Modern surgical management of tongue carcinoma - A clinical retrospective research over a 12 years period

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Abstract

Objectives: In this retrospective study, we present a clinical review of our experience with tongue cancer in order to obtain valid criteria for therapeutic decision-making.

Materials and methods: Between August 1999 and June 2011, a total of 398 patients with squamous cell carcinoma of the tongue were treated at the Department of Oral and Maxillofacial Surgery, King Edward Medical University Lahore Pakistan. Data concerning patient characteristics, clinical and pathologic tumour characteristics and treatment strategies and their results were obtained from a retrospective review of medical records. The average follow-up was 4.6 years. Statistical analysis for survival was calculated by the method of Kaplan and Meier.

Results: There were 398 total patients. The mean age at diagnosis was 49.5 years, 224 (56.3%) were male and 174 (43.7%) female (male/female ratio = 1.3:1). 332/398 patients received surgical treatment, whereas 66 patients were excluded from surgical treatment and received primary radio (chemo) therapy after biopsy. Tongue carcinoma patients treated by non surgical treatment modalities had 5 years survival rate of 45.5% and patients with surgical intervention had survival rate of 96.1%.

Conclusions: We recommend categorical bilateral neck dissection in order to reliably remove occult lymph node metastases. Adjuvant treatment modalities should be applied more frequently in controlled clinical trials and should generally be implemented in cases with unclear margins and lymphatic spread.

Clinical relevance: This study provides modern treatment strategies for the tongue carcinoma.

Keywords: tongue cancer, squamous cell carcinoma, resection, survival, prognostic factors

Introduction

Oral cancer located in the mouth, tongue or oropharynx is a significant health problem throughout the world. It’s the eight most common cancer worldwide with 300,000 new cases reported annually [1]. Many countries feature incidence rates in oral cancer that vary in men from 1 to 10 cases per 100,000 population [2]. Developing countries suffer from higher incidence rates in oral cancer than developed countries [3]. Worryingly, the incidence of the disease is reportedly rising in most countries such as central and Eastern Europe and the USA [2,3]. The overall five-year-survival rate for patients with oral cancer stagnated for the last 20 years [4]. The survival rate is only 54% in industrial countries, one of the lowest rates of all major cancers. Five-year survival rates in developing countries reached the rate of 30% hardly [5]. The middle east is geographically located in the high incidence and mortality of oral cancers. Oral cancer is the second most common malignancy in both genders in Pakistan [1] and there is an epidemic alert of Oral cancers in Pakistan in the year 2030 by WHO [2].

First report of the tongue in medical literature was in 1635 [3]. But Only a limited number of studies have examined larger series of tongue cancer. Spiro and Strong evaluated 314 patients (1957-1963) with tongue cancer and found an overall 5-year survival rate of only 42% [3].
The incidence of tongue carcinoma in males is 6.5 per 100,000 per annum and in some parts of Europe and South Asia is up to 8.0 per 100,000 per annum. The tongue remains the most common intraoral site for oral cancer worldwide [4].

In contrast to other sites of oral cancer, the incidence of the tongue carcinoma has been increasing, especially in the younger age group [5-7]. This is linked with human papilloma virus etiology of tongue cancers [8]. This increase in the incidence needs more expertise and sharing of the experiences of the tongue carcinoma.

The optimal structural and functional integrity of this muscular organ of the human body is vital for the life of the suffering patient. The speech, swallowing and breathing is associated with integrity of the reconstructed tongue muscles after surgical resection [9]. The anatomical and physiological milking muscle action predispose to an early invasion and metastasis of tongue carcinoma [10]. This results in extensive resection of not only the tongue tissue but also floor of mouth, oropharynx, tonsillar area along with cervical lymph nodes dissection even in clinical N0 status for the complete palliation of the occult metastasis [11].

The various treatment options for the tongue carcinoma include surgery, radiotherapy, chemotherapy, and combined modalities [12]. Due to the mutilating affects of the surgical management of tongue carcinoma on the quality of life, organ preservation techniques and treatment protocols have been discussed. The choice of the treatment depends upon tumor factors such as site, size (T stage), location and multiplicity, proximity to bone, pathological features, histology grade and depth of invasion. The patient factors include status of cervical lymph nodes, previous treatments medical condition of the patient. The various flaps for mobile tongue include local (mucosal, buccinator flaps), local neck flap (infrahyoid), free flaps (Latissimus dorsi free flap, anterolateral free flap, rectus abdominis free flap). The micro-vascular flap revolutionised the reconstruction of the tongue and was used first time in 1963 [13] in general surgery and in head and neck reconstruction in 1975 [14].

The resection defect classification guides clinicians for the decision of the reconstructive flap design. According to Urken et al tongue defects are difficult to classify; the volume and function of residual tissue does the quantification of the defect. He classified tongue resection defects as soft tissue defects of mobile tongue Tm, base of tongue Tb and total glossectomy Tg defects along with neural defects. Further classification of Tm is done by longitudinal division in quarters and finally grouping of defects with reconstructive guidelines is described [15].

The purpose of the present study was to give a precise description of our experience with surgical based therapy of tongue cancer during 12 years in a country with limited human expertise and finances. Furthermore, prognostic factors for survival were analyzed in order to obtain valid criteria for therapeutic decision-making in clinical routine.

Materials and methods
Between August 1999 and June 2011, a total of 398 patients with squamous cell carcinoma of the tongue were treated at the Department of Oral and Maxillofacial Surgery, King Edward Medical University Lahore Pakistan. Data concerning patient characteristics, clinical and pathological tumour characteristics and treatment strategies and their results were obtained from a retrospective review of medical records. The average follow-up was 4.6 years. Statistical analysis for survival was calculated by the method of Kaplan and Meier. The relationship between the clinicopathologic variables and survival was assessed in univariate analysis using the log rank test. A value of p ≤ 0.05 was considered of to be statistically significant.

Results
There were 398 patients according to the including criteria. The mean age at diagnosis was 49.5 years, ranging between 13 and 80 ± 10.6 years. There were 224 men (56.3%) and 174 (43.7%) women (male/female ratio = 1.3:1). The lesion size was T1 19/398 (4.8%), T2 60/398 (15.1%), T3 182/398 (45.7%) and T4 137/398 (34.41%) (Table 1). The primary site was lateral border of the mobile tongue 262/398 (65.8%), dorsum of tongue 36/398 (9.04%), base of the tongue 72/398 (18.1%) and all tongue 82/398 (20.7%) (Table 1). The lesion size was T1 19/398 (4.8%), T2 60/398 (15.1%), T3 182/398 (45.7%) and T4 137/398 (34.41%) (Table 1). The primary site was lateral border of the mobile tongue 262/398 (65.8%), dorsum of tongue 36/398 (9.04%), base of the tongue 72/398 (18.1%) and all tongue involvement 28/398 (7.03%). Midline extension was seen in 128/398 (32.2%) of cases. Histopathologically 287/398 (72.1%) were well differentiated, 76/398 (19.1%) moderately differentiated, 12/398 (3%) were poorly differentiated, 12/398 (3%) were verrucous variants of squamous cell carcinoma and 11/398 (2.8%) were minor salivary gland malignancies (Table 2).

332/398 patients received surgical treatment, whereas 66 patients were excluded from surgical treatment and received primary radio (chemo)therapy after biopsy. These patients refused surgery, were in inappropriate condition for general anaesthesia or suffered from inoperable tumour disease. As a consequence, the proportion of advanced tumour stages was higher in this group (Table 1). 317/398 (79.6%) had no previous history of premalignant oral lesion/condition where as 69/398 (17.3%) had the history of Oral premalignant lesion.12/398 (3%) had recurrence of the disease (Table 3).

In patients with surgical therapy, the neck was staged pN0, pN1, pN2 and pN3 in 49.5%, 18.4%, 14.9% and 0.3% of cases. Supra-omohyoid neck dissection was
done in 212/398 (53.3%) of the patients where as radical neck dissection in 88/398 (22.1%), bilateral neck dissection in 17/398 (4.3%) patients; 15/398 (3.8%) had no neck dissection (Table 4). The primary closure was done in 38/398 (9.5%), local Myomucosal in 28/398 (7%), Delto-pectoral in 138/398 (34.7%), Radial forearm free flap 100/398 (25.1%), Anterior thigh flap 16/398 (4%), Rectus abdominis 12/398 (3.0%) (Table 5).

### Table 1 Tumour size (T-Status) of patients and surgical treatment and survival rates of patients with surgical and non surgical management

| T1 | T2 | T3 | T4 | Tumour size | Total | Percentage |
|----|----|----|----|-------------|-------|------------|
| No surgical management only radio chemotherapy | Years of survival | 1 year | 0 | 7 | 3 | 6 | 16 | 24.2% |
| 2 year | 1 | 2 | 3 | 7 | 13 | 19.7% |
| 3 year | 0 | 0 | 1 | 3 | 4 | 6.1% |
| 4 year | 0 | 0 | 7 | 8 | 15 | 22.7% |
| 5 year | 0 | 0 | 7 | 11 | 18 | 27.3% |
| Total | count | 1 | 9 | 21 | 35 | 66 | 100% |
| Percent | 15.6% | 31.8% | 53.0% | 100% |

| Surgical management | Years of survival | 1 year | 0 | 2 | 16 | 3 | 31 | 9.3% |
| 2 year | 2 | 5 | 22 | 17 | 46 | 13.9% |
| 3 year | 4 | 12 | 22 | 11 | 49 | 14.8% |
| 4 year | 3 | 14 | 38 | 24 | 79 | 23.8% |
| 5 year | 9 | 18 | 63 | 37 | 127 | 38.3% |
| Total | count | 18 | 51 | 161 | 102 | 332 | 100% |
| Percent | 5.4% | 15.4% | 48.5% | 30.7% | 100% |

| Treatment | Survival in years | Well differentiated SCC | Moderately differentiated SCC | Poorly differentiated SCC | Verrucous SCC | Basal squamous SCC | Total |
|-----------|--------------------|-------------------------|-----------------------------|--------------------------|--------------|-------------------|-------|
| No surgical management | 1 | 9 | 4 | 0 | 1 | 2 | 16 (24.2%) |
| 2 | 7 | 4 | 1 | 0 | 1 | 13 (19.7%) |
| 3 | 2 | 0 | 1 | 1 | 0 | 4 (6.1%) |
| 4 | 12 | 2 | 0 | 1 | 0 | 15 (22.7%) |
| 5 | 11 | 6 | 0 | 1 | 0 | 18 (27.3%) |
| Total | 41 | 62.1% | 16 | 24.2% | 2 | 3.0% | 4 | 6.1% | 3 | 4.5% | 66 | 100.0% |

| Surgery done | Survival in years | Well differentiated SCC | Moderately differentiated SCC | Poorly differentiated SCC | Verrucous SCC | Basal squamous SCC | Total |
|---------------|--------------------|-------------------------|-----------------------------|--------------------------|--------------|-------------------|-------|
| 1 | 25 | 5 | 0 | 0 | 1 | 31 (9.3%) |
| 2 | 34 | 10 | 0 | 0 | 2 | 46 (13.9%) |
| 3 | 34 | 11 | 1 | 3 | 0 | 49 (14.8%) |
| 4 | 60 | 13 | 2 | 1 | 3 | 79 (23.8%) |
| 5 | 93 | 21 | 7 | 4 | 2 | 127 (38.3%) |
| Total | 246 | 74.1% | 60 | 18.1% | 10 | 3.0% | 8 | 2.4% | 8 | 2.4% | 332 | 100.0% |
The par-operative frozen section technique for the margin free of tumour cells was done in 68/398 (17.1%) patients; whereas histopathological reported tumour cell positive margins were observed in 56/398 (14.1%) and tumour cells negative margins were seen in 208/398 (52.3%). Neo adjuvant radiochemotherapy was done in 10/398 (2.5%), adjuvant in 198/398 (49.7%) whereas 124/398 (31.2%) had no radiochemotherapy. 66/398 (16.6%) were managed by radiochemotherapy without surgical intervention.

Overall 5 year survival rate was 349/398 (87.7%). The survival rate was calculated with Kaplan Meier Log rank with tumour size, treatment modality, previous history of the patient, histopathological variant, neck dissection options and radiochemotherapy modality.

Tongue carcinoma patients treated by non surgical treatment modalities had 5 years survival rate of 45.5% and patients with surgical intervention had survival rate of 96.1% (Log Rank .000). (Figure 2). Survival in both sexes was nearly equal (87.5%, 87.9% Male female) (Log rank .833) (Figure 3). Patients with no previous history of any lesion had maximum survival rate of 94.4% where as recurrent lesion had worst prognosis with survival rate of 26.9% (Figure 4). Patients with bilateral neck dissection had best survival rate of 100% where as supra-omohyoid had survival rate of 95.8% where as patients with no surgical intervention of neck had worst prognosis of 45.5% (Figure 5). Frozen section technique for surgical margin evaluation had survival rate of 98.5% where as patients with no surgical intervention had survival rate of 45.5% (Figure 6). The Myomucosal and Rectus abdominal flap has survival rate of 100% where as Radial forearm free flap has survival rate of 97%; Delto-pectoral flap has survival rate of 94.9%, primary closure 94.7%, and anterior thigh flap of 93.8% (Figure 7).

The well differentiated squamous cell carcinoma had survival rate of 88.9%, moderate differentiated squamous cell carcinoma is 85.5%, poorly differentiated SCC and Verrucous SCC 91.7% each. The Basisquamous SCC survival rate of 63.6% (Figure 8). Survival rate of adjuvant

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**Table 3 Previous history of Tongue carcinoma patients with their survival rate in surgical and non surgical treatment options**

| Previous history          | No history | H/O PML | H/O PMC | Recurrence |
|---------------------------|------------|---------|---------|------------|
| No surgical management only radio chemotherapy | 1 year | 9 | 2 | 2 | 3 |
|                           | 2 year | 5 | 2 | 2 | 4 |
|                           | 3 year | 2 | 0 | 1 | 1 |
|                           | 4 year | 13 | 0 | 0 | 2 |
|                           | 5 year | 9 | 4 | 2 | 3 |
| Total Count               | 38       | 8 | 7 | 13 |
| Percent                   | 57.6%    | 12.1% | 10.6% | 19.7% |

Surgical management

| Years of survival | 1 year | 2 year | 3 year | 4 year | 5 year | Total Count | Percent |
|-------------------|--------|--------|--------|--------|--------|-------------|---------|
| No surgery        | 21     | 44     | 38     | 62     | 102    | 267         | 80.4%   |
| Surgery           | 9      | 1      | 0      | 8      | 22     | 50          | 15.1%   |
| Total             | 30     | 46     | 48     | 70     | 124    | 332         | 0.6%    |

**Table 4 Neck dissection and survival rate in tongue carcinoma patient**

| Survival Years | Non Surgical | Neck dissection |
|----------------|--------------|----------------|
|                | Supra omohyoid | Radical | Bilateral | Local excision |
| 1              | 16            | 19      | 9         | 3          | 0 | 31 |
| 2              | 13            | 28      | 14        | 2          | 2 | 46 |
| 3              | 4             | 30      | 13        | 2          | 4 | 49 |
| 4              | 15            | 48      | 25        | 3          | 3 | 79 |
| 5              | 18            | 87      | 27        | 7          | 6 | 127 |
| Total          | 66            | 212     | 88        | 17         | 15 | 332 |
| Survival rate (%) | 63.9% | 26.5% | 5.1% | 4.5% | 100.0% |

45.5 | 96.1
radiochemotherapy was 95.5%, neoadjuvant 90.0% as compared to group of patients treated by radiochemotherapy of 45.5% (Figure 9).

**Discussion**

The various treatment options for Head and Neck Squamous cell carcinoma including tongue carcinoma are surgical, radio-chemotherapy and combination of both. The outcomes of the treatment affect not only the aesthetics but may also compromise the functions of speech swallowing of the suffering patients (Figure 10). These affects may be of shorter duration or permanent leading to life style changes. The clinician decision for the treatment option depends upon multiple tumour and patient along with health care facilities available.

In this study we evaluated that up to 5 year survival rate was better for the surgical management of tongue carcinoma (96%) as compared to non surgical management (45%) (Table 1). According to literature surgical management has better prognosis [16], [17], [18]. In our study, almost 2.5% of the operated patients received neoadjuvant radiochemotherapy prior to surgery and almost 50% of patients in the surgical group received postoperative radiation due to unclear margins, extensive tumour growth at the primary site, massive lymph node involvement or extracapsular spread, reflecting the scope of changing indications for radiotherapy during a period of three decades. Due to medical almost 17% had no surgical management but only radiochemotherapy. Due to non randomized selection we were unable to determine the impact of radiochemotherapy.

The smaller tumour size T has direct prognostic value. “Smaller the tumour size better the prognosis” this statement is generalized for all HNSCC but most appropriate for the tongue cancer [19]. We have the consistent results (Figure 2). The resection defect is smaller so better the reconstruction and functional rehabilitation.

The prognostic pathogenesis of HNSCC including tongue carcinoma is better known today. The impact HPV, field cancerization and pathogenesis of oral premalignant lesion/conditions with malignant potential in tongue carcinoma patients are also affecting the treatment outcomes [20]. In our study we have the same...
Figure 3: Survival rate of tongue carcinoma in both gender (log rank p = 0.833).

Figure 4: Survival rate of tongue carcinoma with previous history (log rank p = 0.012).

Figure 5: Survival rate of tongue carcinoma in neck management (log rank p < 0.001).

Figure 6: Survival rate in surgical margin management (log rank p < 0.001).

Figure 7: Survival rate of tongue carcinoma in different surgical reconstruction.

Figure 8: Survival rate of tongue carcinoma in histopathological variants (log rank p = 0.038).
results; the patients with no previous history of prema-
lignant lesion, condition and recurrence had better 5
years survival rate as compared to other groups (Figure
4 Log Rank .012).

The management of neck is an important decision for
the clinician. In our study up to 5 years survival is better
in patients with neck management (Table 4). We have
seen that almost 64% with supraomohyoid neck dissec-
tion had 5 year survival rate as it was most frequently
performed. The N0 status in tongue carcinoma is also
requisite for the selective neck dissection [21].

In our study Radial forearm free flap was most fre-
quently performed (almost 25%) as compared to other
free flaps with survival rate of 97%; whereas Deltopec-
toralis pedicled flap was used to reconstruct tongue in
almost 35% of patients of tongue carcinoma with upto 5
years of survival rate of 95% (Table 5).

Conclusions
Radial forearm free flap was most frequently performed
(almost 25%) as compared to other free flaps with survi-
val rate of 97%; whereas Deltopectoralis pedicled flap
was used to reconstruct tongue in almost 35% of
patients of tongue carcinoma with upto 5 years of survi-
val rate of 95%. We recommend categorical bilateral
neck dissection in order to reliably remove occult lymph
node metastases. Adjuvant treatment modalities should
be applied more frequently in controlled clinical trials
and should generally be implemented in cases with
unclear margins and lymphatic spread.

Clinical relevance
This study provides modern treatment strategies for the
tongue carcinoma.

Conflict of interests statement
The authors declare that they have no competing
interests.

Consent statement
Written informed consent was obtained from the patient
for publication of this case report and accompanying
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Authors’ contributions
MR, AI, RW, MRRU, AME and NCG conceived of the study and participated in
its design and coordination. MR and AI made substantial contributions to
data acquisition and conception of manuscript. MR drafted and designed
the manuscript. MR and AI performed the statistical analysis. NCG and AME
were involved in revising the manuscript. All authors read and approved the
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