

# A comparison of histopathological results of conventional surgery and transoral radiofrequency ablation in early stage laryngeal carcinoma

Erken evre larenks karsinomunda konvansiyonel cerrahi ve transoral radyofrekans ablasyonunun histopatolojik sonuçlarının karşılaştırılması

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**Objectives:** This study aims to compare histopathological results of conventional surgery and transoral radiofrequency ablation in patients with early stage laryngeal carcinoma.

**Patients and Methods:** Between January 2006 and May 2010, 36 patients (34 males, 2 females; mean age 61.6 years; range 43 to 77 years) who underwent partial laryngectomy in our clinic were retrospectively analyzed. All patients were randomized to partial laryngectomy with radiofrequency ablation or conventional surgery. Hoarseness due to early stage T<sub>1</sub> and selected T<sub>2</sub>N<sub>0</sub> vocal cord lesions was an indication for surgery. Of 20 patients receiving conventional surgery, 14 underwent partial laryngectomy, while six patients underwent cordectomy for the excision of tumors. Tumors were excised by transoral radiofrequency ablation in 16 patients.

**Results:** We observed thermal artifacts in four patients undergoing conventional surgery and in 13 patients undergoing transoral radiofrequency ablation. There was also hemorrhage in 16 patients undergoing conventional surgery and in seven patients undergoing transoral radiofrequency ablation. Histopathological examination revealed that the surgical margins were safe in 10 patients after radiofrequency ablation. The specimens obtained from six patients showed thermal artifacts which complicated histopathological examination. Sixteen (80%) of 20 conventional surgery patients and nine (56%) of 16 radiofrequency ablation patients had safe surgical margins.

**Conclusion:** In radiofrequency ablation, the surgical zone must be larger than in conventional surgery due to the high risk of tissue damage and complicated histopathological examination.

**Key Words:** Laryngeal carcinoma; partial laryngectomy; radiofrequency ablation; surgical zone; transoral.

**Amaç:** Bu çalışmada erken evre larenks karsinomlu hastalarda konvansiyonel cerrahi ve transoral radyofrekans ablasyonunun histopatolojik sonuçları karşılaştırıldı.

**Hastalar ve Yöntemler:** Ocak 2006 - Mayıs 2010 tarihleri arasında kliniğimizde parsiyel larenjektomi yapılan 36 hasta (34 erkek, 2 kadın; ort. yaş: 61.6 yıl; dağılım: 43-77 yıl) retrospektif olarak incelendi. Hastaların tümü radyofrekans ablasyonu ile birlikte parsiyel larenjektomiye veya konvansiyonel cerrahiye randomize edildi. Erken evre T<sub>1</sub> ve seçilmiş T<sub>2</sub>N<sub>0</sub> vokal kord lezyonlarına bağlı ses kısıklığı, cerrahi endikasyonuydu. Konvansiyonel cerrahi uygulanan 20 hastanın 14'ünde parsiyel larenjektomi, altısında kordektomi ile tümörler eksize edildi. On altı hastada ise transoral radyofrekans ablasyon ile tümörler alındı.

**Bulgular:** Konvansiyonel cerrahi yapılan dört hastada ve transoral radyofrekans ablasyon uygulanan 13 hastada termal artefaktlar gözlemlendi. Konvansiyonel cerrahi yapılan 16 hastada ve transoral radyofrekans ablasyon uygulanan yedi hastada ise kanama vardı. Histopatolojik incelemede radyofrekans ablasyonundan sonra 10 hastada cerrahi sınırların güvenli olduğu tespit edildi. Altı hastadan alınan örneklerde, histopatolojik inceleme-yi güçleştiren termal artefaktlar izlendi. Konvansiyonel cerrahi yapılan 20 hastanın 16'sında (80%) ve radyofrekans ablasyonu uygulanan 16 hastanın dokuzunda (%56) cerrahi sınırlar güvenli bulundu.

**Sonuç:** Yüksek doku hasarı ve zorlaşmış histopatolojik inceleme riski nedeniyle, radyofrekans ablasyonunda, konvansiyonel cerrahiye kıyasla, cerrahi alan daha geniş olmalıdır.

**Anahtar Sözcükler:** Larenks karsinomu; parsiyel larenjektomi; radyofrekans ablasyonu; cerrahi alan; transoral.



For many early laryngeal cancers (stage 1 and 2 tumors), acceptable disease control is expected with either curative doses of irradiation or traditional conservative surgical procedures, including open supraglottic laryngectomy.<sup>[1,2]</sup> Despite high rates of local tumor control afforded by open conservation techniques such as supraglottic laryngectomy, the presence of significant preexisting pulmonary comorbidities in conjunction with the inherent potential for postoperative dysphagia and aspiration associated with this procedure precludes its application in many patients. Furthermore, open supraglottic laryngectomy necessarily requires the adjunctive use of tracheostomy and feeding tubes during the early and intermediate postoperative period.

The margin of resection in head and neck malignant neoplasms is one of the most important factors affecting local recurrence.<sup>[3,4]</sup> Radical surgery, therefore, requires a wide margin of healthy tissue around the lesion. However, there is currently no consensus with regard to how wide this should be. In 2005, Meier et al.<sup>[5]</sup> reported that most American Head and Neck Society members accepted a clean margin to be 5 mm on microscopic evaluation. However, this publication did not address laryngeal cancer. Most authors accept that oral cavity, oropharynx, and hypopharynx cancers require wider margins than cancer of the larynx. This may be reasonable because patients with T<sub>1</sub> and selected T<sub>2</sub>N<sub>0</sub> squamous cell carcinoma of the larynx have local control and organ preservation rates that approach 90% irrespective of treatment modality, which may be transoral surgery or radiotherapy.

The radiofrequency ablation technique seems to offer improvements in postoperative recovery in patients receiving radiofrequency ablation-assisted cordectomy. The radiofrequency energy is directed beneath the epithelium of the vocal cord, to create local damage to the tissue without harming the epithelial surface. In the area surrounding the resultant necrosis, the new tissue formed during wound healing is replaced by fibroblasts, and the consequent wound contraction reduces the volume of the tissue.<sup>[6,7]</sup> As the energy is transferred to the tissue, ionic dissociation occurs, which results in vaporization of tissue and coagulation of vessels at low temperatures (85 °C) with minimal thermal damage to surrounding tissues. Radiofrequency

ablation has been increasingly utilized because of its versatility and applicability.

## PATIENTS AND METHODS

This is a retrospective study, performed between January 2006 and May 2010. Thirty-six patients (34 males, 2 females; mean age 61.6 years; range 43 to 77 years) who were enrolled in the study were randomly assigned to receive partial laryngectomy with radiofrequency ablation or conventional surgery. Indications for the procedure were hoarseness caused by early stage T<sub>1</sub> and selected T<sub>2</sub>N<sub>0</sub> vocal cord lesions. The study was explained to the patients, and signed informed consent was obtained from all participants.

Patients were operated on under general anesthesia and with endotracheal intubation, and were placed in the standard supine position with a shoulder roll. Suspension laryngoscopy (Weerda distending operating laryngoscope) was performed with a microscope (Zeiss OPMI Vario S88) under general anesthesia. Lesions that were excised by a radiofrequency device (Quantum-Telea Electronic Engineering-Molecular resonance device) were considered in terms of surgical zone. No local anesthesia was applied in either group. The same experienced surgeon performed all operations.

All patients started a postoperative intravenous (i.v.) course of antibiotics (amoxicillin-clavulanate, or clindamycin if there was a proven allergy to amoxicillin-clavulanate), which was then prescribed for a standard 10-day course per os (PO). No patient required any other medication after completion of the procedure. All patients were held overnight for observation. There were no restrictions on food or fluid intake. Histopathologic examination was performed on all excised cordectomy specimens. The pathologist was blinded to surgical modality.

## RESULTS

A total of 36 partial laryngectomies were performed and reviewed postoperatively. Surgical indications were hoarseness with early stage T<sub>1</sub> and selected T<sub>2</sub>N<sub>0</sub> vocal cord lesions. Twenty conventional surgeries and 16-radiofrequency ablations were reviewed between 3 and 53 months following surgery by the same attending surgeon. In each group, the

**Table 1.** Type of radiofrequency ablation surgery

Radiofrequency ablation surgery	n
Corpectomy type 3	3
Corpectomy type 4	2
Corpectomy type 5	1
Partial laryngectomy type 5a	10

median age was 57 years, with a range of 43 to 77 years.

In this study, 20 patients were operated on by conventional surgery; in 14 of these patients, tumors were excised by partial laryngectomy, in six patients, tumors were excised by corpectomy. In 16 patients, tumors were excised by radiofrequency ablation (Table 1). We found thermal artifacts in four patients operated on by conventional surgery and in 13 patients treated by transoral radiofrequency ablation surgery. There was also postoperative hemorrhage in 16 patients treated by conventional surgery and in seven patients treated by transoral radiofrequency ablation surgery.

Intraoperative and postoperative blood loss was monitored for both groups. An independent nurse monitored blood lost during the procedure. In conventional surgery, blood loss was noted in only one patient and stabilized spontaneously, while no blood loss was present in radiofrequency ablation procedures. Furthermore, in conventional surgery, edema was noted in three patients, whereas in radiofrequency ablation, edema was only seen in one patient and no tracheotomy was required in that patient because of dyspnea. Dyspnea also occurred in one of the patients with advanced edema after conventional surgery (Table 2).

On histopathologic examination, the surgical margins were safe enough in 10 patients after radiofrequency ablation, the specimens from six patients showed thermal artifacts which made histopathological evaluation difficult (Figure 1).

While safe surgical margins were observed in the specimens from 16 out of 20 conventional surgery patients (80%), nine of 16 radiofrequency ablation patients (56%) had safe surgical margins. The chi-square test was performed on 36 patients using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) statistical software program. The

**Table 2.** Intraoperative follow-up

	Conventional surgery	Radiofrequency ablation surgery
	n	n
Hemorrhage	16	7
Dyspnea	1	–
Edema	3	1
Tracheotomy	–	–

correlation between thermal artifact and surgical zone in conventional surgery was significant ( $p < 0.001$ ). All histopathological evaluations of conventional surgery patients were unsafe. The other statistical differences were insignificant ( $p > 0.005$ ) (Tables 3 and 4).

## DISCUSSION

In the early history of the treatment of laryngeal carcinoma, surgeons in the search for an optimal method tried various tools and techniques. Currently, partial laryngectomy is usually performed by cold dissection or radiofrequency ablation. Both techniques present advantages and disadvantages: cold dissection is considered less painful but is associated with longer operation times and higher intraoperative blood loss when compared with cautery.

Over the years, the success rate with cauterization has remained at a lower level compared with other surgical techniques. These unsuccessful results can be connected



**Figure 1.** The specimen from patient showed with arrow thermal artifacts which made histopathological evaluation difficult (H-E x 20).

**Table 3.** Characteristics of the retrospective trials in conventional surgery patients

Patients	Thermal artifacts	Microscopic hemorrhage	Surgical zone (soft tissue)	Surgical zone (mucosal)
1	None	Minimal	Safe	Safe
2	Minimal	Moderate	Not safe	Not safe
3	None	Minimal	Safe	Safe
4	Minimal	Minimal	Not safe	Not safe
5	None	Minimal	Safe	Safe
6	None	Minimal	Safe	Safe
7	Minimal	Moderate	Not safe	Not safe
8	None	Moderate	Safe	Safe
9	None	Minimal	Safe	Safe
10	None	None	Safe	Safe
11	None	None	Safe	Safe
12	None	Minimal	Safe	Safe
13	None	None	Safe	Safe
14	Minimal	None	Not safe	Not safe
15	None	Minimal	Safe	Safe
16	None	Moderate	Safe	Safe
17	None	Minimal	Safe	Safe
18	None	Moderate	Safe	Safe
19	None	Minimal	Safe	Safe
20	None	Moderate	Safe	Safe

to innovation of technique and new clinical rules. In recent publications, the successful use of cauterization has been reported.<sup>[8]</sup> In

selected early stage cancers, the cure rates in open surgical excision and radiotherapy are the same.<sup>[8,9]</sup>

**Table 4.** Characteristics of the retrospective trials in radiofrequency ablation patients

Patients	Thermal artifacts	Microscopic hemorrhage	Surgical zone (soft tissue)	Surgical zone (mucosal)
1	Minimal	None	Safe	Safe
2	Moderate	Minimal	Not safe	Not safe
3	Maximal	Maximal	Safe	Not safe
4	Maximal	None	Not safe	Not safe
5	Maximal	Minimal	Safe	Safe
6	Minimal	None	Not safe	Not safe
7	Maximal	Moderate	Not safe	Not safe
8	Moderate	Minimal	Not safe	Not safe
9	Minimal	None	Not safe	Not safe
10	Minimal	Maximal	Safe	Safe
11	None	None	Safe	Safe
12	Moderate	Moderate	Safe	Safe
13	None	None	Safe	Safe
14	Minimal	None	Safe	Safe
15	None	None	Safe	Safe
16	Minimal	None	Safe	Safe

Thumfart<sup>[10]</sup> reported that resection of early stage laryngeal carcinoma with cauterization gave only minor postoperative hemorrhage and granulation tissue. In our study, resection with cauterization resulted in only minor hemorrhage compared with open surgical excision. In nine patients operated with radiofrequency cauterization, there was no hemorrhage. In addition to this, we found that cauterization induced tissue destruction in the surgical zone and caused difficulties in histopathological evaluation. Open surgical excision has no such problems.

Furthermore, up to laryngeal cartilage, provides no need for external incision in early stage laryngeal carcinomas. Steiner and Ambrosch<sup>[11]</sup> showed that transoral cauterization gives the same results in early stage laryngeal carcinomas with other treatment modalities in their study but we found transoral radiofrequency ablation gives a surgical zone with uncertain margins because of tissue destruction compared with conventional surgery.

We determined that thermal artifacts are a problem in patients operated on with radiofrequency compared with patients operated on by conventional surgery. The thermal artifacts complicated clear definition of the surgical zone in both radiofrequency ablation and conventional surgery patients. So, for these reasons, the surgical margin should be wider in cancer surgery to achieve safe surgical zones. Jazrawi et al.<sup>[12]</sup> suggested that tissue resection with radiofrequency ablation damages the surgical zone because of its thermal effect.

Currently, transoral laser microsurgery (TLM) represents a minimally invasive approach that is increasingly accepted worldwide as the optimal therapy of early and moderately advanced cancer of the upper aerodigestive tract. An advantage of this technique is that it can be easily repeated in case of histologically proven positive or uncertain resection margins.<sup>[13]</sup>

In this study, we determined that using radiofrequency ablation, excision of small lesions (T<sub>1a-b</sub>) in early stage laryngeal carcinomas damages the tissue and so commenting on these tissues in histopathological evaluation is difficult. However, cauterization with radiofrequency gives uncertain margins in the remaining surgical zone compared with conventional surgery. We suggest that the surgical zone should be increased in

radiofrequency ablation surgery. In our study, in three patients operated on with conventional surgery, the tumor recurred on follow-up, but with radiofrequency ablation, the tumor recurred in only one patient. It is clear that long-term follow-up will give more reliable results.

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