,and Caywood D. Surgical diseases of the esophagus. Vet Clin North Am 1989 :17: 333.
- 5- Walther B,Johansson J ,Johnsson F, Holstein C ,and ZillingT. Cervical or thoracic anastomosis after esophageal resection and gastric tube reconstruction: A prospective randomized trial comparing sutured neck anastomosis with stapled intrathoracic anastomosis . Ann surg 2003 :238(6):803-814 .
- 6- Bouayad H ,Caywood D D, Lipowitz A J ,and Liepold H W. Replacement of the cervical and thoracic esophagus in using free jejunal autografts .J Invest Surg . 1993: 6 (2):157-176.
- 7- Holmberg D L, Kumza A B , and Millrr C W . Free bowel transfer for esophageal reconstruction in the dog. Microsurgery 1991;12:140-144.

- 8-Badylak S F, Vorp D A ,Spievack A R, Byrd A S ,Hanke J, Freytes D O, Thapa A, Gilbert T W , and Nieponice A .Esophageal Reconstruction With ECM and Muscle Tissue in a Dog Model. J Surg Res. 2005: 128:87-97.
- 9- Kim S H ,Lee K S, Shim Y M ,Kim K ,Yang P S ,and Kim T S . Esophageal resection : Indications, Techniques, and Radiologic Assessment. Radiographic. 2001:21:1119-1137.
- 10- Orringer M B ,Marshall B ,and Lannettoni M D .Elimination the cervical esophagogastric anastomotic leak with a side-to-side stapled anastomosis. J Thorac Cardiovasc Surg 2000:119:277-288.
- 11- Rice T W. Anastomotic stricture complicating esophagectomy.Thorac Surg Clin. 2006;16:63-73.
- 12- Hoffer R E .Surgical disease of esophagus In: *Slatter DH.ed. Text book of Small Animal Surgery*.Philadelphia: W B Saunders Co. 1995:654-679.
- 13- Delikaris K PH ,Hatzipantelis K D , Filintatzi C , Kotakido R E , Kitis G , and Raptopoulus D. The use of a dura mater patch to cover esophageal defect of different size :an experimental study in chickens . Euro J of surg. 1999:165: 151-157.
- 14-Lee H B ,Alam M R ,and Kim N S. Reconstruction of the oesophagus using pedicle diaphragm and omentum flaps in a dog :a case report .Veterinari Medicina . 2008: 53(4):224-228.
- 15-Murakami M, Sugiyama A, IkegamiT, Ishida K ,Maruta F ,Shimizu F ,Ikeno T, and Kawasaki S. Revascularization using the short gastric vessels of the gastric tube after subtotal esophagectomy for intrathoracic esophageal carcinoma .J Am Coll Surg. 2000:190(1):71- 77 .
- 16- Oakes M G ,Hosgood G , Snider T G , Hedlund C S ,Crawford P.Esophagotomy closure in the dog.A comparison of a double –layer appositional and two single-layer appositional technique. Vet Surg. 1993: 22:(6)451-456.
- 17-Waterman A E. Fluid therapy and intensive care In Chandler E A, Thompson D J, Sutton J B, Price C J, eds. *Canine medicine and therapeutics*,3rd. ed. Australia:Blackwell Science Ltd.pp.450.
- 18-Athar M T, Chaudhry N L, Shako R K ,and Khan M A .Studies on end to end colonic anastomosis in the dog :A comparison of technique .Acta Vet Hung .1996 :44:349-354 .
- 19- Collard J M , Romagnoli R ,Goncette L , Otte J B and Kestens P J. Terminalized semi mechanical side –to side suture technique for cervical esophagogastrostom .Ann Thorac Surg. 1998: 65:814-817.

- 20-Williams D B ,and Payne W S. Observation on esophageal blood supply . Mayo Clin Proc. 1982:57:448.
- 21- Kai Z ,and Yihua Y. Use of pedicle momentum in oesophagogastric anastomosis : Analysis of 100 cases .Anna Royal Coll Surg Eng . 1987:69:209-211.
- 22-Kumar N , Chaudhary R J ,and Singh K. Histomorphological studies on the effect of suture materials and techniques after cervical esophageal end-to-end anastomosis in dogs .Indian J.Anim. Sci .1994: 64 :683-685.
- 23-Johnson S E ,and Sherding R G .Diseases of the esophagus and disorders of swallowing .In : Birchard S J , and sherding R G (ed).*Saunders Manual of Small Animal Practice*. Philadelphia : W.B.Saunders Com.1994:630-643.
- 24- Lecoinder P , and Cador J .Disorders of the esophagus in domestic carnivores. Eur J Com Anim. 1996 :6:25-40.