TRANSMANDIBULAR AND TRANSCERVICAL SURGICAL APPROACH IN TREATMENT OF TONGUE BASE CANCERS – TEN-YEAR RESULTS

Rajko M. JOVIĆ1, Danijela DRAGIČEVIĆ1, Karol ČANJI1, Jugoslav GAŠIĆ2 and Maša ĐOZIĆ1

Introduction

The problem of treatment of the base of tongue cancer is the aggressiveness of the approach itself on one hand and on the other hand, there is the importance of the act of swallowing, chewing and speech, which are the functions closely connected to the tongue.

Trauma of tissue through which the access to this region is granted, as well as the resection of carcinoma of the base of tongue inevitably lead to disruption of these functions, which greatly affect the quality of life of patients [1]. This is largely the
reason for seeking different modalities which will give better or at least the same response to oncologica functions. An alternative to surgical approach is organ preservation [2]. It includes the use of chemoradiotherapy, which leaves the structure of the organ intact, meaning that functions should be preserved [3]. Although oncological and surgical treatment results are equal, functional results are not encouraging, considering the effects of early and late toxicity [4]. Advanced surgical techniques, particularly the use of flaps for the reconstruction of created defects, visibly improve the functional results of surgery and place surgery again in the spotlight of treatment of the base of tongue cancer [5].

That is why we have accepted the primary surgical approach in the treatment of the base of tongue cancer. The aim of this study was to show the oncological and functional results of surgical treatment of the base of tongue cancer through retrospective analysis of treated patients.

**Material and Methods**

This is a retrospective analysis of 115 patients operated during 2001-2011 at the Department of Ear, Nose and Throat Diseases, Clinical Center of Vojvodina, which is a tertiary health institution in the country and a reference institution for the treatment of this pathology in the province of Vojvodina. Thirteen women (11.3%) and 102 men (88.7%) underwent surgery, the ration being 8:1. Their age ranged between 38 and 80 years (mean age being 57.7 years). Verification of the diagnosis of malignancy was done by pathohistological analyses. Biopsies were performed under local epimucose anesthesia using a curved handle, and a smaller number of patients were subjected to general endotracheal anesthesia. In some patients, the primary origin of tumor was found during general examination, without clinically visible tumor, but with clinically evident metastatic neck lymph nodes. Patients were then prepared according to the standard protocols in order to obtain complete information about locoregional prevalence of disease and the possible existence of distant metastases. In addition to blood tests and laboratory analyses, coagulation status, computed tomography (CT) or magnetic resonance (MR) scan of the head and neck, X-rays of the chest and an abdominal ultrasound were performed. In patients with suspected lung deposits, consultation with pulmonologist, CT scan of chest and bronchological analyses were performed. A fully prepared patient was then presented to the Oncological Consilium, consisting of an internist oncologist, radiotherapist and, if necessary a pathohistologist, along with an otorhinolaryngologist. The decision of surgical treatment was made after the complete evaluation of available data. Patients without contraindications for surgery, without distant metastasis, metachronous or synchronous malignancy were selected for surgical treatment, as the primary treatment protocol.

Surgical approach in treatment of the base of tongue cancer was transcervical and transmandibular and it depended on the localization of cancer in the area of the base of tongue. Indications for surgical treatment were epithelial malignancies of the base of tongue, which did not exceed the level of the papilla circumvallate on both sides, towards the middle third of the tongue; in cancer of the lateral side of the base of tongue and pharyngeal wall, if infiltration of the mandible was not more than 5 mm and if cancer did not cross the midline of the tongue; in carcinomas that originated from salivary gland, larger carcinomas were also operated, but not if total glossectomy was required.

Infrahyoid approach, including the resection of one part (epiglotectomy, supraglottic laryngectomy) or the entire larynx, was used within transcervical approach to carcinomas of the base of tongue that spread to the laryngeal structures.

Transhyoid and suprahyoid approach was performed in cancers that did not reach vallecula. For primary reconstruction of defect, pexy to hyoid or thyroid cartilage was performed. Cancers of the lateral side of the tongue with the expansion to the mandible were operated using the so-called “swing” technique of mandibulotomy or with composite resection. “Swing” technique included para-medial or lateral mandibulotomy to approach malignancies which had not invaded the mandible, and at the end of resection with or without reconstruction with flap, osteosynthesis was performed. In composite or “commando” operations, resection of one part of the mandible or hemiresection of invaded mandible with the base of tongue cancer was performed. The reconstruction was done with pedicled pectoralis major musculocutaneous flap.

In order to improve pathohistological preparation, tumor was fixed in styrofoam, and additional tissue borders were taken and sent to pathohistological analysis. In extensive malignancies with unclear boundaries, borderline tissue was taken during surgery for ex tempore biopsies. In the case of positive borders, additional resection of tissue was done.

Neck dissection was performed in all patients. Unilateral selective neck dissection was done in early T1 and T2 cancers of the base of tongue, which did not cross the midline, whereas in cancers that have crossed the midline, or had multiple or more metastatic nodes, bilateral neck dissection was performed (for N+ modified radical or radical dissection and for N- selective neck dissection). The obtained samples were sent to pathohistological analysis, fixed on a large styrofoam with marked groups of lymph nodes.
All patients underwent tracheostomy, and a nasogastric tube was used until the recovery of swallowing.

Upon completion of the collected materials by pathohistologists, radiotherapy was recommended in patients with following indications for radiation: metastasis in more than two nodes, extracapsular expansion of cancer, advanced stages of cancer, and the positive tissue borders.

After completion of therapy, the patients were regularly followed up, every two months during the first year, every three months during the second year, and twice a year to the end of the fifth year. At each examination, ultrasound of the neck was performed. After 5 years, checkup was done once a year.

Statistical data were analyzed using means, standard deviations, Fisher’s t test and Kaplan Meyer analysis.

Results

In the analyzed period of ten years, 2638 patients with newly discovered malignant tumor in the head and neck region were diagnosed and treated at the Department. Out of 622 (23.5%) cancers of the oropharynx included in the study sample, 150 were diagnosed as cancers of the base of tongue, thus accounting for 5.6% of all diagnosed head and neck cancers and 24.1% of cancers of the oropharynx. One hundred and fifteen patients were treated primarily surgically. In 111 (96.5%) patients, planocellular carcinoma was diagnosed with various degrees of differentiation, one (0.8%) adenocarcinoma, two (1.7%) adenoid cystic carcinoma and one (0.8%) mucoepidermoid carcinoma. Metastatic lymph nodes (N+) were discovered in 88 (76.5%) patients, and 27 (23.5%) patients were not found to have metastatic processes in the neck (N-) after pathohistological treatment.

The patients were divided into groups according to the tumor, nodes and metastases (TNM) classification (Table 1).

According to the stage of the disease, the majority of patients (59.1%) were in IV A stage of disease (Table 2).

Operations were performed by transcervical and transmandibular approach and the resection of laryngeal or other structures within the resection of the base of tongue cancer was done depending on the degree of involvement of these structures (Table 3).

The first two categories, transhyoid and infrahyoid pharyngotomy, as well as mandibulotomy, indicate the type of surgical approach to the base of tongue cancer, while other categories indicate the extent of

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**Table 1.** TN classification of tongue base cancer  
*Tabella 1. TN klasifikacija karcinoma baze jezika*

<table>
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<th>TN</th>
<th>N0</th>
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<th>N2b</th>
<th>N2c</th>
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<td>11</td>
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<td>46</td>
</tr>
<tr>
<td>T4</td>
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<td>2</td>
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<td>11</td>
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<tr>
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<td>5</td>
<td>24</td>
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**Table 2.** Stage of the disease in patients diagnosed to have tongue base cancer  
*Tabella 2. Stadijum bolesti dijagnostikovanih pacijenata sa karcinomom baze jezika*

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<td>M0</td>
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<td>N1</td>
<td>M0</td>
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<td>23.4%</td>
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<td>M0</td>
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<td>N1</td>
<td>M0</td>
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<td>M0</td>
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<td>N2</td>
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</tr>
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resection of the surrounding structures. Defect reconstruction was performed using the pedicled pectoralis major musculocutaneous flap in two patients with tumor spreading to the mandible and in 2 patients where the floor of mouth and lateral pharyngeal wall were infected by tumor.

The operation of the primary base of tongue cancer also included the neck dissection (Table 4).

All patients were fed through the nasogastric tube immediately after operation for 1 to 40 days (6.7 days on average). Due to difficult rehabilitation of swallowing and chewing, three patients had to undergo percutaneous gastrostomy, which was used up to 6 months. Permanent gastrostoma remained in none of the patients.

Tracheostomy was performed in all patients and it was closed after 7 to 36 days (7.4 days on average). In the immediate postoperative period, 17 (14.7%) patients had complications in the form of bleeding, fistula and wound infection, which developed in 7 (6%), 5 (4.3%), and 11 (9.5%) patients, respectively.

No fatal outcomes occurred during the period of hospitalization. After operation, 61 (53%) patients were treated by irradiation therapy.

Checkups of patients were performed every two months during the first year, every three months during the second year, and twice a year to the end of the fifth year. At each examination, ultrasound of the neck was performed. After 5 years, the checkup was done once a year.

Local and regional recurrence developed in 13 (11.3%) and 24 (20.8%) patients, respectively and distant metastases developed in 4 (3.5%) patients. Second primary cancer was diagnosed in 9 (7.8%) patients.

Disease-specific 3-year survival rate (according to T category of cancer) was 73%, 60%, 45% and 21% for T1, T2, T3 and T4, respectively (Graph 1 a). Kaplan Meier survival analysis revealed a significant p = 0.0052 difference in 3-year survival rate between groups in T category.

Disease-specific survival rate (according to N category) was N0 (68%) and N + (32%) (Graph 1 b). Kaplan Meier analysis showed a significant p = 0.0492 difference in 3-year survival rate for patients with negative neck lymph nodes compared to those with positive ones. Overall 3-year survival rate was 42% (Graph 2).

Discussion

The base of tongue is built of histologically different tissues, so malignancies of different histological characteristics occur in this region. A malign-
nant tumor of epithelial origin is most common, and in this study, it accounted for 96.5% of all diagnosed malignancies. Malignant epithelial tumor of other histological structures is rare and mostly related to the salivary glands, with better prognosis.

Base of tongue cancer is an aggressive disease with the progressive spreading. Although the tongue is a richly innervated area, which would indicate an early onset of symptoms, a good number of patients are diagnosed in advanced stages of the disease, in stages III and IV (92.9% of patients). Rich drainage of lymphatic system contributed to the presence of metastases in 88/115 (76.5%) of patients at the time of diagnosis. High incidence of metastasis in patients has been reported by other authors, including Gourin and Johnson [6], who found them in 84% of patients in their series.

Advanced clinical stages of disease and metastases contribute to a poor prognosis and it is difficult to select treatment protocols.

Since 1991, when the use of chemoradiotherapy protocol in the treatment of head and neck cancers was initiated [2], many institutions have been implementing this protocol in order to avoid mutilant operations, and have achieved the preservation of organ and seemingly better functional results. However, cancer of the tongue base is often at an advanced stage at the time of diagnosis; therefore, it is difficult to be controlled by radiotherapy and after radiotherapy has failed, salvage surgery is rarely performed [7]. The primary surgical treatment with subsequent radiotherapy in certain cases is an alternative to chemoradiotherapy protocol. Regardless of the degree of mutilation done by surgery in this region due to the complicated approach to the base of tongue, advanced reconstructive surgery leads to better oncological and functional results. This has reconciled the two basic principles of treatment of malignancies of the base of tongue in some way, because each of them has its good and bad sides.

Classic transmandibular approach is now rare, because it leaves more functional problems, some of which are malocclusion, impaired swallowing, and difficulty in speech. Cosmetic effect should not be neglected, either. Huet described transhyoid approach to base of tongue cancers in 1946 [8], and this method has been adopted because it shows an easier and closer approach to the base of tongue with good visibility of structures. The technique was improved by Moore and Calcaterra [9] and others, and an increasing number of authors [10] promote its advantages, and one of the most important is that the neurovascular bundle remains far away, so lesions are rare, visibility is excellent and larger tongue tumors are also approachable for dissection, along with epiglottis and the lateral wall of the pharynx. Transcervical approach to the base of tongue cancer was the basic approach (94.8%) in patients treated in this series. After cancer resection, suspension of larynx to the rest of the tongue was performed. The flap was not used to close the defect in any one because resection did not exceed the level of the papilla circumvalata.

None of the patients with carcinoma of the base of tongue underwent endoscopic transoral surgery because the visibility and possibility to control he-
Most metastasis was poor, although some authors apply this approach using the laser technique [11].

Another approach used to operate the base of tongue cancer in this series of patients was the transmandibular approach. In the “swing” technique, after the resection of cancer, the defect was filled with pedicled pectoralis major flap in two patients, and osteosynthesis was done afterwards. Segmental resection of the tumor-invaded mandible was done in two patients, then the defect was also covered with the pectoralis major flap. No patient underwent “near” total or total glossectomy. Total glossectomy includes total laryngectomy because of a swallowing disorder that occurs, although recent studies show that this is not necessary. Tiwari et al. performed total glossectomy with suspension of the larynx and achieved excellent functional results [12]. Chien et al. [13] closed the defect created after total or near total glossectomy with vascular free flaps. A good and understandable speech was achieved in 89.7%, and the patients had difficulty in speaking because of the gap between the soft palate and the flap. Dziegielewski et al. [14] also used the free vascular flaps for reconstruction of defects; however, they achieved worse results regarding swallowing since only 24% of patients achieved good swallowing function.

We believe that transpharyngeal rather than transmandibular approach leads to better functional results, which is also the opinion of other authors [15].

An integral part of primary cancer surgery of the base of tongue is neck dissection. It includes groups II and III of lymph nodes at least, because they are located on the drainage path of this region [16]. Because of the high incidence of metastasis in the region, neck dissection was performed in 109/115 (94.7%) patients. A high percentage of metastases found (76.5%) indicates a very early cancer metastasis in the neck lymphatics. The most common dissection performed was bilateral neck dissection (75.2%), followed by the modified radical one, which was second according to the extent of dissection and it was done in 60/109 (55%), while the radical and selective dissection was performed in 11/109 (10.1%) and 38/109 (34.8%) patients, respectively. None of dissections resulted in major complications.

Tracheostomy was performed in all patients due to a swallowing disorder and consequent aspiration of saliva. Tracheostomy was closed after the wound had healed and swallowing function had been resumed in all patients with the exception of 14 patients who had undergone total and near total laryngectomy. Feeding began with nasogastric tube until swallowing function was resumed. The process of rehabilitation as the general complications related to wound healing, solving complications and the total recovery of the patient were met. Rehabilitation was done with professional help and always started with thick porridge. Three patients underwent gastrostomy because the rehabilitation was difficult and long. All three patients had lesions of both hypoglossal nerves so swallowing orally was virtually impossible. In later period, one or both hypoglossal nerves recovered, swallowing was resumed and gastrostoma was closed in all three patients. After 6 months, all patients had good swallowing results. In further follow-up period, no patients from this study needed any support in swallowing.

O Connel et al. [17] achieved good functional results in swallowing (95%) after surgery and reconstruction of the base of tongue defects with vascular flaps. The wide application of flaps in this region has significantly contributed to better functional results in treatment of advanced carcinoma of the base of tongue. Swallowing was assessed by penetration-aspiration scale, aspiration implying each penetration of bolus below the vocal cords.

The advantages of chemoradiotherapeutic protocol should mean better functional results than those achieved by primary surgery. However, examination of swallowing function in this group of patients suggests that these patients have difficulties. In their study, Logmen et al. [18] found the reduction of retraction of the base of tongue in 89% and the tongue strength in 51%, as well as slowed or delayed closure of vestibular larynx in 31%, in 53 patients treated with chemoradiotherapy three months after radiation. The effect of radiation was a delayed triggering of the pharyngeal swallowing, reduction of tongue retraction and reduced rise of the larynx. Xerostomia was present in all patients after radiation. As many as 21/53 (40%) patients had a gastrostomy or jejunostomy 3 months after chemoradiation. It seems that organ preservation is not a functional preservation as well.

Rieger et al. [19] showed that swallowing had been resumed in 29 (90.6%) patients after reconstruction of defect with anterbrachial flap, whereas three (9.4%) patients needed enteral nutrition.

The most common postoperative complication was wound infection in 11 (9.5%) patients, that percent going up to 17% [6]. The low social status of these patients and very poor oral hygiene put these patients at high risk for the occurrence of inflammation of wound, although carious teeth had been extracted before operation. Bleeding was the second most common (7.6%) complication. Mostly alcohols with poor liver function showed a greater tendency to bleed in comparison with the normal population. Within the preoperative treatment, all parameters of hemostasis were within normal range, but in spite of that, traumatic shock of ensuing surgical procedure of these proportions led to bleeding in a small number of patients. Revision of wound and ligation of the arterial blood vessels was performed in one patient only. In others, bleeding stopped spontaneously after the cannula with cuff had been placed and fresh frozen plasma administered. Complications of extensive surgical interventions affect the recovery and prolong hospital
stay. They are related to the primary surgery of malignancies but also to the reconstruction by using flaps. Session et al. [20] reported severe complications in 45% of patients.

Locoregional recurrence developed in 37 (32.1%) treated patients, that is in the tongue and pharyngeal wall in 13 patients (11.3%) and regional recurrence in 24 (20.8%) patients. Great biological potency of planocellular cancer, lack of natural barriers that slow down the progression of cancer, a rich network of blood vessels and lymphatics allow the tumor to spread quickly and easily through the structure of tongue and regional lymph nodes. This is the reason of high percentage of local and regional recurrence, and difficult intraoperative diagnosis. A high percentage of recurrence was reported by Gourin and Johnson; local relapse occurred in 5.7%, and regional relapse occurred in 13.8% of patients [6]. Sessions et al. [20] reported local recurrence in 12.2% of patients, regional positive lymph nodes in 8.8%, and both local and regional recurrence in 5.3% of patients. In 89% of patients, recurrences developed within four years after the primary treatment.

According to the protocol, patients with positive marginal tissue after definite pathological analyses were referred to radiation. Sessions et al. [20] found that 41% of surgically treated patients had positive borders in this region. Although all patients were subjected to radiotherapy, they have concluded that the positive tissue borders reduce survival rate and that additional radiation does not improve survival.

Distant metastases were diagnosed in 4 (3.5%) patients in this study, that being significantly less than 25.3% and 16% as recorded by Gourin and Johnson [6] and Sessions et al. [20], respectively. Second primary cancer was diagnosed in 9 (7.8%), and Sessions et al. [20] found it in 20% of patients.

T and N categories have the greatest influence on the survival rate of patients. The survival rate becomes lower with the more advanced stage of tumor and the greater number of metastases. It is therefore expected that patients with T1 tumors have the best survival rate (73%), then those with T2 (60%), and T3 (45%) and patients with T4 (21%) have the worst survival rate. There are significant statistical differences among the categories. Another important criterion for survival is regional spread of the disease. With positive neck lymph nodes, the disease-specific survival rate according to N category is N0 (68%) and significantly worse in N+ (32%). The overall 3-year survival rate was 42%. It is very difficult to compare the survival of patients from different series, because of the differences in protocols, the structure of patients, length of follow-up, method of reconstruction, surgeon’s skill - therefore the data are only seemingly comparable.

Gurin and Johnson reported the overall survival rate to be 49% [6]. Chien et al. [13] found the total 4-year survival to be 63.8%, for tongue cancer and 42.9% for the base of tongue cancer.

The overall 3-year survival was 46% in the study conducted by Mahtay et al. [21], whereas it was 57% with radiation therapy as reported by Robertson et al. [22].

The overall survival rate of patients after the applied primary surgical protocol did not differ significantly from the survival rate shown in the series of other authors or in comparison with other therapeutic protocols applied.

**Conclusion**

Cancer of the base of tongue is a silent, progressive, very aggressive disease which is discovered at an advanced stage, although it creates regional and distant metastases early. From the oncological aspect, surgical treatment does not provide significant improvement of survival rate; however, resection all the way to the healthy tissue with good reconstruction yields excellent functional results. Transpharyngeal approach has the advantage over the transmandibular one because it enables an easy access to the base of tongue, good visibility, and the suspension after resection of the tongue base is possible for the larynx through the thyroid cartilage if the epiglottis/supraglottis is removed, or via the thyrohyoid membrane when the epiglottis is preserved. The resumed function of swallowing indicates that a good surgical technique and quality reconstruction have been performed. As the base of tongue cancer increases in younger population, in relation to human immunodeficiency virus infection, the surgical treatment becomes a matter of choice.

**References**

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