

## Treatment of a case of tracheal stenosis in a dog with tracheal resection and anastomosis

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**ABSTRACT:** A case of tracheal stenosis in the cervical portion of the trachea was encountered in a 5.5-month-old St. Bernard-Rottweiler cross dog. Breathing difficulty was seen in the clinical examination and presence of an obvious narrowing between the 3rd–5th cervical tracheal rings was determined in the radiological examination. Under general anesthesia the portion with stenosis was resected and the healthy trachea ends were anastomosed using the split cartilage technique. In the postoperative period the breathing difficulty disappeared and there was no development of a new stenosis in the anastomosis region. In the late period check-up the patient was seen to lead a healthy life.

**Keywords:** tracheal; stenosis; resection; anastomose; dog

Tracheal resection and anastomosis is the procedure of reforming the ends that went apart after removing a specific segment from the trachea (Fingland, 1994; Fossum, 1997).

Tracheal resection and anastomosis is rarely used in the veterinary clinical practice. This operative technique is used in stenosis resulting from trauma or neoplasia, irreparable laceration, and segmental tracheomalacia (Fingland, 1994; Fingland *et al.*, 1995; Fossum, 1997; Samsar and Akin, 1998).

Some criteria must be carried out for the processes of the treatment of tracheal stenosis resection and anastomosis. The amount of trachea to be removed before anastomosis changes according to the age of dogs. Generally, it is stated that the ratio of length of trachea to the ratio of resection is 25% at adult dogs. When this ratio increases to 50%, deformations dehiscence and anastomosis stenosis are formed due to tension. Therefore, it is pointed out that adult dogs can tolerate a resection of 50% maximum, and puppies can tolerate this at 20–25% (8–10 rings) (Nelson, 1993; Fingland *et al.*, 1995; Lipowitz *et al.*, 1996). According to another source (Fossum, 1997), materials used in tracheal resection can go up to 60% in adult dogs.

Tracheal anastomosis is accomplished by split cartilage technique or by annular technique (Caywood and Lipowitz, 1989; Nelson, 1993; Fingland, 1994).

Fingland *et al.* (1995) compared simple continuous and simple interrupted suturing techniques

for tracheal anastomosis after tracheal segment resection in dogs. They stated that comparing to simple interrupted suturing method, continuous suturing provided better tracheal segmental apposition, was processed in a shorter time, but caused a larger stenosis at the anastomosis area. They determined that there is a statistical difference in the duration of the operation and the stenosis at the anastomosis area, but this difference had no clinical significance.

To specify the ratio of stenosis forming at the trachea, Fingland *et al.* (1995) developed a special formula calculated by measuring the lumen diameters from dorsum to ventrum. According to this formula, evaluated on lateral radiography:

$$\% \text{ DV luminal stenosis} = 100 - \left[ \left( D_A / \frac{D_{Cr} + D_{Cd}}{2} \right) \times 100 \right]$$

where:  $D_A$  = the mean lumen diameter at the anastomosis

$D_{Cr}$  = the mean lumen diameter 1 cm cranial to the anastomosis

$D_{Cd}$  = the mean lumen diameter 1 cm caudal to the anastomosis

The measurements have been carried out three times by a micrometer and the mean values had been put in the formula.

For dogs that had tracheal anastomosis it is suggested to leave the endotracheal tube at its place until the swallowing reflex forms. It is also stated that suction is helpful to remove the clotted blood in the tracheal lumen after extubation. Complications

such as difficulty in respiration, edemas in the larynx or pharynx, occlusion of the tracheal lumen at the anastomotic site or iatrogenic laryngeal paralysis may occur. It is suggested that glucocorticoids and antitussives may be used to reduce inflammation and to suppress coughing (Lipowitz *et al.*, 1996; Fingland, 1998).

## MATERIAL AND METHOD

The case reported in this study was a male St. Bernard-Rottweiler cross-bred dog of 5.5 months. In the anamnesis, it was found out that when he was two months old, he had been seriously bitten from his neck and had undergone tracheotomy at a veterinary hospital where he was taken urgently. In the clinical examination, the radiographs of the neck area in latero-lateral and ventro-dorsal positions were taken. In the radiographic evaluations it was determined that stenosis had formed between the third-fifth tracheal rings (in the area where tracheotomy had been applied) (Figure 1). It was decided to apply anastomosis by tracheal ring resection and split cartilage technique to remove stenosis.

Thirty minutes before the surgery, glucocorticoid (methylprednisalone 2 mg/kg *i.v.*) and antibiotic (ceftriaxon 25 mg/kg *i.v.*) intraoperatively were applied. After a pre-medication of atropin (0.04 mg/kg *i.m.*) and xylasine (2 mg/kg *i.m.*) anesthetics induction ketamine (5 mg/kg *i.v.*) was applied and the dog was intubed. For this purpose, a cuffed endotracheal tube with a 5.5 number was used so it could go through the stenotical area of the trachea. General anesthetics continued with isoflouran as inhalation anesthetics (Duzgun and Perk, 1998).



Figure 1. Radiographic view of the stenotic site between the third and the fifth tracheal rings before the surgery

To provide resection and to make the primary anastomosis easier, tension sutures (3/0 polydioxanon) were applied to the left and right lateral areas of the proximal and distal tracheal segments (Figure 2). Both of the tracheal cartilages surrounding the stenotic area was resected (Figure 3).

The trachea was made to proceed end to end by pulling the opposite tension sutures. Then, to join the half third and fifth tracheal rings, simple continuous sutures (4/0 monophylament polydioxanon) of 2–3 mm intervals were applied starting from ventral (Figure 4). Finally, anastomosis was completed by putting separate knots at the tension sutures that had been put previously in the proximal and distal segments. After extubating the case, the exudat was suctioned. Post operatively for three days, glucocorticoid, and for seven days antibiotics and antitussives were used.

## RESULTS

The clinical examination after the anamnesis findings showed that the case had difficulty during inspiration and expiration. There were clear dyspnea symptoms after exercise. The examination after sedation showed snoring findings. In the LL and VD radiography of the case stenosis was evident in the proximal 1/3 cervical area of the trachea, in the 3rd–5th trachea rings.

According to the formulation of Fingland *et al.* (1995), the lumen stenosis ratio is 60%. The radiological measurements showed that the length from larynx to the bifurcation area of the trachea was 37 cm. The stenotic area was 2 cm. As the part causing stenosis was 25% shorter than trachea length

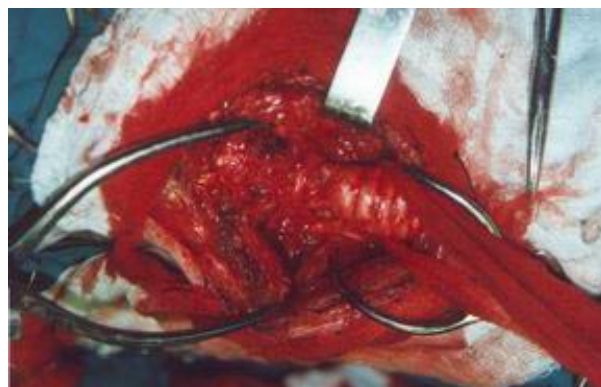


Figure 2. The view of the stenotic area after separation of the paired sternocephalicus and sternohyoideus muscles

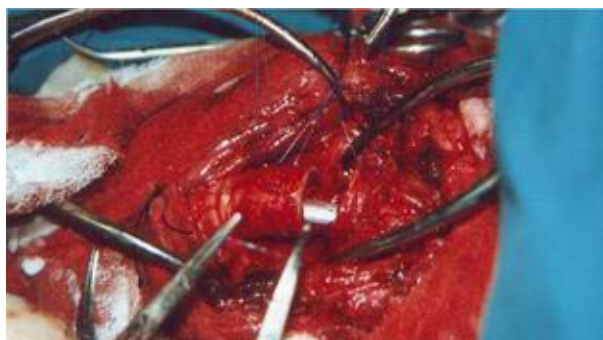


Figure 3. The tagged tension sutures were used to approximate the proximal and distal segments of the trachea for primary anastomosis



Figure 4. The view of simple continuous suture technique for tracheal anastomosis. The split third and fifth tracheal cartilages are apposed beginning on the ventral midline of the trachea



Figure 5. Radiographic view of the stenotic segment showing 70% of the width immediately after surgery



Figure 6. Radiographic view of the stenotic segment showing 90% of the width at day 120

resection and anastomosis were applied efficiently and easily.

According to the radiographic measurement, immediately after the operation it was specified that the ratio of lumen stenosis reduced to 20% (Figure 5). In other words, after the operation an approximate extension of 70% was provided in the area of stenosis.

On the first postoperative day, it was observed that inspiration and expiration were better compared to the before operation period. After the operation no complications such as larynx edema, larynx paralysis, and coughing, dyspnea and subcutan amphysem were observed. The operation wound healed per-primam and the sutures were removed on day 10.

The clinical examinations on the 30th day showed that, respiration had recovered completely. It was found out from the owner of the patient that there was no snoring during sleep and the difficulties during exercises were minimal.

The last examination, which was made after having the case run, on the 120th day showed no dif-

ficulty in respiration. The radiological evaluation on the same day showed that, the lumen stenosis ratio in the anastomosis area was 6.25% (Figure 6). Finally, compared with the preoperative findings, it was specified that the stenosis at the case had been removed by approximately 90% and the animal was living healthily.

## DISCUSSION

Tracheal stenosis is a rare lesion in dogs. Tracheal stenosis can form at each age due to different etiologic factors. Among these those caused by cicatrix tissue formation because of tracheal injuries are the most frequent (Fingland, 1998; Nelson, 1993). The 5.5 month old age of our case and the stenosis being cicatrix is in accordance with the literature.

The amount of the part to be resected from the trachea plays a great role on the healing of anastomosis. If the tension increases on the anastomosis line at young animals, it will cause fissures and new stenosis due to granulation tissue formation.

This will delay the development of tracheal rings at the end of anastomosis (Nelson, 1993; Lipowitz *et al.*, 1996; Fingland, 1998). It is stated that if the length of the resected trachea is less than 20% of the total trachea length, there will be no tension at the anastomosis line (Nelson, 1993). In our case the total trachea length was 37 cm and the removed part was 2 cm, thus a resection of 5% was applied. As no tension developed at the anastomosis area in accordance with the literature, healing was achieved with no problems and no new cicatrix stenosis developed.

Different techniques are used at the tracheal anastomosis of the dogs. Usually methods which form minimum stenosis at the anastomosis area are preferred (Caywood and Lipowitz, 1989; Nelson, 1993; Fingland, 1994).

In the split cartilage technique, the tension sutures applied on the trachea, both release the tension at the anastomosis area and expose the dorsal tracheal membrane, making work at the operation area efficient (Fingland, 1994, 1998; Lipowitz *et al.*, 1996). We observed that these sutures made manipulation easier during primary anastomosis in our case.

Although usually simple interrupted suturing are used at tracheal anastomosis, continuous suturing technique is dominant because of the duration of the operation and tracheal apposition (Nelson, 1993; Fingland *et al.*, 1995). We also found that continuous suturing technique was appropriate due to its advantage for timing and application easiness. It is discussed in literature that in simple interrupted suturing less anastomosis stenosis form (Fingland *et al.*, 1995), however, in this case where we applied continuous suturing technique, we obtained an extension of 90% at the end of 120th day.

When the tracheal cartilage of young animals are compared with those of the adults, they are found to be friable and insufficient in mineralization, thus, it is suggested that a fine cutting needles be used to prevent risks of cracks and tears during anastomosis (Lipowitz *et al.*, 1996). We used non-traumatic needles in the anastomosis, but encountered no cracks in the tracheal rings. We believe this was achieved by applying the sutures with utmost care and with suitably long needles.

It is stated in cases, where tracheal anastomosis is applied that, complications such as larynx or pharynx edema, coughing, laryngeal paralysis may develop (Fingland, 1994, 1998; Lipowitz *et al.*, 1996). No above mentioned complications developed in this case and we believe that the reason is the anti-inflammatory effect of the glucocorticoids used preoperatively and 3 days postoperatively.

## REFERENCES

- Caywood D.D., Lipowitz A.J. (1989): Atlas of General Small Animal Surgery. The C.V. Mosby, Co. Toronto. 72–74.
- Duzgun O., Perk E.C. (1998): Research of the effects on blood parameters of a ketamine induced isoflurane anesthesia in the dogs. J. Fac. Vet. Med. Univ. Istanbul, 24, 379–401.
- Fingland R.B. (1994): Diagnosis and surgical management of obstructive upper airway diseases. In: Birchard S.J., Sherding R.G. (eds.): Saunders Manual of Small Animal Practice. W.B. Saunders Co., Philadelphia. 559–560.
- Fingland R.B. (1998): Tracheal resection and anastomosis. In: Boyrab M.J., Ellison G.W., Slocum B. (eds.): Current Techniques in Small Animal Surgery. 4th ed. Williams & Wilkins, Philadelphia. 387–391.
- Fingland R.B., Layton C.I., Kennery G.A., Galland J.C. (1995): A comparison of simple continuous versus simple interrupted suture patterns for tracheal anastomosis after large – Segment tracheal resection in dogs. Vet. Surg., 24, 320–330.
- Fossum T.W. (1997): Small Animal Surgery. Mosby, Philadelphia. 609–616.
- Lipowitz A.J., Caywood D.D., Newton C.D., Schwartz A. (1996): Tracheal anastomosis. In: Complication in Small Animal Surgery. A Waverly Co., Philadelphia. 212–213.
- Nelson A.W. (1993): Lower respiratory system. In: Slatter D. (ed.): Textbook of Small Animal Surgery. 2nd ed. W.B. Saunders Co., Philadelphia. 777–803.
- Samsar E., Akin F. (1998): Respiratory system disease. In: Special Surgery. Tamer Co. 123.

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