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CASE REPORT

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Radiation-induced myofibroblastoma within the nasal sinus requiring maxillectomy and ethmoidectomy: A case report and literature review

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Abstract

We report a case of radiation-induced myofibroblastoma of the right nasal cavity in a patient with a remote history of radiotherapy for pediatric retinoblastoma. The patient required maxillectomy and ethmoidectomy. To our knowledge, a rare number of cases have been reported in this location.

KEYWORDS

extramammary-myofibroblastoma, nasal sinus tumor, radiation-induced lesion, retinoblastoma

1 | INTRODUCTION

Mammary-type extramammary myofibroblastoma (MTEM) is a rare mesenchymal neoplasm that is histologically and immunohistochemically identical to mammary myofibroblastoma.[1] These extramammary neoplasms are composed of spindle cells, usually arise in the subcutaneous tissues, and traditionally express desmin, smooth muscle actin (SMA), and CD34; they are closely related to spindle cell lipomas and cellular angiofibromas.[2] Presentation outside of the embryological mammary crest is exceedingly rare, where involvement of extramammary sites classically includes the inguinal and groin area, vulva, perineum, and scrotum.[1] There is a paucity of cases reporting head and neck MTEM following radiotherapy, and even more so concerning the nasal sinuses.[3–7]

We report a case of radiation-induced MTEM requiring maxillectomy and ethmoidectomy. This lesion was most likely secondary to distant periorbital radiotherapy, which the patient sustained during treatment for retinoblastoma during childhood.

2 | CASE REPORT

A 70-year-old male patient presented to an otorhinolaryngology clinic by referral for evaluation of a right sinonasal passageway tumor. He had a medical history notable for retinoblastoma treated more than 60 years ago with periorbital radiotherapy and ultimately right eye enucleation. He was noted as being blind in the contralateral eye as well. Details regarding radiotherapy fields were requested from childhood treatment but were unfortunately not obtainable. Patient was likely treated with parallel opposed fields that would have included the sinonasal region. Additionally, he had a reported history of sarcoma on the back of the right leg and bladder cancer, for which detailed medical history records were not available upon request. The patient reported for the past year he had experienced progressively worsening right-sided nasal congestion and drainage. He also noted that his right eye prosthesis had begun to fit improperly. On physical examination, the patient had a soft tissue mass centered in the right nasal passage visualized by nasal telescope to involve the ethmoid and medial maxillary regions. Mild right-sided septal deflection was also noted. Cranial nerves III through XII were intact on examination.

Magnetic resonance imaging (MRI) demonstrated a large, T1 hypointense, heterogeneous T2, and enhancing soft tissue mass measuring approximately 6.1 × 3.1 × 4.1 cm centered within the right nasal cavity. The mass appeared to extend from the right piriform aperture to the ventral aspect of the right nasopharynx (Figure 1A,B). A craniocaudal measurement demonstrated the mass extending 4.1 cm from the floor of the right nasal cavity to the floor of right anterior cranial fossa (Figure 1C,D). Bony remodeling and thinning of adjacent osseous structures were present, with significant leftward bowing of the nasal septum and rightward bowing of the medial right maxillary sinus wall. Additionally, post-obstructive mucosal changes in the lateral recess of the maxillary sinus leading into the sphenoid sinuses were noted. The right-sided nasal turbinates were completely obstructed with partial obstruction of right ethmoid air cells. Chronic obstruction of the right sphenoid sinus at the sphenoethmoidal recess and right frontal sinus were present. Imaging showed thinning of the medial floor of the right orbit with mild displacement of an atrophic right medial and right inferior rectus muscle without intracranial soft tissue mass extension.

The pathology report from biopsies taken in the office indicated a spindle cell neoplasm consistent with myofibroblastoma of low to intermediate grade. It was initially suspected the patient most likely had a radiation-induced sarcoma, which would require surgical treatment in the form of a partial or total right maxillectomy and ethmoidectomy. Additional resection of the alveolar and palatal bone was discussed, as well as the inferior and medial orbital walls which could limit future use of his prosthesis. If the patient's lesion was determined to be non-malignant, more conservative resection measures would be considered.

The patient underwent a maxillectomy and ethmoidectomy. During surgery, no evidence of tumor extension through the base of the maxilla, floor of the nose, or orbit was noted. Tumor was seen involving the inferior and medial orbital wall and was adherent but not invasive to the adjacent bone. It was also found that the tumor had adhered to the nasal septum, without apparent extension into the perichondrium or periosteum. Total ethmoidectomy with preservation of the base of the skull was achieved and thought to provide an adequate oncologic margin. A portion of the posterior turbinate and adjacent choana mucosa, along with a retained portion of the inferior medial maxillary wall, were also excised to provide an adequate posterior oncologic margin. Ultimately, a partial maxillectomy was achieved. The patient tolerated the procedure well and was discharged home the next day without perioperative complications.

The specimen received for histopathologic analysis consisted of a well-defined, ovoid, tan, mass having a soft and glistening surface, measuring (5.7 × 4.2 × 2.6 cm), with partial mucosal covering and attached bony fragments over the resection margins. Sectioning revealed the mass to have a tan-white, soft, smooth, homogenous cut surface with minute foci of hemorrhage. Histologic examination showed a well-circumscribed purely mesenchymal neoplasm that lacked a true capsule, demonstrating short to elongated spindle cells arranged in haphazard intersecting fascicles (Figure 2A). Bands of hyalinized, eosinophilic collagen were observed in the background. On higher magnifications, the tumor was mainly composed of bland spindle-shaped myofibroblasts with scattered larger epithelioid cells with mild to moderate nuclear pleomorphism. Focal areas of tumor degeneration and occasional mitotic figures were identified. These features can be contributed to reactive atypical changes in the tumor background. Diagnostic features of malignancy were not observed. The tumor was excised completely with negative surgical margins. Immunohistochemical studies showed strong diffuse reactivity to SMA and desmin in the tumor cells with focal reactivity of moderate intensity for CD34 (Figure 2B–D). Taken together, the findings are consistent with low to intermediate grade myofibroblastoma. The patient was subsequently discharged without further intervention required. Close follow-up scheduled on a six-month basis for repeat MRI imaging. Written informed consent was obtained from the patient for their anonymized information to be published in this article.

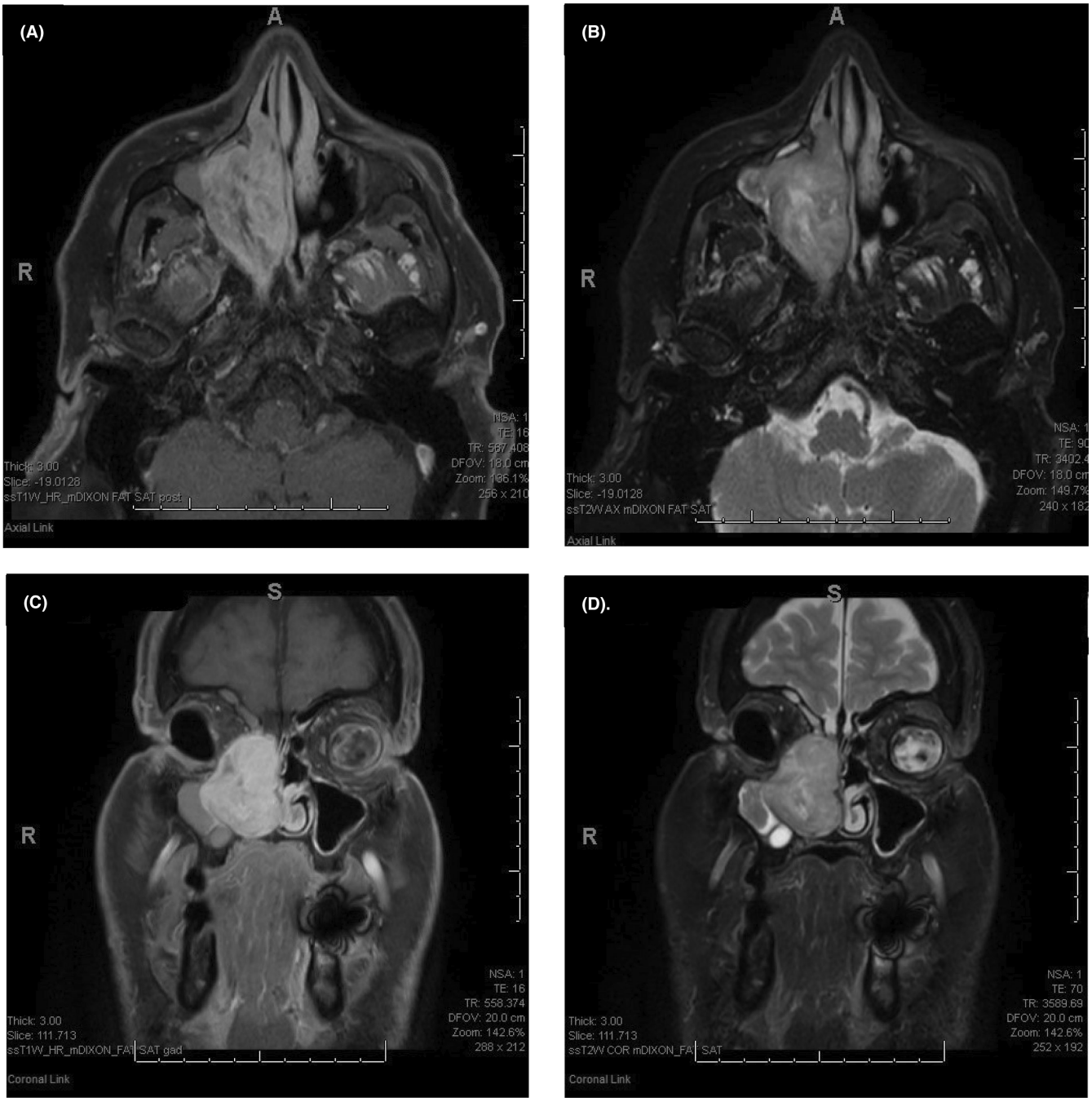

FIGURE 1 (A) Axial T1 fat saturated post-contrast magnetic resonance imaging of the face/paranasal sinuses. (B) Axial T2 fat saturated magnetic resonance imaging of the face/paranasal sinuses. (C) Coronal T1 fat saturated with gadolinium contrast magnetic resonance imaging of the face/paranasal sinuses. (D) Coronal T2 fat saturated magnetic resonance imaging of the face/paranasal sinuses. Imaging demonstrates findings of a right-sided sinonasal passageway lesion.

3 | DISCUSSION

Mammary myofibroblastomas, in contrast to their MTEM counterparts, are well-circumscribed tumors composed of spindle cells with myofibroblasts, hyalinized collagenous stroma, and adipose tissue.[1] Often times, these masses can be mistaken for fibroadenomas, hamartomas, or angiofibroma.[2] Myofibroblastic differentiation can be distinguished from other stromal tumors via SMA, desmin, and CD34 immunohistochemical staining.[2] Outside the breast, myofibroblastomas are exquisitely rare, particularly in the head and neck region. Previously described cases include the suprasellar, zygomatic arch, and orbital bone regions.[4–7] The etiology of MTEM is often thought to be sporadic, but, notably, there is a report of mammary-type myofibroblastoma in an irradiated breast.[8] These

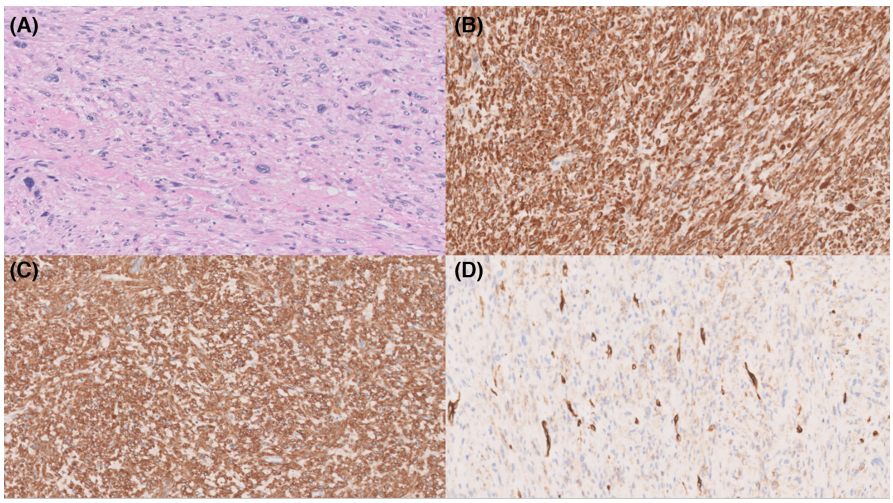

FIGURE 2 (A) Photomicrograph of hematoxylin and eosin-stained section of the tumor depicting a mixture of bland spindle-shaped myofibroblasts intermixed with collagenous stroma. Larger atypical cells demonstrate prominent nuclear pleomorphism and occasional multinucleated cells in the setting of reactivity. (B) Tumor cells are strongly positive for desmin; cytoplasmic (C) Tumor cells are strongly positive for Smooth Muscle Actin; cytoplasmic. (D) Tumor cells are focally positive for CD34 with moderate intensity; membranous.

cases generally report remission and resolution of symptoms following surgical excision of the MTEM. Metastasis or malignant transformation of MTEM has not been reported in literature.[9]

Ionizing radiation is considered a weak carcinogen, at least in comparison with some cytostatic drugs.[10] Radiation-induced neoplasms in the head and neck, while rare, can be aggressive, with estimated 5-year survival rates as low as 10%–30%.[11] The risk of malignancy increases with time following radiation therapy.[10] The etiology of neoplastic growth after radiation exposure is still unclear but thought to be due to ionizing DNA damage. Another mechanism of neoplasm formation is inherited loss of heterozygosity with subsequent environmental insults, resulting in complete knock-out of tumor suppressor genes leading to malignant transformation.[12] In this patient with a germline *Rb* mutation, the addition of radiation exposure in childhood carried a significant risk for the development of future malignancies.

The diagnosis of radiation-induced sarcomas was established with the Cahan criteria in 1948. Criterion includes developing a sarcoma type tumor in the field of previous radiation treatment with a minimum latency of 5 years. The tumor must also be histologically distinct from the initial primary tumor.[13] While this case satisfies the Cahan criteria, final tissue pathology revealed a much rarer neoplasm of the head and neck and implies a similar connection between myofibroblastomas and external beam radiation exposure.

Radiation-induced myofibroblastomas have been reported in the literature, most commonly concerning the breast.[14,15] An instance of radiation-induced, low-grade myofibroblastic sarcoma in the maxillary sinus was reported with a patient receiving radiotherapy for nasopharyngeal carcinoma, with the median radiation dose at the cancer site being 66 Gy during previous radiotherapy.[16] The reported latency in this case was approximately 60 years, which is a larger time duration when compared with reported solid tumor induction times[10] and for the case of reported myofibroblastic sarcoma in the maxillary sinus found in literature.[16]

General management of radiation-induced neoplasms consists of surgery with wide local resection.[17] This is generally advised, as many radiation-induced head and neck neoplasms are aggressive and show bone destruction and local invasion on imaging.[16] The reported benign myofibroblastoma lesion in this case was not locally invasive and therefore did not require extensive surgical intervention. Additional radiation therapy and/or chemotherapy have both been suggested but have not been shown to increase overall survival.[18] This was also thought to be relatively contraindicated in our patient given his presumed germline retinoblastoma mutation. As such our patient underwent partial maxillectomy and total ethmoidectomy, which was thought to be the most appropriate course of action for this rare but benign lesion.

4 | CONCLUSIONS

MTEM is a rare neoplasm that is associated with radiation therapy, especially with a long latency period after initial exposure.[10] They are histologically and immunohistochemically identical to mammary myofibroblastoma. Radiation-induced neoplasms are rare, but potentially life-threatening complications of radiotherapy generally

requiring aggressive surgery. This case illustrates successful diagnosis and treatment of a radiation-induced MTEM in a patient with a history of retinoblastoma treated by external beam radiation. The neoplasm was removed with negative margins via partial maxillectomy and total ethmoidectomy without perioperative complications or local recurrence to date.

AUTHOR CONTRIBUTIONS

DBM collected pertinent case information, assembled and submitted the final article. MCL, CK collected pertinent case information and assisted with article preparation. MM and BAZ assisted with case preparation and pathological specimen analysis. BNB and AWJ: provided case analysis and perspective concerning otolaryngology on final article. KP: provided case analysis and perspective concerning pathology on final article.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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