Induction Chemotherapy Prior to Endoscopic Resection of Alveolar Rhabdomyosarcoma

Ben Gillette DO[1], Daniel Lofgren DO[1], Brandon Knight DO[1], Eric Succar MD[2]

[1]Otolaryngology & Facial Plastic Surgery Resident, McLaren Oakland Hospital, Pontiac, MI, USA
[2]Department of Otolaryngology, St. Joseph Mercy Oakland Hospital & Medical Center, Pontiac, MI, USA

Abstract

- A 46-year-old male presented to an outside emergency department with five days of progressively worsening diplopia and nasal congestion. Ophthalmology evaluation noted right papilledema and follow up computed tomography (CT) and magnetic resonance imaging (MRI) revealed an expansile mass of the right nasal cavity involving the bilateral ethmoid and sphenoid sinuses with orbital apex involvement and planum sphenoidale erosion. No intracranial extension was noted.
- Endoscopic biopsy revealed alveolar rhabdomyosarcoma (RMS). The patient was presented at a multidisciplinary tumor board as a T2a RMS of the ethmoid sinus. Tumor board recommendation was for neoadjuvant induction chemotherapy followed by definitive resection followed by adjuvant chemotherapy and radiation.
- The patient had a significant clinical and radiographic response to induction chemotherapy. He underwent definitive endoscopic resection including an orbital/optic nerve decompression and extended pterygopalatine fossa dissection to obtain negative frozen section margins along the sphenoid and ethmoid skull base, periorbita, pterygopalatine fossa (PPF), and optic nerve sheath.
- Final pathology did unexpectedly reveal microscopic disease along the optic nerve sheath. This necessitated the use of concurrent adjuvant chemotherapy and proton beam radiation therapy.
- The patient is currently one year out from completion of adjuvant therapy with intact vision and without radiologic or clinic evidence of disease recurrence.

Introduction

- Rhabdomyosarcoma (RMS) is a malignant soft tissue tumor composed of immature mesenchymal cells with the potential to differentiate into striated muscle tissue. It is a rare tumor that accounts for only 350 cases annually, yet they comprise about half of soft-tissue sarcomas in children and adolescents.[1] Approximately 35-40% of pediatric RMS occurs in the head and neck region, compared with 33% in adults. In contrast, RMS represents only 2-5 percent of soft-tissue tumors in adults.[2,3]
- Head and neck rhabdomyosarcoma (HNRMS) has been reported to the Surveillance, Epidemiology, and End Results (SEER) registry 558 times from 1973 to 2007, with an overall incidence of 0.041 cases per 100,000 population.[2] Of all cases, adults make up approximately 31.2% of all diagnoses of HNRMS. Although there is no known gender predilection, it has a propensity to affect Caucasian patients more often than other races (77.1% Caucasian vs. 13.8% Black vs. 8.4% Other).[2]
- HNRMS can be divided into three subtypes based on location with the following frequencies: orbital in 25.6% of patients, parameningeal (infratemporal fossa, pterygopalatine fossa, ear, mastoid, nasal cavity, paranasal sinuses) in 44.4% of patients, and nonorbital non-parameningeal (tongue, parotid, palate, all other head and neck sites) in 29.9% of patients.[2]
- Three primary histologic subtypes have been identified: pleomorphic, embryonal, and alveolar, and the most common histologic subtypes are embryonal and alveolar, with embryonal presenting more commonly in children and alveolar more commonly in adults. Immunohistochemical markers are the most reliable way to differentiate between the two.[2,5,6] Myogenin, myoD1, and Desmin are more specific to alveolar RMS compared with embryonal, and the presence of PAX/FOX01 translocation favors the alveolar subtype as seen in our patient.[1,2,5,6,7]
- Here, we present a 46-year-old male with a T2a parameningeal RMS with involvement of the orbital apex, abutment of the planum sphenoidale, and extension to the foramen rotundum (FR) who underwent induction chemotherapy followed by endoscopic resection followed by adjuvant concurrent chemotherapy and proton beam radiation. The treatment course was modeled after pediatric protocols for similar parameningeal RMS.
- To the authors' knowledge, there are no previous reports of this type of operative and post-operative treatment regimen for parameningeal RMS in an adult.

Imaging

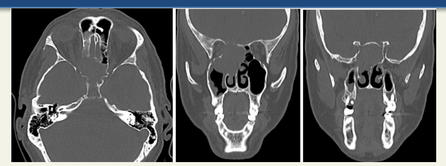

Figure 1a: CT Maxillofacial without contrast, coronal and axial planes in a bone window, showing 4.5 cm x 4.1 cm x 4.0 cm soft tissue mass centered in the right ethmoid air cells involving the right sphenopalatine foramen, right olfactory recess, bilateral sphenoid sinuses, and right maxillary sinus. Noted bony destruction of the medial orbital apex and mass effect on the right optic nerve, thinning of the right planum sphenoidale and posterior medial right orbital wall, and enlargement of the right maxillary antrum.

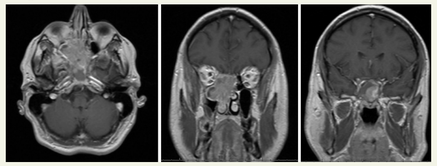

Figure 1b: T1 with contrast MRI brain showing an enhancing, expansile mass of the right nasal cavity extending from the right ethmoid sinus to the right sphenoid sinus and right anterior skull base, with extension of the mass into the right orbital apex.

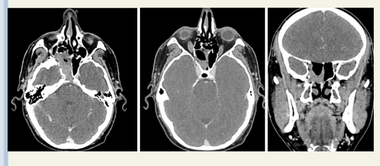

Figure 2a: Computed tomography (CT) scan of sinuses in the axial and coronal planes after completion of induction chemotherapy. Noted extension of the mass to the pterygopalatine fossa (PPF), with lack of regression from the right maxillary and sphenoid sinuses.

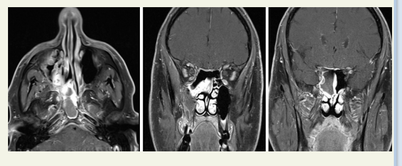

Figure 2b: T1 fat-suppressed MRI brain in the axial and coronal planes post-induction chemotherapy. Resolution of the mass from the right orbital apex and continued involvement of the right sphenoid sinus laterally and right maxillary sinus anteriorly.

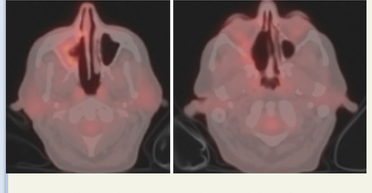

Figure 3a. A three-month post-treatment PET-CT axial plane. Interval right frontoethmoidectomy and bilateral sphenoidectomy with tumor resection noted. Mild amount of mucosal thickening of the right maxillary sinus, which was mildly FDG avid, with an SUV 3.4.

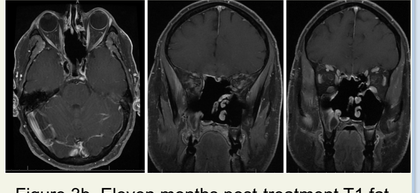

Figure 3b. Eleven months post-treatment T1 fat-suppressed post-contrast MRI Brain/Orbit axial and coronal planes. Extensive postsurgical changes with no definite signs of residual or recurrent tumor were noted.

Discussion

- Due to its rare incidence in adults, RMS prognosis and treatment is based on data identified by the Intergroup Rhabdomyosarcoma Study Group Outcomes I and II, which only included patients diagnosed in the first two decades of life.[8-10] It relies on the TNM classification, disease site, FOX01 translocation factor presence, and clinical group findings. Data gathered from these studies incorporated tumor spread at diagnosis and the amount remaining after the initial intervention.[4,8-10] Overall, worse prognostication was associated with tumor size greater than five centimeters, positive surgical margins, cervical lymph node involvement, advanced age, and the parameningeal (PM) subsite. The PM subsite has a poorer prognosis and with recurrence. This is likely because these tumors tend to extend into meningeal and intracranial sites, as seen in our patient.[7]
- Of the Three primary histologic RMS subtypes identified (pleomorphic, embryonal, and alveolar), embryonal has the best 5-year relative survival (RS) of 72.2% compared with alveolar at 44.1%.[2]
- The reported 5-year overall survival (OS) of HNRMS ranges from 33-45%.[8] One single institution's findings of 59 adult patients reported a five-year OS rate of 36%, with metastasis to cervical lymph nodes in 29% of patients. Local recurrence and distant metastasis were the primary causes of treatment failure.[8,9] Extent of disease (Localized vs. Regional) is a key prognostic factor of HNRMS relative survival (RS) more than involvement of a primary site, with regional disease portending a worse prognosis [1,2]
- In general, adult and pediatric treatment guidelines are similar, which consists primarily of chemotherapy with the addition of radiation and/or surgical resection.[10-13] Although there is limited data for adults, surgical resection of parameningeal RMS in the pediatric population is correlated with a higher 5-year survival rate.[12] Initial surgical resection may be difficult secondary to the anatomic location of the lesion, the use of induction chemotherapy to shrink the tumor can allow for surgical resection in adult patients.[14] One study compared delayed primary excision after induction chemotherapy versus concurrent chemoradiotherapy after induction, and found that the surgical excision group had better 3-year locoregional control than the chemoradiotherapy group.[14] Craniofacial approaches have been reported, but these result in transfacial incisions or facial osteotomies, which can be disfiguring and have an increased risk of neural and vascular injury secondary to poorer visualziation.[15–17]
- Our patient would be considered Stage II (cT2aN0M0), with tumor extension into an unfavorable site (orbital apex) and FOX01 translocation positive, which would correspond to the intermediate risk group of 50-70 percent event-free survival.[10]
- While there was no direct extension into the cranial fossa in our patient, there was the involvement of the PPF and orbital apex. With the patient opposed to an orbital exenteration, a pterygopalatine fossa dissection was a feasible option. Our patient underwent this procedure without orbital injury, cranial nerve injury or CSF leak.
- The patient is currently one year out from completion of adjuvant therapy with intact vision and without radiologic or clinic evidence of disease recurrence.

References and Acknowledgements

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