

Adenocarcinoma of the ethmoid sinus: radio-pathological correlations and outcomes

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ABSTRACT

Objective: To evaluate the agreement between TNM stages as determined by preoperative imaging studies and by operative specimen pathology in 28 patients treated for adenocarcinoma of the ethmoid sinus.

Material and methods: Retrospective study of 28 patients with adenocarcinoma of the ethmoid treated at our department between May 1981 and June 1997. The preoperative imaging study findings used to determine the TNM stage were recorded, as well as the pathological findings. Agreement rates between preoperative TNM stage and pathology-based TNM stage were examined.

Results: According to preoperative imaging study findings, 3 patients were T2, 19 were T3, and 6 were T4. Pathological findings led to reclassification of 9 patients from T3 to T2 based on integrity of the cribriform plate and of 2 patients from T3 to T4 based on invasion of the sphenoid. Thus, according to pathological findings, 12 patients were T2, 8 were T3, and 8 were T4.

Conclusion: Imaging studies failed to determine the correct stage in 11 of 28 patients. Treatment decisions and outcome studies should be based on pathological findings.

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INTRODUCTION

Adenocarcinoma of the ethmoid sinus is an uncommon tumor that contributes only 3% of all oronasal tumors [1-4]. Exposure to wood dust, leather tanning chemicals, chromium, or nickel is associated with an increased risk of adenocarcinoma of the ethmoid sinus [5-7]. Mean time since exposure onset is 30 years. In a study by Marandas [8], 78% of patients were exposed for less than 30 years and 15% for less than 10 years. In France, workers with adenocarcinoma of the ethmoid are eligible for compensation; consequently, physicians should report the disease to the appropriate authorities [9].

A combination of surgery and radiation therapy is used in most patients [5-6,10]. Selection of the surgical technique is based on imaging study findings. However, the preoperative TNM stage determined from imaging studies may fail to reflect the final TNM stage determined from pathological findings. The objective of this study was to evaluate the agreement between TNM stage according to preoperative imaging studies and final TNM stage according to operative specimen pathology in 28 patients treated at the Poitiers Teaching Hospital, Poitiers, France.

MATERIAL AND METHOD

We retrospectively reviewed the medical records of 28 patients managed at our department between May 1981 and June 1997 for adenocarcinoma of the ethmoid sinus. Surgery via the anterior subfrontal approach followed by radiation therapy was used in all 28 patients. There were 26 men and 2 women with a mean age of 58 years (range, 28-76 years). Exposure to wood dust was noted for 20 (71.4%) patients; mean exposure time was 35 years. Nasal symptoms were the main presenting manifestations; in addition, 6 patients had ophthalmologic symptoms and 5 had neurological symptoms at presentation (Table I). An endonasal biopsy done during the first visit provided the diagnosis in all 28 patients.

The staging workup consistently included computed tomography (CT) with transverse and coronal sections, before and after iodinated contrast agent injection. In addition, magnetic resonance imaging (MRI) with gadolinium injection was performed in 13 patients.

The classification scheme for malignant ethmoid tumors was developed in 1997, before the study

Table I: Presenting symptoms in 28 patients with adenocarcinoma of the ethmoid sinuses.

| <i>Number of patients</i> | |
|------------------------------|------------------|
| Nasal symptoms | 28 (100%) |
| Unilateral nasal obstruction | 21 |
| Bilateral nasal obstruction | 1 |
| Blood-tinged rhinorrhea | 17 |
| Nose bleeds | 5 |
| Hyposmia | 1 |
| Anosmia | 1 |
| Neurological symptoms | 6 (21.4%) |
| Frontal headaches | 5 |
| Facial neuralgia | 1 |
| Ophthalmologic | 5 (17.8%) |
| Exophthalmos | 3 |
| Tearing | 2 |
| Periorbital pain | 2 |
| Diplopia | 1 |
| Loss of visual acuity | 1 |

period. In the study patients, the UCLA neurosurgical classification scheme for esthesioneuroblastomas was used for preoperative TNM staging:

- T1, involvement of the nasal cavities and/or paranasal sinuses, (excluding the sphenoid), sparing the most superior ethmoid cells;
- T2, involvement of the nasal cavities and/or paranasal sinuses (excluding the sphenoid) with extension to the most superior ethmoid cells (including the frontal cell) and cribriform plate, without osteolysis;
- T3, involvement of the nasal cavities and/or paranasal sinuses with extension to the anterior wall of the sphenoid bone or erosion of the cribriform plate or protrusion into the anterior cranial fossa with or without invasion of the dura mater;
- T4, extension to the orbit or to the brain, body of the sphenoid bone, pterygopalatine fossa, or the nasopharynx.

Patients with a T4 tumor extending to the orbit were included in the study. The other patients with a tumor classified as T4 with an extension to the brain, the body of the sphenoid, the pterygopalatine fossa or the nasopharynx were treated with a combination of chemotherapy and radiotherapy and were excluded from the study.

Surgery was performed via the anterior subfrontal approach with or without a concomitant transfacial approach. Pathology findings were used to determine

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the final TNM stage. For both CT and MRI, we calculated sensitivity, specificity, and agreement with operative specimen pathology findings.

RESULTS

According to preoperative imaging studies, 3 patients were T2, 19 were T3, and 6 were T4. All 28 patients were N0M0. The subfrontal approach was used alone in 4 patients and in combination with a transfacial approach in 24 patients. The surgical team consistently included otorhinolaryngologists and neurosurgeons. Single-block excision was performed whenever possible.

In 11 patients, imaging study findings failed to provide the correct TNM stage. Among them, 9 were reclassified from T3 to T2 based on the absence of cribriform plate involvement by pathological examination of the operative specimen. The remaining 2 patients were reclassified from T3 to T4 based on invasion of the sphenoid body that was not visible on preoperative imaging studies. No patients were reclassified from T2 to T3.

Thus the final distribution was T2, 12 patients; T3, 8 patients; and T4, 8 patients (Table II).

Table II: Agreement between staging based on preoperative imaging studies and staging based on the pathological examination of the operative specimen.

| | Imaging studies (Number of patients) | Pathology |
|--------------|---|-----------|
| T2 | 3 | 12 |
| T3 | 19 | 8 |
| T4 | 6 | 8 |
| Total | 28 | 28 |

Sensitivity and specificity in determining the correct stage were 72% and 66.7% for CT, respectively, and 80% and 66.7% for MRI, respectively. Agreement between imaging study findings and pathological findings was 82.1% for the CT-MRI combination, 71.4% for CT used alone, and 76.9% for MRI used alone.

DISCUSSION

CT with transverse and coronal sections is reliable for evaluating tumor spread to the orbit, anterior wall of

the sphenoid bone, and maxillary sinus. MRI T1-weighted spin-echo images are valuable for detecting invasion of adipose tissue in the orbit and pterygomaxillary fossa; furthermore, gadolinium injection provides information on spread to the cribriform plate, dura mater, cavernous sinus, and cerebral parenchyma. T2-weighted spin-echo images help to differentiate tumor tissue from sinus retention and inflammation [11]. Nevertheless, the accuracy of imaging studies for evaluating tumor spread remains debatable. In our study, 9 patients initially believed to be T3 were classified T2 when the pathological study found no evidence of cribriform plate involvement. On the other hand, 2 patients initially classified T3 were classified T4 based on pathological evidence of sphenoid body invasion, which was not visible on the preoperative imaging studies. Salvan et al. and Georges et al. [12-13] reported that 4 of 14 patients had cribriform plate involvement that was not visible on preoperative imaging studies. In a study by Moreau et al. [11], 6 of 25 patients had intracranial extension that was underestimated by the imaging studies. Similarly, Graamans et al. [14] reported discrepancies between imaging study findings and pathology findings regarding spread to the orbit. The CT-MRI combination has been reported to provide 98.5% agreement with pathological findings [15], as compared to 85.2% with CT only and 94.1% for MRI only [16]. The lower agreement rates in our study can be ascribed to the small number of patients and to the availability of MRI for only 13 of the 28 patients. Improvements in CT and MRI resolution provided by new technologies can be expected to increase the rate of agreement between the final pathological diagnosis and the imaging studies used to make treatment decisions. The discrepancy between imaging studies and pathology underscores the need for using operative specimen pathology to stage ethmoid tumors according to the 2002 AJCC-UICC classification in patients enrolled in therapeutic trials [17]. In addition, routine staging based on pathology allows comparisons across studies.

The impact of staging mistakes deserves to be evaluated. In our series, several patients who were classified T2 preoperatively underwent endoscopic surgery, which did not allow adequate resection, so that subsequent surgery via the anterior subfrontal route was required; these patients had T3 tumors with cribriform plate involvement detected only by the final pathological examination. On the other hand, 9 patients with a diagnosis of cribriform plate involvement based on

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the imaging studies (T3) were found to have T2 disease that could have been managed via the endonasal route.

CONCLUSION

Combined CT and MRI should be used for the preoperative staging of adenocarcinoma of the ethmoid sinuses. However, these investigations may fail to provide the correct stage. The final pathological examination of the operative specimen should be used to determine the TNM stage in order to select the best treatment and to improve the evaluation of treatment outcomes.

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