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Case Report

Aggressive Pulmonary Mucoepidermoid carcinoma in Adolescence: A case Report (Highlighting Diagnostic and Management Challenges)

B Dina Rose[1*], Leena Dennis Joseph[2], G A Vasugi[3], G Barathi[3], T Periyasamy[4]

[1]Resident, Department of Pathology, Sri Ramachandra Institute of Higher Education & Research, Chennai
[2]HOD & Professor, Department of Pathology, Sri Ramachandra Institute of Higher Education & Research, Chennai
[3]Associate Professor, Department of Pathology, Sri Ramachandra Institute of Higher Education & Research, Chennai
[4]Professor, Department of cardiovascular surgeon, Sri Ramachandra Institute of Higher Education & Research, Chennai

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***Corresponding author:** B Dina Rose
Resident, Department of Pathology, Sri Ramachandra Institute of Higher Education & Research, Chennai

Abstract

Pulmonary mucoepidermoid carcinoma (PMEC) is an extremely rare salivary gland-type tumor that arises from submucosal bronchial glands and accounts for less than 1% of lung tumors. Here we describe a very unusual case of high-grade PMEC in a 17-year-old male, in whom low-grade tumors are more common. The clinical course was characterized by extensive mediastinal involvement, ipsilateral hilar lymph node metastasis with extranodal extension, and bronchial margins involved with disease. PET-CT and FNAC was done as part of the diagnostic process followed by chemotherapy, surgical debulking, and left pneumonectomy. Pathology confirmed high-grade tumor with multiple adverse prognostic features. This case demonstrates how difficult it is to diagnose PMEC in adolescents and that even if diagnosed early, high-grade PMEC can have aggressive biological behavior requiring tailored management approaches involving multidisciplinary teams.

Keywords: Pulmonary, Mucoepidermoid, Salivary Gland Tumor, High Grade.

INTRODUCTION

Pulmonary mucoepidermoid carcinoma (PMEC) is considered an extremely rare form of malignancy, accounting for 0.1% to 0.2% of all primary lung cancers, and less than 1% of all lung tumors(Shen & Che, 2014). It was first described by the World Health Organization in 1993 as a malignant neoplasm of salivary gland-type that is known to arise from submucosal bronchial glands within the tracheobronchial tree. Histologically, PMEC exhibits three main cell types: squamous cells, mucin-secreting (mucous) cells, and intermediate cells that are present in different proportions and architectural arrangements (Shen & Che, 2014).

PMEC is extremely rare in children and adolescents and is almost exclusively reported as case reports (Huang *et al*., 2023; Uppal *et al*., 2022), whereas high-grade PMEC is far more prevalent in adult patients (75.6% of adults with PMEC had a high-grade tumor)(Jiang *et al*., 2014), which points to significant differences in tumor biology, natural history, or the time it takes for malignant transformation in children and adolescents. This particular case of a high-grade PMEC in a 17-year-old male is particularly rare and clinically important, as this represents an aggressive form of the disease seen in a population where it is rarely reported; therefore, it is important to document such cases to further characterize high-grade PMEC in younger patients.

Here we present a case of high-grade pulmonary mucoepidermoid carcinoma in an adolescent male and summarize the clinical presentation, diagnostic workup, pathological characteristics, and management through a review of current literature to provide insight into this rare case.

CASE PRESENTATION

A 17-year-old male patient came into the clinic complaining of cough and chest pain. This is indicative of non-specific symptoms that are commonly seen in many benign and malignant respiratory conditions, which often lead to large delays in diagnosis due to

misdiagnosis by other common respiratory ailments such as asthma or bronchitis. These initial complaints for the patient correspond with this diagnostic challenge.

Initial imaging consisted of a PET-CT scan that demonstrated FDG avid soft tissue density lesions within the mediastinum, with noted encasement of the left main bronchus and left pulmonary artery. High levels of FDG uptake, often expressed as an SUVmax value above 6.5, are commonly associated with high-grade tumors, lymph node metastasis, and a poorer prognosis [1].The widespread mediastinal disease with vessel encasement and bronchial obstruction demonstrated on this PET-CT scan is characteristic of advanced local disease [2].

Fine needle aspiration cytology (FNAC) of the left lung mass showed highly cellular smear with discohesive cells and pleomorphic nuclei favouring malignancy [1]. After the initial diagnostic workup, chemotherapy was initiated followed by surgical debulking and a left pneumonectomy. Surgical resection is the mainstay of treatment for PMEC [2], but complete resection can be particularly difficult to obtain with high-grade tumors due to their aggressive and infiltrative nature [1]. Chemotherapy is given because of advanced or high-grade PMEC, but its use as primary or adjuvant therapy remains controversial.

Gross examination of the resected lung showed irregular nodules on its outer surface; cut section revealed a lesion 2.5 cm x 2.3 cm x 1 cm that extended from the left main bronchus into the anterior mediastinum (Figure :1)and encased the left pulmonary artery, with a mass in the anterior mediastinum measuring 2.5 cm x 1.1 cm x 0.9 cm. The infiltrative growth pattern, irregular nodules, and extensive local spread with major vessel encasement and mediastinal extension on gross examination are all strongly suggestive of an aggressive high-grade malignancy.

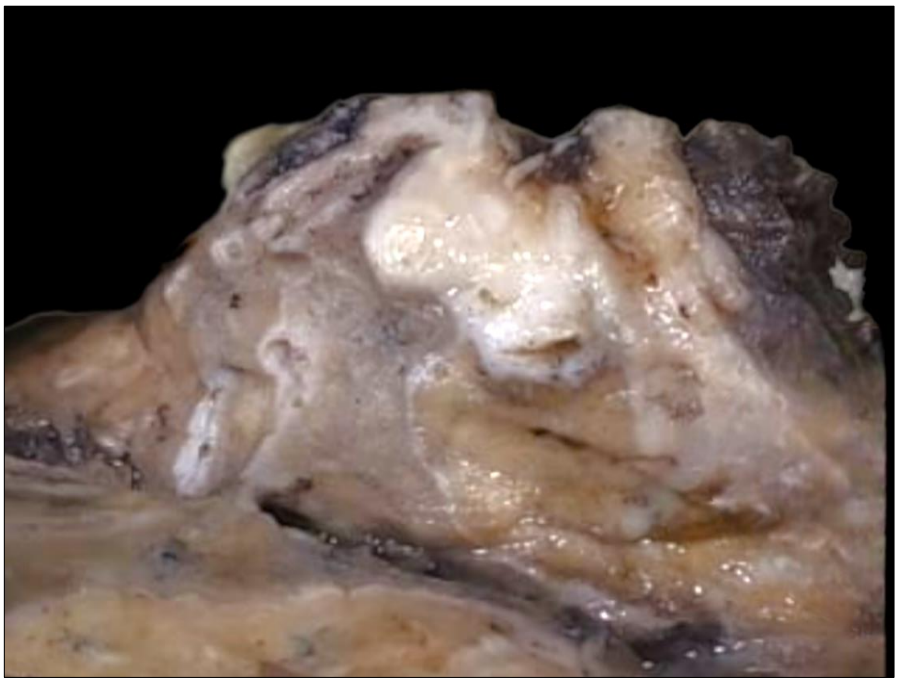

Figure 1: A grey, white, firm lesion measuring 2.5x 2.3x1 cm was visible in the cut section of the left main bronchus

Microscopic examination provided further critical details. The tumor cells were predominantly arranged in solid nests, sheets, and cords of squamous cells, admixed with mucinous cells and intermediate cells (Figure 2). Luminal and extracellular pools of mucin were also observed. A significant finding was the presence of increased mitotic activity (2-5 mitoses per 10 high-power fields) and atypical mitotic figures. Furthermore, metastasis to the ipsilateral hilar lymph nodes with extranodal extension was identified. Based on these findings, a diagnosis of high-grade mucoepidermoid carcinoma of the lung (ypT2b pN1) was made, with the bronchial margins involved by the tumor.

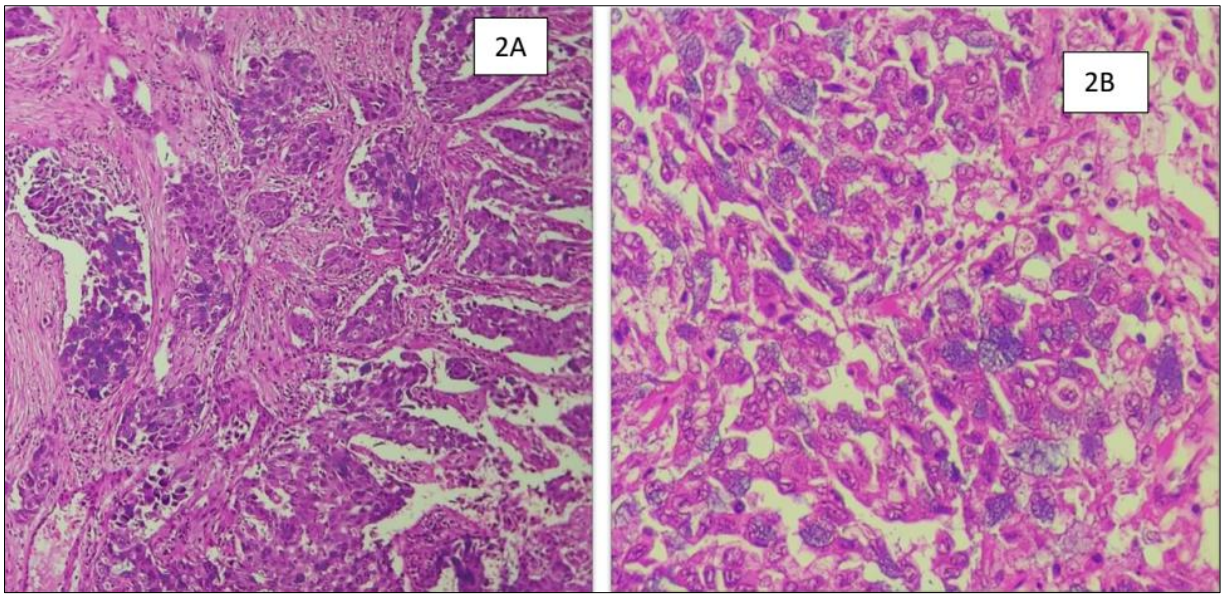

Figure 2: A -Tumor cells were arranged predominantly in solid nests, sheets and cords of squamous cells admixed with mucinous cells and intermediate cells (H&E -200X). 2B- High power view of squamous cells, mucinous cells and intermediate cells (H&E -400X).

These microscopic findings, including solid growth patterns, predominance of squamous and intermediate cells, increased and atypical mitotic figures, and implied necrosis (consistent with the high-grade diagnosis), all meet the criteria for high-grade MEC. Lymph node metastasis, particularly with extranodal extension, and positive surgical margins are significant adverse prognostic factors.

DISCUSSION

Primary neoplasms arising from the tracheobronchial tree and lungs are exceedingly rare, with PMEC accounting for a small fraction of these neoplasms: 0.1% to 0.2% of all primary lung cancers (Huang *et al*., 2023; Shen & Che, 2014). The incidence of PMEC is extremely low in children and adolescents; only about 55 cases have been reported among this age group through the year 2000 (Uppal *et al*., 2022), and 92.5% of these were low-grade tumors (Huang *et al*., 2023).

Conversely, high-grade tumors are more frequently seen in adults with one study finding 75.6% of adult cases were high grade (Jiang *et al*., 2014), and therefore this case of a 17-year-old male diagnosed with high-grade PMEC is extremely rare and significantly different from what is expected for low-grade tumors that occur most often in the pediatric and adolescent population.

The literature is conflicting regarding the gender distribution of patients with PMEC, with some reports suggesting an increased incidence in men(Gaillard F *et al.,* 2025; Huang *et al*., 2023) , while others report that there is an equal gender ratio or a female predominance(Wang *et al*., 2015). These epidemiological disparities may be due to small sample sizes typical of published studies on PMEC; larger multi-institutional cohort studies are required to give more definitive demographic information.

The symptoms of PMEC are nonspecific because irritation or obstruction of the large airways causes persistent cough, chest pain, hemoptysis, wheezing, and recurrent pneumonia(Krishnamurthy *et al*., 2016; Shen & Che, 2014; Wang *et al*., 2015); these symptoms are not specific to PMEC and may overlap with more common respiratory conditions(Krishnamurthy *et al*., 2016; Shen & Che, 2014). This can result in significant delays in diagnosis as patients may first be misdiagnosed with asthma or bronchitis, which can delay the correct diagnosis of a mucoepidermoid tumor for over a year (Uppal *et al*., 2022). These non-specific symptoms are consistent with the presenting complaints (cough and chest pain) of these patients and represent the diagnostic challenge. The relatively slow growth and non-specific clinical presentation of such tumors can lead to a prolonged diagnostic delay, often compounded by the lack of specific imaging findings, which may result in diagnosis at advanced stages as seen here with extensive mediastinal involvement and vascular encasement. This highlights the need for a high index of suspicion for uncommon tracheobronchial neoplasms in patients (especially adolescents) who have persistent or recurrent respiratory symptoms despite conventional treatment.

Computed tomography (CT) findings for PMEC are typically nonspecific for diagnosis but can provide clues about tumor grade; low-grade tumors appear as centrally located masses (at the main or lobar bronchus), with smooth oval or spherical borders, well-

defined margins, homogeneous density, and marked contrast enhancement(Mago, 2021; Wang *et al*., 2015); high-grade tumors tend to be more peripherally located, have lobular contours, poorly defined margins, heterogeneous density, and demonstrate less enhancement(Gaillard F *et al*., 2025; Wang *et al*., 2015).

PET-CT with 18F-fluorodeoxyglucose (FDG) is a common imaging modality for PMEC because these tumors are usually FDG-avid, and PET-CT can be used to predict tumor grade, nodal stage, and long-term prognosis; an SUVmax of more than 6.5 often indicates high-grade tumors with lymph node metastasis and increased risk of recurrence(Krishnamurthy *et al*., 2016). The FDG avid lesions seen on PET-CT in this patient are consistent with high-grade tumors, which is one example of how imaging modalities such as CT and PET-CT cannot provide a definitive histological diagnosis but can give valuable preoperative predictive information regarding the likely aggressive nature of a tumor based on certain patterns (such as FDG avidity, margin definition, homogeneity, and enhancement characteristics), allowing clinicians to plan more appropriate surgical and adjuvant therapeutic strategies in cases where initial biopsies may be limited or inconclusive.

PMEC is histologically characterized by a combination of squamous, mucin-secreting, and intermediate cells that may be arranged in various architectural patterns, including solid nests, sheets, cords, and cystic structures. In this patient, the pathology showed mostly solid nests, sheets, and cords consisting of these cell types with luminal and extracellular mucin(Gaillard F *et al*., 2025; Kalhor & Moran, 2018).

PMEC is further subdivided into low, intermediate, and high grades based on histological features such as nuclear pleomorphism, mitotic activity, and the presence or absence of necrosis (Huang *et al*., 2023; Jiang *et a*l., 2014).

* Low-grade tumors have mucus cell predominance, prominent cyst formation, and minimal cellular atypia with rare or no mitoses.

* High-grade tumors tend to have a greater proportion of squamoid and intermediate cells, are predominantly solid in pattern, display significant nuclear pleomorphism, exhibit a high frequency of mitoses (often 4 or more per 10 HPFs), and may contain areas of necrosis and hemorrhage. The findings in the patient (increased mitosis [2-5/10HPF] and atypical mitosis, solid growth, and final high-grade diagnosis) are all consistent with these aggressive features.

The Armed Forces Institute of Pathology (AFIP) system offers an internationally accepted three-tiered scoring system for MEC (Kalhor & Moran, 2018; Wang *et al*., 2015)., although initially designed for salivary gland tumors, which includes five histological features: intracystic component greater than 20%, perineural invasion, necrosis, mitotic activity (4 or more per 10 high-power fields), and anaplasia; a total score of 0-4 is low-grade, 5-6 intermediate-grade, and 7 or more is high-grade(Wang *et al*., 2015). Although developed for salivary gland MEC, these criteria are applicable to pulmonary counterparts and offer standardized, objective framework for grading. Morphologically, MEC can show considerable heterogeneity that may complicate accurate grading; however, the high-grade diagnosis is supported by the detailed pathological findings described in this case, especially the high mitotic activity, atypical mitosis, and solid growth patterns. A standardized system such as the AFIP criteria even if primarily for salivary gland MEC improves reproducibility and prognostic value of grading pulmonary MEC, which has often been done subjectively by histological interpretation.

The t(11;19)(q21;13) translocation, which produces the CRTC1-MAML2 gene fusion product(Okumura *et al*., 2020; Saade *et al*., 2016), is one of the most frequent genetic alterations observed in MEC and this fusion product has been proposed as a diagnostic biomarker for MEC.

The prognostic significance of the CRTC1-MAML2 fusion is controversial; some studies (primarily those involving salivary gland MEC) indicate that it is a marker of favorable tumor characteristics and overall survival (Okumura *et al*., 2020), while others find no association with differences in survival outcomes. The conflicting evidence on the role of the CRTC1-MAML2 fusion in determining prognosis again emphasizes how molecular findings can be difficult to translate into definitive clinical prognostication for rare tumors such as PMEC that lack large-scale dedicated studies. For high-grade PMEC, it is possible that the more aggressive histologic features (high mitotic activity, necrosis, extensive invasion, lymph node metastasis with extranodal extension) have a greater impact on prognosis and mask any favorable prognostic effects of the fusion. This implies that although molecular markers may be useful in diagnosis, their role in determining the clinical course of high-grade PMEC may be secondary to the overt histopathologic indicators of malignancy.

CONCLUSION

This case report of high-grade pulmonary mucoepidermoid carcinoma in a 17-year-old male is a critical addition to the limited literature on this rare malignancy, especially given that such aggressive presentations are very uncommon in adolescents. The clinical course with nonspecific symptoms leading to delayed diagnosis, extensive mediastinal involvement, and significant pathological findings including high mitotic activity, lymph node metastasis with extranodal

extension, and positive surgical margins highlights the aggressive biological behavior of this high grade variant however, the detailed pathological assessment, guided by established grading criteria, proved critical in characterizing the tumors aggressiveness and guiding subsequent management. Although imaging modalities such as PET-CT provided useful preoperative predictive information about tumor grade and extent, final diagnosis and prognostication were largely dependent on comprehensive histopathological examination.

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