Objective: To determine overall survival and prognostic factors for cancer of the nasal cavity.

Design: Cross-sectional analysis of a national cancer database.

Methods: All cases of nasal cavity cancer were extracted from the Surveillance, Epidemiology and End Results database for 1988 through 1998. Cases with distant metastatic disease were excluded. Tumor histologic types, TNM staging, and pathological features were computed. Kaplan-Meier and Cox proportional hazards analyses were conducted to determine factors influencing overall survival.

Results: A total of 981 cases were identified, with 3.5% presenting with distant metastatic disease. After exclusion of missing variables, 783 cases were analyzed, with a mean patient age of 63.8 years. Squamous cell carcinoma was the most common tumor histologic type (49.3%), followed by esthesioneuroblastoma (13.2%). More than half of the cases presented with early (T1) primary site disease, and only 5% had positive nodal disease at presentation. Overall mean (median) survival was 76 (81) months, with an overall 5-year survival rate of 56.7%. On multivariate analysis, male sex, increasing age, T stage, N stage, and poorer tumor grade independently adversely affected survival (P < .05). Radiotherapy was administered in 50.5% of patients and also independently predicted poorer survival (P = .03). The mean (median) survival for squamous cell carcinoma was 79 (84) months; only melanoma showed a statistically significantly poorer mean survival of 40 (30) months when compared with other tumors (P < .001).

Conclusions: Age, sex, and staging variables have a significant prognostic impact in nasal cavity cancer. Melanomas of the nasal cavity manifest very poor survival.

A total of 981 cases of cancer of the nasal cavity were identified in the Surveillance, Epidemiology, and End Results database. At presentation, 34 patients (3.5%) had evidence of distant metastatic disease. For 164 patients, T stage was indeterminate or in situ were excluded from the database. As these patients were unlikely to be treated with curative intent, they were dropped from subsequent analysis. Thus, 783 cases were tabulated in Table 1. For patients alive at the end of the period, the mean follow-up was 45.9 months. For the overall cohort, the mean (median) survival was 76 (81) months. Overall 5-year survival was 56.7% (Figure 1).

Survival variables according to T stage, N stage, and tumor grade are tabulated in Table 3. On univariate analysis, T stage, N stage, and tumor grade each statistically significantly influenced survival (P < .001). Survival curves according to these variables are depicted in Figures 2, 3, and 4. Radiotherapy was administered to 50.5% of patients. Mean (median) survival for patients receiving radiotherapy was 69 (58) months vs 86 (94) months for those patients who did not receive radiotherapy. This difference in survival was significant (P < .001). When stratified according to T stage, differences in survival with and without radiotherapy were not significant for T1, T3, and T4 lesions. T2 lesions fared worse if they required radiotherapy (P < .001; Figure 5). Given the negative association between radiotherapy and survival identified for T2 lesions, further subgroup analysis was conducted. The distribution of histologic types within the T2 group did not differ significantly from that of the overall cohort. Eighty-eight percent (56/64) of patients in this group also underwent cancer-directed surgery. This limits a potential bias against radiotherapy by diminishing the chance that these patients simply underwent biopsy and then were treated with curative radiotherapy alone.

Results of the Cox proportional hazards analysis are tabulated in Table 4. On multivariate analysis, increasing age, male sex, increasing T stage, increasing N stage, and increasing tumor grade each significantly reduced survival for nasal cavity cancer. Also, radiotherapy was associated with a significant reduction in overall survival. Among tumor histologic types, only malignant melanoma was associated with a statistically significant decrease in survival. Hazard ratios and 95% confidence intervals are also listed in Table 4.

Cancer of the nasal cavity proper is an uncommon entity. Because it is so uncommon, several problems arise when attempts are made to determine its clinical behavior. First, tumors of the nasal cavity proper have historically often been rolled into case series of paranasal sinus carcinoma, making determination of survival indistinct for cancer of
the nasal cavity proper. Survival analysis is also hampered by the fact that many different cancer histologic types may be encountered in the nasal cavity. The lack of a universally accepted staging system for malignant tumors of the nasal cavity leads to additional difficulties when survival results are compared across various studies. Likewise, significant variations in treatment exist in the literature, with some authors recommending radiotherapy primarily for these tumors, other authors recommending combination therapy, while still others recommend radical surgery. The goal of the present study, which used data from a national cancer database, was to examine enough cases in a short period to provide sample sizes large enough to undergo multivariate analysis with respect to histologic type, staging, and other clinical variables, in hopes of overcoming some of these difficulties.

Squamous cell carcinoma was by far the most common malignant tumor of the nasal cavity proper, accounting for almost 50% of cases, in keeping with other institutional series of nasal cavity cancer. In a dual-institutional series of 32 patients with squamous cell carcinoma of the nasal cavity, Fornelli et al identified an absolute 2-year survival of 69% and an overall 5-year survival of 50%. Recurrence was common, occurring in 56% of patients, with most (13 of 18 cases) being regional recurrences. They found that multiple subsite involvement within the nasal cavity predicted poorer survival. Interestingly, patients with known occupational risk factors for cancer of the nasal cavity did not demonstrate more advanced disease at presentation or higher recurrence rates. Our 5-year survival for squamous cell car-

### Table 3. TNM and Grade Classification and Survival for Nasal Cavity Cancer

<table>
<thead>
<tr>
<th>Classification</th>
<th>No. (%) of Patients</th>
<th>Mean Survival, mo</th>
<th>Median Survival, mo</th>
<th>5-y Survival, %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>431 (55.0)</td>
<td>85</td>
<td>94</td>
<td>66.4</td>
</tr>
<tr>
<td>T2</td>
<td>64 (8.2)</td>
<td>67</td>
<td>66</td>
<td>51.8</td>
</tr>
<tr>
<td>T3</td>
<td>222 (28.4)</td>
<td>65</td>
<td>51</td>
<td>45.6</td>
</tr>
<tr>
<td>T4</td>
<td>66 (8.4)</td>
<td>53</td>
<td>39</td>
<td>40.2</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N0</td>
<td>356 (45.5)</td>
<td>82</td>
<td>88</td>
<td>62.3</td>
</tr>
<tr>
<td>N1</td>
<td>39 (5.0)</td>
<td>46</td>
<td>25</td>
<td>28.4</td>
</tr>
<tr>
<td>N2</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>N3</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Not assigned</td>
<td>388 (49.6)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well differentiated (I)</td>
<td>121 (15.5)</td>
<td>87</td>
<td>105</td>
<td>75.3</td>
</tr>
<tr>
<td>Moderately differentiated (II)</td>
<td>163 (20.8)</td>
<td>86</td>
<td>NA</td>
<td>61.9</td>
</tr>
<tr>
<td>Poorly differentiated (III)</td>
<td>139 (17.8)</td>
<td>60</td>
<td>49</td>
<td>47.6</td>
</tr>
<tr>
<td>Undifferentiated (IV)</td>
<td>62 (7.9)</td>
<td>55</td>
<td>46</td>
<td>36.8</td>
</tr>
<tr>
<td>Not assigned</td>
<td>298 (38.1)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*NA indicates not applicable.*

![Figure 1](https://example.com/figure1.png)

**Figure 1.** Overall survival for the entire cohort.

![Figure 2](https://example.com/figure2.png)

**Figure 2.** Overall Kaplan-Meier survival according to T stage.

![Figure 3](https://example.com/figure3.png)

**Figure 3.** Overall survival according to nodal stage.
Adenoid cystic carcinoma also exhibited a similar 5-year survival of 59.1%, in keeping with the results of others. However, survival for adenoid cystic carcinoma of the nasal cavity is probably better assessed by 10-year survival rates, since patients may live significant periods with locally recurrent but slowly progressive disease. Our data also reinforce the data of Lund et al, who found that chondrosarcoma and esthesioneuroblastoma tended to exhibit more favorable survival than other histologic types within the nasal cavity and paranasal sinuses. Among the histologic types encountered, melanoma was clearly found to manifest the poorest survival, demonstrating a survival of only 22% at 5 years. Melanoma of the sinonasal cavity has previously been found to carry a very poor prognosis, with other authors reporting 5-year survival rates ranging from 19% to 31%. Sinonasal undifferentiated carcinoma also exhibited a relatively poorer survival than other lesions, although this difference was not statistically significant on multivariate analysis. Other authors have previously commented on the relatively aggressive nature of sinonasal undifferentiated carcinoma, with very poor 3-year survival rates despite aggressive multimodality therapy.

Comparing survival and treatment results from various authors for cancer of the nasal cavity is difficult primarily because of the lack of a uniformly accepted staging system. The staging system used in the present study did effectively segregate patients into distinct clinical groups that had notably different survivals (Figure 2). Therefore, the T-stage designations proposed in Table 2 deserve further prospective study. As this was a retrospective analysis based on a national database, I cannot recommend this as a primary site staging system until it is validated by further prospective evaluation. Not surprisingly, a more advanced T stage predicted significantly poorer survival, on both univariate and multivariate analysis. Although advances in craniofacial resection and reconstructive techniques have made almost every cancer of the nasal cavity “resectable,” involvement of the eye and anterior cranial fossa remain clinically important negative prognostic factors. These data clearly indicate that cervical node involvement at the time of presentation predicts poorer survival in nasal cavity cancer. Given that the hazard ratio was highest for nodal involvement among the variables studied, this is a very significant prognostic factor. Since nodal involvement has such a pronounced impact, treatment of positive cervical disease should be aggressive. However, in the case of necks with N0 disease, treatment of the ipsilateral lymphatic drainage basins has been the subject of some controversy. Netterville et al found that regional metastasis from midface carcinomas may arise in a delayed fashion. Therefore, at the very least, these patients merit careful extended follow-up.

Tumor grade was found to have a significant prognostic impact on both univariate and multivariate analysis. The influence of tumor grade is well established for carcinoma of the nasal cavity, as it may help select subgroups of patients with given histologic types that are likely to do poorly without aggressive therapy. Recent advances in radiotherapy have allowed the delivery of higher doses of external beam radiation and particle radiation to the nasal cavity and paranasal si-
nuses, while sparing critical structures such as the globe and optic chiasm.\textsuperscript{16,20} Some centers have reported successful treatment of nasal cavity cancer with radiotherapy alone.\textsuperscript{9} Whether to use radiotherapy as a primary treatment modality or as an adjunct to surgery depends on the histologic type of the lesion, the initial tumor extent, and the status of postoperative margins. In certain histologic types, such as esthesioneuroblastoma, radiotherapy offers a significant survival benefit, especially for more advanced lesions.\textsuperscript{21} Unfortunately, risk to the globe and vision is often the rate-limiting step in radiotherapy for these cancers.\textsuperscript{9}

Somewhat surprising were the survival trends for patients who receive radiotherapy. On univariate analysis, radiotherapy was found to be associated with poorer survival rather than improved survival for the overall cohort. On stratified analysis according to T stage, the use of radiotherapy was found to exert a negative prognostic influence on survival only for T2 lesions; survival for other T stages was not significantly influenced by radiotherapy. On multivariate analysis, radiotherapy was found to be an independent predictor of poorer survival (hazard ratio, 1.35). Since the multivariate analysis controls for tumor histologic type and primary site stage, radiotherapy does seem to influence prognosis negatively. The reasons for this are unclear, and this deserves further study.

Although the current method provides a large sample size with a wide variety of tumor histologic types and stages accrued in a relatively short period with good follow-up, it has several limitations. As this is a national cancer database, the analysis is dependent on the accuracy of recorded information, especially information concerning extent of disease. Although data are entered by trained personnel, variations in diagnostic evaluation such as use of computed tomography and/or magnetic resonance imaging and other factors may alter the staging for a given patient. However, since the tumor registry spans multiple regions and institutions, systematic biases in staging or treatment should be limited. One significant drawback of the database is that no information is available with respect to the status of surgical margins. Surgical margins are widely believed to be a significant prognostic factor in head and neck cancer. However, the interpretations of surgical margins at the skull base and within the nasal cavity are fraught with difficulties. Analysis of bone margins is complex, and the intricate 3-dimensional nature of the nasal cavity and adjoining structures makes margin interpretation even more difficult. I believe that these disadvantages of the Surveillance, Epidemiology, and End Results database are offset by the advantages afforded by larger sample size and the diversity of the patient population studied.

**CONCLUSIONS**

Prognosis in cancer of the nasal cavity is determined by multiple factors including T stage, N stage, tumor grade, and tumor histologic type as well as age and sex. All of these factors need to be considered when treatment modalities and prognosis are determined for patients with newly diagnosed cancer of the nasal cavity. Further study will be required to determine whether the staging system used herein will prove valuable in prognostication and evaluation of various treatment modalities in the future.

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**REFERENCES**