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The Impact of the Multidisciplinary Tumor Board on Head and Neck Cancer Outcomes

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Abstract

Objectives: While the Multidisciplinary Tumor Board (MTB) is accepted as best practice for the management for head and neck squamous cell carcinomas (HNSCC) there is limited evidence showing its impact on survival. Our goal was to investigate the impact of MTB following the hiring of a fellowship trained head and neck surgeon and implementation of an MTB at our institution. We hypothesized that these changes would demonstrate an improvement in survival.

Methods: A retrospective chart review of HNSCC treated at our institution between 10/2006 and 5/2015 was performed. The cohort was divided into preMTB (10/06–2/11) and postMTB (2/11–5/15) cohorts. Patient demographics, cancer stage, and treatment outcomes were reviewed. Univariate, multivariate, and survival analysis were performed.

Results: 224 patients were included for study. We included 98 patients in the preMTB cohort and 126 patients included in the postMTB cohort. Of total patients, 139 (62%) were black and 91 (40%) were Medicaid or uninsured. Average follow-up time was 2.8 years and most cases were advanced stage (68%).

On Kaplan-Meier evaluation, Overall Survival (OS) and Disease Specific Survival (DSS) were significantly improved in the postMTB cohort compared to preMTB cohort, with a 5-year DSS of 52% vs. 75% ($p=0.003$). A matched cohort analysis showed that the postMTB cohort had significantly lower risk of death (HR 0.48).

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Conclusion: Our study demonstrates that treatment of HNSCC by a dedicated multidisciplinary team results in improved survival. Multidisciplinary care should be considered best practice in the care of HNSCC.

Keywords

Head and Neck Neoplasm; Squamous Cell Carcinoma; Multidisciplinary tumor board; Cancer Survival

Introduction

The multidisciplinary tumor board (MTB) is an important part of head and neck cancer evaluation and management. Head and neck cancer treatment decisions can be complex, with multimodality treatment routinely employed for advanced disease.¹ Coordination of care between radiation oncology, medical oncology, and head and neck surgery is often facilitated with an MTB.² The available clinical and pathological data is presented and discussed, with treatment plans refined. In addition, ancillary services such as speech language pathology, physical therapy, nutrition, psychology and social work support all complement treatment and provide supportive care to the patient. Multiple publications support the value the MDT and its cost effectiveness in the cancer treatment process.^{3,4} In head and neck cancer, review in an MTB affects and refines treatment plans in up to 30–60% of cases.^{5,6} Despite data showing the effects of MTB, there is a paucity of data showing survival benefit of MTB, with limited studies showing a survival impact in head and neck cancer.^{7–10}

In 2011, our institution instituted a formal multidisciplinary tumor board for the treatment of head and neck cancers. From 2006–2011, the head and neck treatment team was comprised of non-fellowship trained otolaryngologists, medical oncologists, and radiation oncologists, which met inconsistently (approximately monthly). In 2011, the MTB structure changed. A fellowship trained head and neck surgeon organized the tumor board. In addition to medical oncology and radiation oncology, the MTB was expanded to include neuroradiology, speech therapy, nutrition, pathology, dental services, and social work. The MTB meeting frequency was standardized to weekly conferences. All new head and neck cancer cases were presented for decision making and discussion. In addition, any patient undergoing surgery, radiation, and/or chemotherapy for their head and neck cancer were discussed weekly during treatment to coordinate their care between specialty, ancillary, and social services.

We set out to determine if implementation of this MTB had impact on the survival of cohorts before and this MTB implementation. A secondary goal was to determine if the formal MTB, with incorporation of speech therapy, would impact tracheostomy and gastrostomy rates. We hypothesized that these changes to the treatment process would improve head and neck cancer survival and outcomes.

Methods

Following Institutional Review Board approval, a search of the tumor registry for HNSCC at our institution between January 1, 2006 and May 31, 2015 was performed. May 31, 2015

was selected to allow adequate follow up data for the postMTB cohort. On February 1, 2011, a new fellowship trained head and neck surgeon was recruited to the health system and the MTB changes were made as previously discussed. The patient cohort was divided into a preMTB cohort, from Jan 1, 2006 to Feb 1, 2011, and postMTB cohort from Feb 1, 2011 to May 31, 2015.

Patients were included for analysis if they had a pathologically confirmed mucosal squamous cell carcinoma of the head and neck. Only patients whose treating otolaryngologist was within the institution were included. Patients referred from outside the institution for radiation or chemotherapy only, without involvement from the institutional otolaryngology team, were excluded. Patients with non-SCC pathologies or inadequate records, were excluded. Chart review included patient demographic data, cancer stage and subsite, treatment modality and timing of treatment. The need for gastrostomy or tracheostomy, recurrences, survival measures and last followup and status were collected.

Our primary outcomes were overall survival (OS) and disease specific survival (DSS). Univariate analysis was performed using chi squared tests or logistic regression. Multivariate analysis was performed using a cox-proportional hazard ratio. Stata 13 (College Station, TX) was used for statistical analysis. Kaplan-Meier survival function was used for survival analysis. For the matched analysis, patients in the pre and postMTB cohort were matched on gender, race, stage (early/late), and comorbidities (Charleston Comorbidity Index).¹¹

Secondary outcomes included time to treatment, defined as the time between biopsy and initiation of first treatment course, gastrostomy and tracheostomy rate, and whether these interventions were before during or after initial treatment, and recurrence rate

Results:

From 2006–2015, 440 unique patients were identified from the tumor registry. Following exclusion criteria, 224 patients were available for analysis. We identified 98 patients in the preMTB cohort, and 126 patients were identified in the postMTB cohort. Demographics are reported in Table 1. Most of the patients self-reported as black (62%) and had Medicare (46%) insurance. Medicaid was also a substantial portion of the cohort (39%). The mean length of follow-up was 3.25 and 2.6 years in the preMTB and postMTB cohorts respectively. Gender, smoking, and race were not significantly different between the two cohorts.

Cancer stage information is presented in Table 2. Most (68%) of the cancers treated were advanced (stage III/IV) stage cancers. Larynx/hypopharynx cancer was the most common subsite (49%). Chemoradiation was the most common treatment modality (49%). The postMTB cohort had a higher percentage of early cancers, which was statistically different than the preMTB cohort (χ^2 , $p=0.003$). The postMTB cohort also had a statistically higher percentage of patients that included surgery in the initial treatment (37% vs. 17%, χ^2 $p=0.002$).

Univariate analysis demonstrated no association of gender, black race, tobacco use, or Medicaid insurance as a predictor of overall survival (OS) or disease specific survival (DSS).

The postMTB cohort had a significantly lower risk of death on both OS and DSS (OR 0.4 for both). On a multivariate model accounting for gender, black race, tobacco use, Medicaid status, tumor stage, and MTB status, tumor stage and MTB status were predictive of OS and DSS. The odds ratio for disease specific survival in the postMTB cohort was 0.47 (CI 0.24–0.29). See Table 3.

Kaplan Meier survival data for OS and DSS are shown in figures 1a and 1b, respectively. The preMTB two year and five-year OS was 55% and 40% respectively, while the postMTB cohort was 64% and 61%, which was significant ($p=0.008$). The preMTB two year and five-year DSS was 65% and 52% respectively, while the postMTB cohort was 77% and 75%, which was also significant ($p=0.0029$).

To remove the possible confounding effects of unbalanced early/late cancer cases and HPV positive oropharynx cancers in the two MTB cohorts, we compared only advanced stage non-oropharynx cancers pre and postMTB. The survival differential between HPV positive and negative cancers is significant, and unbalanced HPV oropharynx SCC could confound the survival results.¹² Given the time frame of the study, not all oropharynx cancer patients had reported HPV or p16 status, and therefore could not be controlled for in this analysis. The DSS when evaluating only advanced non-oropharynx cancers remained significant ($p=0.02$) as shown in Figure 2. In this subset of cases, the preMTB two year and five year survival was 56% and 44% compared to postMTB survival of 81% and 63%.

To further evaluate the two cohorts, we performed a matched analysis. Pre and postMTB cohorts were matched by gender, race, stage, and comorbidity as measured by the Charlson Comorbidity Index. In particular, matching by stage eliminated the unbalanced early stage cancer incidence between the two cohorts. 88 patients were matched from each cohort resulting in 176 patients for analysis. On analysis preMTB vs. post MTB status was still significant for both OS and DSS. For OS, the odds ratio for overall survival was 0.46 (CI 0.24 – 0.83), and for DSS the odds ratio for disease specific mortality was 0.48 (CI 0.25–0.92). The Kaplan Meier survival curve is shown in Figure 3. Disease specific outcomes in this matched cohort significantly different ($p=0.035$).

We also evaluated certain prognostic factors including time to treat and the use of pretreatment tracheostomy and gastrostomy within the two cohorts. Time from biopsy to treatment was 53.34 days in the preMTB cohort and 50.5 days in the postMTB cohort which was not significant ($p=0.58$). Overall, there was no difference in the frequency of pretreatment tracheostomy or gastrostomy. When examining only advanced disease patients, the use of pretreatment gastrostomy was statistically higher in the preMTB than postMTB cohorts (39% vs. 26%, $p=0.03$).

Discussion

As cancer care has become more complicated and multidisciplinary, discussion at an MTB has become a critical part of the cancer patient assessment. A recent meta-analysis demonstrated that the MTB improves cancer evaluation processes and improves cancer survival across multiple cancer subtypes.¹³ In head and neck cancer, MTB discussions

frequently change treatment decisions, with one prospective study showing 27% of cases change diagnosis, stage or treatment plan.⁶ Coordination of care is also improved through the MTB.⁴

Despite ample data showing the impact of MTB on decision making and coordination of care, studies showing improvement in head and neck cancer survival are less common. The largest institutional series evaluated 1616 patients with oral cavity cancer treated over a 15-year period. A statistically significant improvement in neck regional control, DSS, and OS were reported after implementation of an MTB. Five-year DSS was 83% in the MTB group vs. 78% in their preMTB group. Patients were more likely to complete adjuvant treatment in the MTB group. They concluded that the improved survival from the MTB was multifactorial, allowing better the identification of high-risk patients, selection of the optimal supportive care approaches, and the reduction of treatment related morbidity.⁸

Tsai et al⁹ also reported a large series of patients of oral cavity cancer by utilizing the Taiwan cancer registry database. In their study, 19,766 new oral cancers from 2005–2008 were divided into MTB (n=3324) and nonMTB (n=13,367) patients. The use of MTB was captured by institutional billing for MTB services. In this database-based study, improvement in overall survival (HR 0.94, p=0.032) was reported with the MTB cohort.

These studies were limited to only oral cavity cancer, but other studies evaluating all head and neck sites also show benefit. Friedland et al⁷ compared the outcomes of 395 MTB vs. 331 nonMTB head and neck cancer patients. They reported significant improvement in OS for the MTB group, especially in Stage IV patients (HR 0.69, p=0.004). Patil et al¹⁴, evaluated 51 preMTB vs. 66 postMTB head and neck patients in the Veterans Administration system following implementation of an MTB. They reported significant improvement in time to evaluation and time to initiation of treatment from biopsy, but no improvement in overall survival between the two groups.

Our study reports the impact of MTB on 224 head and neck patients over a nine-year period. Like some of the aforementioned studies^{8,14}, MTB was introduced at a certain time and the cohorts before and after were compared and evaluated. Similar to other studies, we also demonstrate a survival difference in all head and neck patients with an improvement in five-year OS (64% vs. 40%) and DSS (75% vs. 52%). When analysis was performed evaluating only advanced non-opharynx cancers, the five-year DSS remains significantly different at 63% vs. 44%. A matched cohort analysis, which included matching for stage, also demonstrated improved DSS. Our data confirms the findings of other studies while including all head and neck cancer patients and controlling multiple potential confounders. We conclude that inclusion of the MTB in the evaluation of head and neck cancer patients has significant impact on cancer outcomes and survival.

There are many benefits to the MTB, but the exact mechanism of impact on survival is less clear. The MTB affects the accuracy of staging through data and imaging review, as well as accuracy of diagnosis through pathology review. Treatment plans are refined with the latest data and trials to provide the best evidence-based recommendation.^{6,13} Treating patients following accurate staging and executing the most informed treatment plans would be

expected to improve survival. In addition, MTB allows coordination of multimodality treatment, resulting in reduced package time.³ As time to initiation of treatment and radiation delivery time have been shown to impact survival, the MTB facilitates timely treatment thus improved outcomes.^{15–18} Our study did not observe an improvement in time to initiation of treatment with MTB, thus more analysis needs to be done if other impacts on total package time may have occurred with a formal MTB. It is possible that incorporation of ancillary support into the MTB – speech language pathology (SLP), social work, nutrition – may provide greater patient supportive care resulting in better adherence to prescribed treatments, including post-treatment surveillance, or that patients in the postMTB cohort received a higher standard of care. This remains to be examined further.

An interesting finding in our study was the reduction in preoperative gastrostomy tube usage in the postMTB group. With the formal MTB in 2011, reactive rather than prophylactic gastrostomy tube placement was implemented in coordination with our SLP team. Patients would undergo SLP evaluation and intervention pretreatment and throughout treatment. Patients identified as high risk due to significant pretreatment functional loss or weight loss were referred for pretreatment gastrostomy. During treatment, gastrostomy tubes were placed as needed with SLP monitoring and input. Pretreatment evaluation by SLPs has been shown to improve swallow function following head and neck cancer treatment in multiple studies.^{19–21} The incorporation of the SLP team allowed transition to reactive gastrostomy.

Our study has some multiple limitations. The outcomes are biased by the years of treatment. The preMTB cohort preceded the postMTB cohort by about five years, and improvement in treatment techniques alone may impact the survival outcome. Also, as this study is retrospective, it is limited by the available data for inclusion. Functional data is also not captured in this study, making measuring the impact of SLP and nutritional support unavailable.

Although the clinical volume at our institution is modest (on average 1.8–2.5 new cases per month), our data shows that having a dedicated multidisciplinary team impacts patient survival. It supports the general understanding that the best patient care with the best outcomes occurs when delivered with a multidisciplinary team. Future directions will work to identify explanations for why the MTB improves patient outcomes.

Conclusions

This study evaluated the outcome of two cohorts of head and neck cancer patients before and after implementation of a multidisciplinary tumor board. Our data shows improved OS and DSS with implementation of an MTB. The benefits of MTB are multifactorial, improving multiple elements of cancer care, including staging, treatment planning, treatment coordination, and ancillary service incorporation. In this single institutional study, we show that the MTB improves head and neck cancer survival. For patients to achieve the best outcomes, evaluation and treatment of head and neck cancer patients should include evaluation by a multidisciplinary tumor board.

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Figure 1a (top) and 1a (bottom):

Kaplan-Meier Curves demonstrating improved (1a) overall survival, $p=0.008$, and (1b) disease specific survival, $p=0.0029$, in the postMTB cohort. MTB: Multidisciplinary Tumor Board.

Figure 2: Disease specific survival of advanced non-oropharynx cancers remained statistically significant ($p=0.02$). DSS: Disease Specific Survival, MTB: Multidisciplinary Tumor Board.

Figure 3: Disease specific survival of Pre and Post MTB matched by gender, race, stage, and comorbidity remained statistically significant ($p=0.038$). MTB: Multidisciplinary Tumor Board.

Table I:

Patient Demographics.

	preMTB	postMTB	All
	n = 98	n = 126	n = 224
Age			
range	(36–86)	(28–92)	(28–92)
median	62	61	61.50
mean	61.16	61.5873	61.40
Gender n (%)			
Male	70 (71)	91 (72)	161 (72)
Female	28 (29)	35 (28)	63 (28)
Smoking n (%)			
Ever	92 (94)	107 (85)	199 (89)
Never	6 (6)	19 (15)	25 (11)
Race n (%)			
White	19 (19)	33 (26)	52 (23)
Black	65 (66)	74 (59)	139 (62)
Hispanic	12 (12)	19 (15)	31 (14)
Other	2 (2)	0 (0)	2 (1)
Payer n (%)			
Private	7 (7)	19 (15)	26 (12)
Medicare	40 (41)	63 (50)	103 (46)
Medicaid	47 (48)	40 (32)	87 (39)
Other/Unk/Unins	4 (4)	4 (3)	8 (3.5)
Follow-up	3.25 years	2.6 years	2.8 years
Average Time to Treatment	53 days	51 days	52 days

MTB: Multidisciplinary Tumor Board, Unk: Unknown; Unins: Uninsured

Table II:

Cancer Stage, Site, and Treatment.

Stage	preMTB (%)	postMTB (%)	All (%)
I/II	14 (14)	42 (33)	56 (25)
III/IV	75 (77)	77 (61)	152 (68)
Subsite			
Oral Cavity	12 (12)	24 (19)	36 (16)
Oropharynx	33 (34)	30 (24)	63 (28)
Larynx/Hypopharynx	45 (46)	66 (52)	111 (49)
Nasopharynx	5 (5)	5 (4)	10 (5)
Other	3 (3)	1 (1)	4 (2)
Treatment			
Surgery Only	8 (8)	19 (15)	27 (12)
Surgery + RT	3 (3)	21 (17)	24 (11)
Surgery + CRT	6 (6)	6 (5)	12 (5)
RT Only	20 (20)	30 (24)	50 (23)
CRT	61 (62)	48 (39)	109 (49)

Percentage in parentheses; MTB: Multidisciplinary Tumor Board, RT: Radiation therapy, CRT: Chemoradiation therapy

Table III:

Univariate and Multivariate Analysis for Survival.

	Univariate		Multivariate	
	OS	DSS	OS	DSS
Gender	0.95 (0.53–1.7)	1.0 (0.6–2.0)	1.1 (0.6–2.1)	1.1 (0.6–2.3)
Black Race	1.2 (0.7–2.1)	1.2 (0.7–2.2)	1.1 (0.6–2.1)	1.2 (0.6–2.3)
Pre MTB vs. Post MTB	0.4 (0.24–0.71)	0.4 (0.23–0.7)	0.45 (0.24–0.83)	0.47 (0.24–0.9)
Early vs Late Stage	4.9 (2.4–10)	10.6 (3.2–35.5)	5.0 (2.4–10.7)	9.2(2.7–31.4)
Tobacco ever	2.0 (0.8–4.9)	0.87 (0.36–2.1)	2.7 (0.950–7.494)	0.98 (0.34–2.8)
Medicaid Yes/No	1.2 (0.70–2.0)	1.7 (0.96–3.1)	0.64 (0.34–1.2)	0.95 (0.49–1.8)

95% confidence interval in parentheses; MTB: Multidisciplinary Tumor Board, OS: Overall Survival, DSS: Disease Specific Survival