

Comparison of Two Suturing Techniques in Tracheobronchial Anastomosis Following the Wedge Carinal Resection in Dogs

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Summary

Tracheobronchial resection in humans is a still problem in lung cancer invading the carina, because there is not a standard surgical procedure. This study aimed to compare postoperative complications and histopathological results of simple continuous and simple interrupted suturing techniques in tracheobronchial anastomosis following the wedge carinal resection in dogs. Twelve mongrel dogs were divided into A and B groups. Right pneumonectomy with wedge carinal resection technique was performed under general anesthesia, and then tracheobronchial resection line was sutured simple continuously in group A and simple interruptedly in group B. The dogs were checked during two months in terms of postoperative complications, and euthanized at the end of two months to evaluate tracheobronchial anastomosis lines histopathologically. No postoperative complication was encountered in group A; but, 2 dogs in group B died due to respiratory failure on postoperative 4th and 12th days. Autopsy of the dogs revealed tracheobronchial dehiscence and opening of the simple interrupted suturing line, which was considered operative technique failure of suturing. Histopathologically, the sections taken from tracheobronchial anastomosis line had similar microscopic results in both group. Statistically, Fisher's exact test was applied between groups to determine the differences with regard to postoperative complications and histopathological results. There was no statistically significant differences between the groups in postoperative complications and histopathological results. In conclusion, operative technique failure of suturing is still common in tracheobronchial anastomosis; however, taking the histopathological results of the study into consideration, it has been implied that both suturing technique can be performed in tracheobronchial anastomosis following the wedge carinal resection.

Keywords: Dog, Suturing, Tracheobronchial anastomosis, Wedge carinal resection

Köpeklerde Kama Karinal Rezeksiyon Sonrası Trakeobronşiyal Anastomozda İki Dikiş Uygulama Tekniğinin Karşılaştırılması

Özet

Standart bir cerrahi prosedür olmadığından dolayı insanlarda karinaya yayılmış akciğer kanserlerinde trakeobronşiyal rezeksiyon hala problemdir. Bu çalışma köpeklerde kama karinal rezeksiyon sonrası trakeobronşiyal anastomozda basit sürekli ve basit ayrı dikiş tekniklerinin postoperatif komplikasyon ve histopatolojik bulgularını karşılaştırmayı amaçlamaktadır. Oniki melez köpek A ve B gruplarına ayrıldı. Kama karinal rezeksiyon tekniği ile genel anestezi altında sağ pnömonektomi yapıldı ve sonrasında trakeobronşiyal rezeksiyon hattı grup A'da basit sürekli ve grup B'de basit ayrı olarak dikildi. Köpekler postoperatif komplikasyonlar bakımından iki ay boyunca kontrol edildi ve ikinci ayın sonunda trakeobronşiyal anastomoz hattını histopatolojik olarak değerlendirmek için ötenazi edildi. Grup A'da postoperatif komplikasyon görülmedi ancak grup B'de 2 köpek postoperatif 4 ve 12. günlerde solunum yetmezliğinden dolayı öldü. Köpeklerin otopsi trakeobronşiyal dikiş hattında bozulma ve dikiş uygulamasının operatif teknik başarısızlığı olarak düşünülen basit ayrı dikiş uygulanan hattın açıklığını ortaya çıkardı. Histopatolojik olarak, trakeobronşiyal anastomoz hattından alınan kesitler her iki grupta benzer mikroskopik bulguları gösterdi. İstatistik olarak, postoperatif komplikasyon ve histopatolojik bulgular yönünden gruplar arasındaki farklılıkları belirlemek için Fisher'in kesin testi uygulandı. Postoperatif komplikasyon ve histopatolojik bulgularda gruplar arasında istatistik olarak önemli farklılık bulunmadı. Sonuç olarak dikiş uygulamasının operatif teknik başarısızlığı trakeobronşiyal anastomozda hala yaygındır. Ancak, çalışmanın histopatolojik bulguları göz önüne alındığında kama karinal rezeksiyon sonrası trakeobronşiyal anastomozda her iki dikiş tekniğinin kullanılabilirliği kanısına varıldı.

Anahtar sözcükler: Köpek, Dikiş uygulama, Trakeobronşiyal anastomoz, Kama karinal rezeksiyon



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INTRODUCTION

Bronchial stump closure following pneumonectomy is technically challenging because of poor bronchial stump vascularity and other factors, such as bronchial stump infections and inflammatory reactions¹⁻³. In cases where cancer has already infiltrated the main bronchus, bronchoplastic procedures are used in humans to save disease-free parenchyma^{3,4}. In lung cancer invading the carina, resection of the lung parenchyma within disease-free margins is indicated^{4,5}. If there is a proximal tumor extension into the carinal site, the alternative tracheo-bronchial resection techniques are considered¹.

The morbidity and mortality after carinal resection are significant, and the postoperative prognosis is not good^{5,6}. However, previous studies from highly experienced centers have reported their surgical results with the acceptable mortality and morbidity⁶.

Since there is not a standard surgical procedure on this region, resection of lung cancer invading the carina is still problem in humans⁵. Here, simple continuous and simple interrupted suturing techniques in tracheobronchial anastomosis following the wedge carinal resection were compared with respect to postoperative complications and histopathological results in dogs.

MATERIAL and METHODS

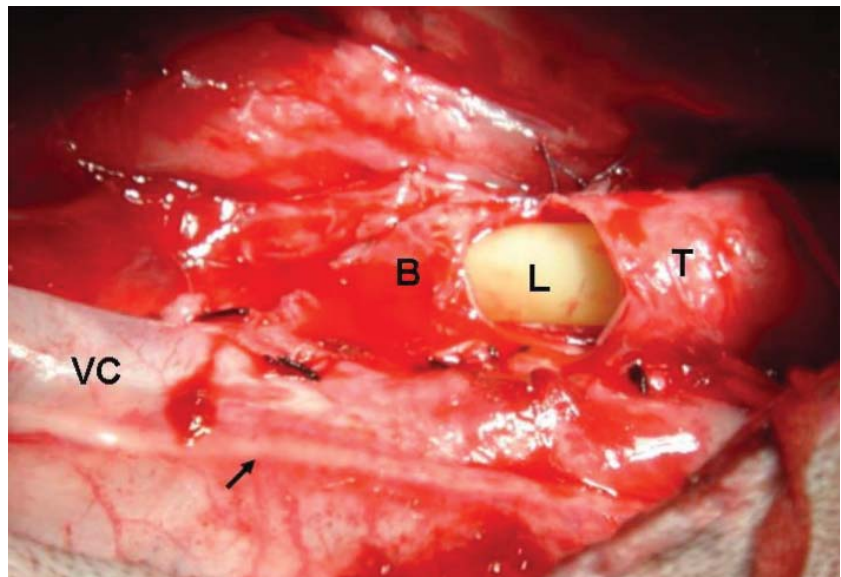
Twelve mongrel dogs were cared in compliance with the European Convention on Animal Care and used upon approval of the Uludag University Faculty of Medicine Ethics Committee (reference: 14.12.2004/3). Median weight of the dogs was 20±2 kg and they had not any systemic pathology. The dogs were undergone right intercostal thoracotomy, and then right pneumonectomy with the wedge carinal resection technique. Tracheobronchial

anastomosis was performed with simple continuous suturing in group A (n=6) and simple interrupted suturing in group B (n=6).

The dogs were induced with thiopental Na (Pentothal sodium®, Abbott, UK) after premedication with xylazine HCl (Alfazyne®, Egevet, Turkey). General anesthesia was achieved with 2% isoflurane (Forane®, Abbott, UK) following endotracheal intubation. Respiration was ensured with mechanic ventilation (15 ml/kg tidal volume, respiration rate 15/min and 25 cm H₂O airway pressure). The dogs were monitored during surgery with the monitors of SPO₂, end-tidal CO₂ and ECG. All operations were performed by the same surgeons. The right thoracic wall was prepared for surgery and right intercostal thoracotomy was performed from 4th intercostal space. Individual arteries and veins of the lung lobes were ligated and trachea was suspended with the tapes. The wedge carinal resection was performed with surgical blade and one-lung ventilation was established with the intraluminal insertion of an optimal size latex tube (Fig. 1). Trachea and bronchus were approximated manually to adequate ventilation. In Group A, sutures (3/0 Vicryl®, Ethicon, UK) were started to posterior site of the trachea and passed between the trachea and main bronchus inside out, continually. In Group B, the first interrupted suture was used base of the wedge to approximate cartilaginous portions, and the others were began anterior side of the trachea and lasted posterior side. In both groups, the latex tube was removed before suturing was over. The suture line was checked with air leakage test. For this purpose, the pleural space was filled with warm sterile saline solution, and 50 cm H₂O endobronchial pressure was applied. No air leakage was determined from suturing lines. The saline solution was aspirated, and a thoracostomy tube was inserted into the pleural cavity. After thoracic closure, pethidin HCl (Aldolan®, Liba, Turkey) and cefazolin Na (Sefazol®, Mustafa Nevzat, Turkey) were given as analgesic and antibiotic

Fig 1. Per-operative view of the wedge resected carina (VC: caudal vena cava, B: left bronchus, L: latex tube, T: trachea, Arrow: phrenic nerve)

Şekil 1. Kama rezeksiyonu olmuş karinanın per-operatif görünümü (VC: vena kava kaudalis, B: sol bronş, L: lateks tüp, T: trakea, Ok: frenik sinir)



agents, respectively. Postoperative medical applications were maintained for 5 days.

Postoperative encountered complications in groups were recorded. At the end of postoperative two months, the dogs were euthanized with high dose of thiopental Na and tracheobronchial anastomosis line was removed from each animal. The samples were fixed in 10% neutral-buffered formalin and then embedded in paraffin. Five micrometer thick sections taken from the samples were placed on slides and stained with hematoxylin and eosin for microscopic examination.

Statistically, Fisher's exact test was applied between groups to determine the differences with regard to postoperative complications and histopathological results.

RESULTS

No postoperative complication was encountered in group A. In group B, 2 dogs died due to respiratory failure on postoperative 4th and 12th days. Autopsy of the dogs revealed tracheobronchial anastomosis dehiscence, opening of the simple interrupted suture line, which was considered operative technical failure of suturing.

In the microscopic examination of slides, both group had dense collagen layer, fibrocytes with spindle shape nucleus, mononuclear cells infiltration and new capillary formations. The submucosal vessels were hyperemic, and edema was observed in submucosal tissues of tracheobronchial anastomosis line (Fig. 2 and 3).

Fig 2. Microscopic view of simple continuous sutured line. L: lumen, C: collagen tissue, Right arrow: new capillary formations, Left arrow: mononuclear cells. H&E stain, x 4

Şekil 2. Basit sürekli dikiş uygulanmış hattın mikroskopik görünümü. L: lümen, C: kollojen dokusu, Sağ ok: yeni kapillar oluşumu, Sol ok: mononükleer hücreler, H&E boyama, x 4

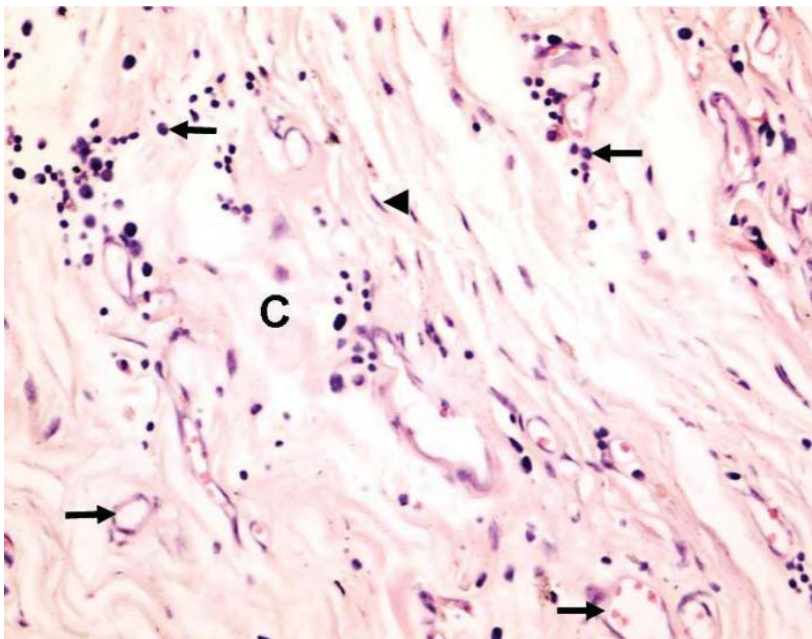
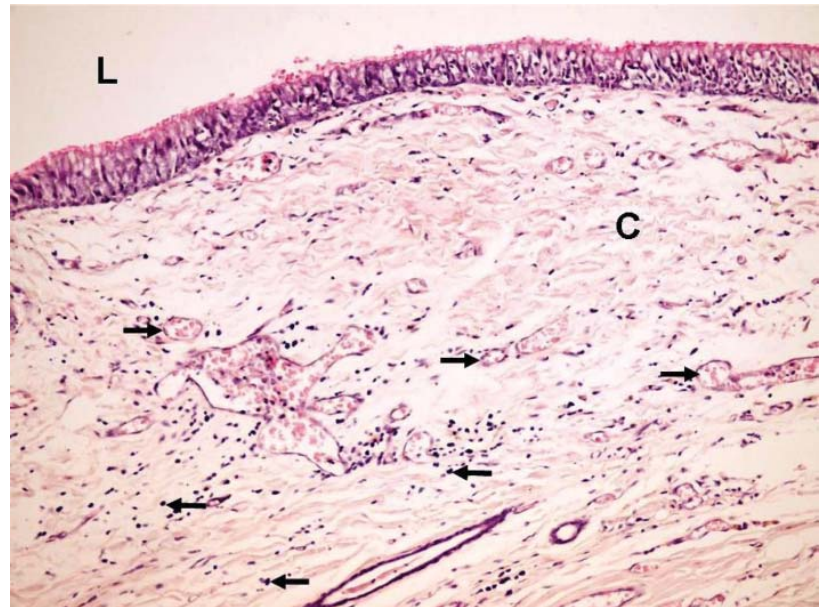


Fig 3. Microscopic view of simple interrupted sutured line. C: collagen tissue, Arrow head: fibrocytes, Right arrow: new capillary formations, Left arrow: mononuclear cells. H&E stain, x 40

Şekil 3. Basit ayrı dikiş uygulanmış hattın mikroskopik görünümü. C: kollojen dokusu, Ok başı: fibrositler, Sağ ok: yeni kapillar oluşumu, Sol ok: mononükleer hücreler. H&E boyama x 40

There was no statistically significant differences between the groups in postoperative complications ($P=0.22$; $P>0.05$) and histopathological results ($P=1.00$; $P>0.05$).

DISCUSSION

Invasion of lung cancer to the carina is judged to be a contraindication for pulmonary resection. However, development of carinal resection techniques has been become indicated the pulmonary resection⁵. For this purpose, three types of bronchoplastic procedures have been described: sleeve, flap and wedge¹⁻⁷. Wedge bronchoplastic procedures are performed for lobar tumors with local infiltration of the carina^{4,7}. There has been much discussion about indication, approach, perioperative respiratory management and carino-plastic procedures. In this study, postoperative and histopathological results of simple continuous and simple interrupted suturing techniques in tracheobronchial anastomosis line following the wedge carinal resection were investigated in dogs.

The incidence of postoperative complications of lung resection techniques is high^{2,3,5,7}; thus, resection of cancer invading the carina has problems, and there is no a standard surgical procedure. Carinal resection is usually performed for a right side lung cancer, because visual field of left side is restricted by the aortic arch⁵. However, in case of lung cancer invading the carina, resection can be performed from the left side. In presented study, considering the technical difficulty, right side wedge carinal resection was planned.

Carinal resection for bronchogenic carcinoma remains a challenging surgical procedure with associated^{6,7}. The bronchoplastic procedures are applied not only in patients with poor respiratory reserve, but also in all those patients, that it is technically possible⁴. The success of the procedures and the lack of postoperative complications depend mainly on proper lung mobilization, use of proper sutures and recognition of the need to use pedicled flaps or not²⁻⁴. Sutured line is the most usual site for postoperative complication. It is encountered as stenosis

(3-9%) or dehiscence (3-5%) of the anastomosis that results in postoperative pneumonia (4-6%) and empyema (2%), respectively⁴. Complications were only encountered in two dogs of Group B that this was tracheobronchial anastomosis dehiscence confirmed by autopsy. However, microscopic examination results pointed out that simple continuous or simple interrupted suturing technique in tracheobronchial anastomosis line following the wedge carinal resection has not any superiority over each other. In addition, no statistically significant differences were determined between the groups in postoperative complications ($P=0.22$; $P>0.05$) and histopathological results ($P=1.00$; $P>0.05$).

Although operative technique failure of suturing is still encountered in tracheobronchial anastomosis, it has been concluded with the histopathological results that both suturing techniques (simple continuous and simple interrupted) can be performed in tracheobronchial anastomosis following the wedge carinal resection.

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