Epidemiologic, Prognostic, and Treatment Factors in Sinonasal Diffuse Large B-Cell Lymphoma

Antonios N. Varelas, BA; Michael Eggerstedt, MD; Ashwin Ganti, BA; Bobby A. Tajudeen, MD

**Objectives:** To further characterize the epidemiology, prognostic disease-specific factors, and treatment outcomes— including newly available chemotherapy data—for patients with sinonasal diffuse large B-cell lymphoma (DLBCL).

**Methods:** The Surveillance, Epidemiology, and End Results registry was queried from 1973 to 2015 for patients with DLBCL of the nasal cavity and paranasal sinuses. Demographic and disease parameters were collected. Prognostic disease-specific survival and overall survival factors were evaluated with univariate Kaplan-Meier analysis. Significant variables were analyzed with multivariate Cox regression analysis.

**Results:** A total of 1,273 cases of DLBCL of the sinonasal tract were identified. Significant differences in age of diagnosis between men (65.3) and women (71.1) existed (P < .01). Most common primary sites of DLBCL were maxillary sinus (36.1%) and nasal cavity (34.5%), with nasal cavity more common among Asian/Pacific Islands (43.4%) and maxillary sinus more common for Caucasians (36.3%) and African Americans (42.1%). Overall survival was 70% at 2 years, 54% at 5 years, and 38% at 10 years. Disease-specific survival was 81%, 73%, and 67%, respectively. Chemotherapy (hazard ratio [HR]: 0.551; P < .001) and radiation therapy (HR: 0.818; P = .012) were associated with improved prognosis, whereas higher Ann Arbor stage worsened prognosis (HR: 1.21; P < .001). Surgical intervention did not significantly impact survival.

**Conclusion:** This is the first study to include chemoradiation therapy in population-based analysis of sinonasal DLBCL. Chemotherapy and radiation therapy use significantly improve survival in these patients, whereas Ann Arbor staging is significantly associated with poorer outcomes. The mainstay of treatment for DLBCL should remain combination chemotherapy.

**Key Words:** Diffuse large B-cell lymphoma, DLBCL, SEER, sinonasal, population study, survival.

**Level of Evidence:** NA

**INTRODUCTION**

Lymphoma is an uncommon malignancy of the nasal cavity and paranasal sinuses.\(^1\)–\(^4\) Non-Hodgkin’s lymphoma (NHL), specifically diffuse large B-cell lymphoma (DLBCL) and natural killer T-cell lymphoma (NKTCL), are the most common variants.\(^5\)–\(^7\) Although classically a malignancy of the lymph nodes, lymphoma can manifest in extra-nodal sites in roughly one-third of patients.\(^8\) Within the head and neck, most extra-nodal lymphomas arise in Waldeyer’s ring, comprised of the adenoid tonsils, eustachian tonsils, palate tonsils, and lingual tonsils.\(^9\),\(^10\) Other sites commonly involved include the nasal cavity, paranasal sinuses, orbit, thyroid, and salivary glands.\(^5\),\(^6\) Non-Hodgkin’s lymphoma represents the most frequently diagnosed nonepithelial neoplasm of the nasal cavity and paranasal sinuses, often localizing to the maxillary and ethmoid sinuses.\(^1\),\(^11\) Globally, there exist clear regional and racial variations in the incidence of NHL: Western populations more commonly present with DLBCL, whereas Asian and Latin American populations are more likely to present with NKTCL.\(^3\)–\(^5\),\(^8\)

Within the nasal cavity and paranasal sinuses, NHL may present with epistaxis, nasal obstruction, rhinorrhea, visual changes, bloody discharge, hearing impairment, facial swelling, and classic B-symptoms such as weight loss and fever.\(^4\),\(^11\) With its increasing prevalence and the significant morbidity associated with this malignancy, it is critical to diagnose and treat NHL early in its course. This study focuses exclusively on DLBCL of the nasal cavity and paranasal sinuses. Previous population studies investigating sinonasal DLBCL have commented on the demographic characteristics, epidemiology, and survival impact of gender, race, site, and radiation therapy.\(^4\),\(^6\) These studies found that sinonasal DLBCL patients were largely Caucasian, with no impact of gender, race, or primary site on survival.\(^4\),\(^6\) Radiation therapy was shown to significantly improve survival, with an unreported significance for increased 5-year disease-specific survival (DSS).\(^4\),\(^6\) However, neither study investigated the significance of Ann Arbor stage, surgical intervention, and the current mainstay of treatment—chemotherapy—on overall survival and DSS for DLBCL.

With newly added chemotherapy data now available on the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute, this study is the first to comment on the impact of chemotherapy in patients with DLBCL of the nasal cavity and paranasal sinuses and
to provide an update on the changing epidemiologic and survival statistics for a disease that is becoming increasingly prevalent. The addition of chemotherapy data is not limited to new patients added in the last few years; rather, it represents newly included data for all available patients in the SEER registry. Therefore, the aims of this study are to investigate the impact of demographic, disease-specific, and varying treatment factors on both the DSS and overall survival (OS) of patients with DLBCL.

**MATERIALS AND METHODS**

The latest version of the SEER program was queried to identify patients for inclusion in a population-based cohort study. The SEER 18 registry includes groupings from SEER 9 (Atlanta, Connecticut, Detroit, Hawaii, Iowa, New Mexico, San Francisco–Oakland, Seattle–Puget Sound, and Utah), SEER 13 (Los Angeles, San Jose–Monterey, Rural Georgia, and the Alaska Native Tumor Registry), and SEER 18 (Greater California, Greater Georgia, Kentucky, Louisiana, and New Jersey). Data from SEER 9 extends back to years 1973 to 1975, SEER 13 back to 1992, and SEER 18 back to 2000. All patient identifiers in SEER have been removed; therefore, no institutional review board approval was required prior to the commencement of this study.

Histological cases of DLBCL were identified using the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) code 9680. These cases were then restricted on the basis of primary site using corresponding ICD-O-3 anatomical codes C30.0 (nasal cavity), C31.0 (maxillary sinus), C31.1 (ethmoid sinus), C31.2 (frontal sinus), C31.3 (sphenoid sinus), C31.8 (overlapping lesion of accessory sinuses), and C31.9 (accessory sinus, not otherwise specified). During data analysis, both codes for the accessory sinuses, C31.8 and C31.9, were treated as one unified category. Collected study parameters included 1) gender, 2) race, 3) age at diagnosis, 4) survival months, 5) Ann Arbor lymphoma stage, 6) primary site, 7) use of chemotherapy, 8) use of radiation therapy, 9) use of surgery, and 10) laterality.

SEER data was extracted using SEER*Stat 8.3.5 (National Cancer Institute, Bethesda, MD). Outcome analysis end-points were comprised of DSS and overall survival (OS). DSS was defined as patient mortality secondary to the underlying malignancy. Overall survival was defined as all-cause mortality. Data analysis was conducted using SPSS version 22 (SPSS, Inc., Quarry Bay, Hong Kong). Univariate Kaplan-Meier analysis was performed on suspected prognostic factors of DSS and OS; significant variables (P value < .05) were subsequently evaluated with multivariate Cox regression analysis. Data values are reported as percentages for variables and as mean ± standard deviation for continuous variables.

**RESULTS**

A total of 1,273 patients diagnosed with DLBCL between 1973 through 2015 were identified (Table I). The average patient age was 67.9 ± 15.9, and the majority of the cohort was male (55.4%). There were significant differences in ages between males and females, respectively (65.3 vs. 71.1; P < .01). A higher number were Caucasian with 1,015 (79.7%), whereas African American with 76 (6.0%) and other races such as Asian/Pacific Islander/Other with 182 (14.3%) were less common. The most common primary site was the maxillary sinus with 460 cases (36.1%), followed by the nasal cavity with 439 (34.5%), accessory sinus 169 (13.3%), ethmoid sinus 120 (9.4%), sphenoid sinus 59 (4.6%), and frontal sinus 26 (2.0%). By race, the most common primary site for Asian/Pacific Islanders was the nasal cavity (43.4%), whereas for Caucasians and African Americans it was the maxillary sinus (36.3% and 42.1%, respectively). Ann Arbor staging was listed in 1,179 of 1,273 cases (92.6%), with the vast majority of recorded cases being stage I (55.9%), followed by stage II (21.5%) and stage IV (19.8%).

Treatment modalities investigated in this study included chemotherapy, radiation therapy, and surgical intervention. Patients in this study were more likely to have received chemotherapy (75.2%) and radiation therapy (53.7%), and to not have undergone surgical intervention (64.6%). Only 12.3% of patients underwent all three forms of treatment, with the most common combination being chemoradiation (40.9%). However, the SEER database is unable to delineate the unknown cohort from the

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>65.3</td>
</tr>
<tr>
<td>Female</td>
<td>71.1</td>
</tr>
<tr>
<td>Gender, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>705 (55.4%)</td>
</tr>
<tr>
<td>Female</td>
<td>568 (44.6%)</td>
</tr>
<tr>
<td>Race, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>1,015 (79.7%)</td>
</tr>
<tr>
<td>African American</td>
<td>76 (6.0%)</td>
</tr>
<tr>
<td>Asian/Pacific Islander/Other</td>
<td>182 (14.3%)</td>
</tr>
<tr>
<td>Primary site, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Maxillary sinus</td>
<td>460 (36.1%)</td>
</tr>
<tr>
<td>Nasal cavity</td>
<td>439 (34.5%)</td>
</tr>
<tr>
<td>Accessory sinus</td>
<td>169 (13.3%)</td>
</tr>
<tr>
<td>Ethmoid sinus</td>
<td>120 (9.4%)</td>
</tr>
<tr>
<td>Sphenoid sinus</td>
<td>59 (4.6%)</td>
</tr>
<tr>
<td>Frontal sinus</td>
<td>26 (2.0%)</td>
</tr>
<tr>
<td>Ann Arbor stage, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Stage I</td>
<td>659 (55.9%)</td>
</tr>
<tr>
<td>Stage II</td>
<td>254 (21.5%)</td>
</tr>
<tr>
<td>Stage III</td>
<td>32 (2.7%)</td>
</tr>
<tr>
<td>Stage IV</td>
<td>234 (19.8%)</td>
</tr>
<tr>
<td>Chemotherapy, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>957 (75.2%)</td>
</tr>
<tr>
<td>No</td>
<td>316 (24.8%)</td>
</tr>
<tr>
<td>Radiation therapy, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>684 (53.7%)</td>
</tr>
<tr>
<td>No</td>
<td>589 (46.3%)</td>
</tr>
<tr>
<td>Surgery, no. (%)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>451 (35.4%)</td>
</tr>
<tr>
<td>No</td>
<td>822 (64.6%)</td>
</tr>
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DLBCL = diffuse large B-cell lymphoma.
cohort that did not receive chemotherapy or radiation treatment. Surgical treatment data was available for 1,142 of 1,273 cases (89.7%), whereas all 1,273 cases commented on radiation and chemotherapy use.

Overall survival and DSS were calculated using Kaplan-Meier survival curves. Overall survival at 2 years, 5 years, and 10 years was 70%, 54%, and 38%, respectively. Median survival time was 72 ± 4.6 months. Disease-specific survival over the same time period was 81%, 73%, and 67%, respectively.

Univariate analysis for both OS and DSS was significant for Ann Arbor stage (OS: P < .01; DSS: P < .01), chemotherapy status (OS: P < .01; DSS: P < .01), and radiation therapy status (OS: P < .01; DSS: P = .011) (Table II). Location of primary site was significantly associated with DSS (P < .001) but not OS (P = .067), with lymphoma of the maxillary sinus and nasal cavity representing the most favorable prognostic sites. Multivariate analysis of OS (Table III) was significant for worse prognosis associated with increasing Ann Arbor stage (hazard ratio [HR]: 1.21; P < .001), and improved prognosis with use of chemotherapy (HR: 0.551; P < .001) and radiation therapy (HR: 0.818; P = .012). These same variables were significant in DSS, specifically Ann Arbor stage (HR: 1.26; P < .001), chemotherapy (HR: 0.589; P < .001), and radiation therapy (HR: 0.759; P = .02). However, primary site was not a significant predictor of DSS in multivariate analysis (P = .22).

### TABLE II.
Univariate Analysis of Epidemiologic, Disease-Specific, and Treatment Factors of DLBCL on Overall Survival and Disease-Specific Survival

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall Survival (log-rank P)</th>
<th>Disease-Specific Survival (log-rank P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td>.096</td>
<td>.403</td>
</tr>
<tr>
<td>Gender</td>
<td>.605</td>
<td>.061</td>
</tr>
<tr>
<td>Ann Arbor stage</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Primary site</td>
<td>.067</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Chemotherapy use</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Radiation therapy use</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
<td>.011&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Surgical intervention</td>
<td>.718</td>
<td>.113</td>
</tr>
<tr>
<td>Laterality</td>
<td>.774</td>
<td>.121</td>
</tr>
</tbody>
</table>

<sup>1</sup> Significant at P < .05

DLBCL = diffuse large B-cell lymphoma.

### TABLE III.
Multivariate Analysis of Significant Factors for DLBCL on Overall Survival and Disease-Specific Survival

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall Survival (hazard ratio)</th>
<th>P Value</th>
<th>Disease-Specific Survival (hazard ratio)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann Arbor stage</td>
<td>1.21</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.26</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Chemotherapy use</td>
<td>.551</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
<td>.589</td>
<td>&lt; .01&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Radiation therapy use</td>
<td>.818</td>
<td>.012&lt;sup&gt;1&lt;/sup&gt;</td>
<td>.759</td>
<td>.02&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> Significant at P < .05

DLBCL = diffuse large B-cell lymphoma.

### DISCUSSION

DLBCL is the most common nonepithelial neoplasm of the nasal cavity and paranasal sinuses. Although its overall incidence is low, it remains a significant contributor to morbidity and mortality for many patients. Rare diseases such as this require large, comprehensive, database analysis for discussion of epidemiologic implications and treatment response. Prior studies have attempted to quantify these factors; however, they lack commentary on age of presentation between genders; impact of race on primary site; and hazard analysis for Ann Arbor staging, surgical intervention, and chemotherapy. Moreover, patient data in prior SEER studies ranged between years 1973 through 2009 and 1973 through 2011.<sup>4,6</sup> This study includes patients from 1973 through 2015, representing 6 and 4 years, respectively, of additional data. Thus, this is the first study to comment on the impact of chemotherapy—the most pervasive therapy for lymphoma—in addition to new significant demographic data for DLBCL of the nasal cavity and paranasal sinuses using a national cancer database.

### Demographic Factors (Age, Race, Sex)

In this study, the male-to-female ratio was 1.24:1, consistent with prior studies suggesting a male preponderance, and represents a marginal increase in that discrepancy when compared to other population studies.<sup>4,6</sup> However, the average age of presentation for males was significantly lower than for females by roughly 6 years. This relationship has not been identified in prior literature on sinonasal DLBCL. Prior studies investigating the impact of gender on the presentation of lymphoma have postulated about the seemingly protective nature of the female gender. Their hypotheses include the protective influence of estrogen on suppressing interleukin 6, estrogen’s modulatory effect on vascularization and dissemination of lymphoma, and its impact on estrogen receptors found on B lymphocytes and within the bone marrow as observed in mouse models.<sup>12-16</sup> In contrast, other studies have commented on the potential deleterious effects of estrogen supplementation in postmenopausal women, suggesting that there might instead be a positive association with estrogen replacement and the incidence of DLBCL.<sup>17</sup> The mechanism of this association remains poorly understood; there are likely several other factors at play, including the various subtypes of NHL and DLBCL. When examining the race of the current cohort, these patients were overwhelmingly more likely to be Caucasian, which is in line with the current paradigm that Western populations more often present with DLBCL than their Asian and Latin American counterparts.<sup>1,2,5</sup> Such findings have not varied over the past few years, even in the face of the changing racial demographics seen in North America. This is suggestive of a more racial, as opposed to geographical, component to the presenting contrast between DLBCL and NKTCL; immigration and geographical changes would be reflected in changing incidence percentages among races. Additional studies have suggested that race impacts the prevalence

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of a variety of NHLs in other sites of the body as well. Nonetheless, age, gender, or race did not play a significant role in OS and DSS in this study.

**Primary Site**

DLBCL of the sinonasal tract classically has a predilection for the maxillary sinus as well as for the nasal cavity. This is represented in our study population, with maxillary sinus being the most common site, followed by nasal cavity. Laterality was not significant. Waldeyer's ring is the most common site for lymphoma of the head and neck, and its anatomical relationship with the larger structures of the maxillary sinus and nasal cavity may potentially contribute to the substantially higher incidence of DLBCL in these locations. It remains difficult, however, to consistently and accurately differentiate the primary site between maxillary sinus and nasal cavity in large, locally advanced tumors. Prior studies have mentioned a variability between the primary site and race. In this population study, the most common primary site for Caucasians and African Americans is the maxillary sinus, whereas the nasal cavity is the most common site for Asian/Pacific Islanders. No prior large population studies have commented on this racial association. It is unclear why the Asian/Pacific Islander population has a higher predisposition for DLBCL of the nasal cavity. It is possible that the inciting factors are related to that of nasopharyngeal carcinoma, a malignancy that more frequently impacts Asian/Pacific Islanders than other races. Those factors include diets rich in nitrosamines, exposure to wood dust, infection with Epstein-Barr virus, and potentially alcohol consumption and exposure to cigarette smoke. These factors have not been studied in DLBCL; however, Epstein-Barr virus, autoimmune disease, and family history are thought to play a role.

**Ann Arbor Stage**

Our analysis suggested that higher Ann Arbor stage was associated with poorer OS and DSS (Fig. 1). This is a commonly utilized staging metric for both Non-Hodgkin's and Hodgkin's lymphoma (Table IV). The vast majority of patients with recorded staging in this study were diagnosed with stage I disease, a slight increase when compared to previous population studies. This may be the result of more aggressive early detection practices and a higher index of suspicion for malignancy in patients presenting with nonspecific features of nasal obstruction, rhinorrhea, and epistaxis. Still, it remains that in this study nearly 20% of patients had stage IV disease at the time of diagnosis.

**Treatment**

Combination chemoradiation has long been the mainstay of treatment for sinonasal DLBCL. Chemo-therapy data in the SEER population cancer database has previously been unavailable and has not been investigated prior to this study. Of patients in this population, 75.2% underwent some form of chemotherapy, the highest treatment percentage of any intervention. Concurrent chemotherapy and radiation therapy were administered in 40.9% of patients. Although SEER is limited in its description of the administered chemotherapy, the most common treatment regimen used is traditionally CHOP (cyclophosphamide, doxorubicin, vincristine, prednisolone). Newer

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**TABLE IV. Ann Arbor Lymphoma Classification**

<table>
<thead>
<tr>
<th>Ann Arbor Stage</th>
<th>Ann Arbor Lymphoma Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single site of extra-lymphatic involvement without involvement of lymph nodes</td>
</tr>
<tr>
<td>2</td>
<td>Extra-lymphatic involvement, regional lymph node involvement, and possible additional lymph nodes on same side of the diaphragm</td>
</tr>
<tr>
<td>3</td>
<td>Extra-lymphatic involvement, regional lymph node involvement, lymph nodes on both sides of diaphragm, no involvement of spleen</td>
</tr>
<tr>
<td>4</td>
<td>Involvement of one or more extra-lymphatic sites or metastasis to liver, bone marrow, lungs, or cerebrospinal fluid</td>
</tr>
</tbody>
</table>
Regimens are now starting to incorporate rituximab, with studies revealing increased survival in comparison to older paradigms, especially in women.\textsuperscript{7,23,24} Other chemotherapy combinations, including BACOP (bleomycin, doxorubicin, cyclophosphamide, vincristine, prednisolone) and CEOP (cyclophosphamide, epirubicin, vincristine, prednisone), have been utilized with some success.\textsuperscript{11}

Radiation therapy alone has been argued to be effective for early-stage disease.\textsuperscript{2,22,25} Despite this, debate exists whether combination chemoradiation therapy remains more effective.\textsuperscript{22,25} In this study, patients rarely received external beam radiation alone, leaving the data underpowered to comment on its effectiveness as monotherapy. Nonetheless, both chemotherapy use and radiation therapy use were associated with significant reductions in OS and DSS in both univariate and multivariate analysis (Fig. 2). The hazard ratio for chemotherapy was lower than that of radiation therapy in both analyses; however, this does not conclusively argue for one treatment over the other. Treatment options for patients are not independent of disease severity and patient’s preference. Nonetheless, these findings agree with the current paradigm for treatment of DLBCL of the nasal cavity and paranasal sinuses.

Surgery continues to play a limited role in these patients, with only 35.4\% undergoing any form of surgical intervention. SEER cannot differentiate between surgical interventions such as a biopsy and debulking procedures, thereby limiting the ability to draw meaningful conclusions from the data. Classically, surgical removal of DLBCL has not demonstrated good therapeutic response and is often limited to a biopsy for diagnostic purposes.\textsuperscript{1,22,25} It is notable that only a potential 35.4\% of patients underwent biopsy as their surgical intervention in this study, and that it did not have a significant impact on either OS or DSS. Therefore, although otolaryngologists will potentially encounter sinonasal DLBCL in their practices, definitive treatment likely remains in the hands of medical and radiation oncologists. It remains possible that surgical intervention can provide utility if the disease is focal and there is a reasonable expectation of clear margins—or if tumor burden is so great that the patient would improve symptomatically through diminished morbidity.

Limitations

This study addresses the largest limitation of previous SEER population studies of DLBCL of the sinonasal tract in that it includes chemotherapy data. However, it still lacks descriptive information of the chemotherapy regimens supplied and the number and dosages of radiation therapy treatments received. Moreover, this study still suffers from inherent limitations faced by large, database-driven, population investigations. Data accessed from the SEER database is predicated on the assumption that diagnoses and information are accurately coded. This random variation can skew the data toward either end of the spectrum. By the same notion, retrospective studies rely on accurate data collection by a number of different physicians, leading to the potential for nondifferential classification bias. Nonetheless, one of the best ways to collect data and make meaningful conclusions concerning uncommon diseases remains large population database studies.

Conclusion

Diffuse large B-cell lymphoma of the nasal cavity and paranasal sinuses is an uncommon entity. Chemotherapy and radiation therapy use significantly improve survival in these patients, whereas Ann Arbor staging is significantly associated with poorer outcomes. These findings further emphasize the utility of combination chemoradiation for sinonasal DLBCL given the growing use of radiation therapy alone for early stage disease. Surgery should only be considered to aid in diagnosis or to augment treatment in cases deemed appropriate by the treatment team. Furthermore, patients should be counseled at time of diagnosis on 2-year, 5-year, and 10-year survival using this most recent population data for primary site and Ann Arbor stage.

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