

Clinical Records

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Mucoepidermoid carcinoma of unknown primary in the head and neck: a case report and review of the literature

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Abstract

Objective. Mucoepidermoid carcinoma of unknown primary (MEC-UP) in the head and neck is a rare presentation of the most common salivary gland cancer. Cancers of unknown primary sites often have poorer prognoses than similar cancers with known primary. Few cases of MEC-UP have been reported; therefore, the objective of this report is an overview of the diagnosis and management of MEC-UP.

Methods. We present two patients with low-grade MEC-UP at a high-volume tertiary care institution in Ontario, and a database search returning 1560 citations of which five studies with seven MEC-UP cases were identified.

Results. Review of the limited cases suggest many clinicians use positron emission tomography-computed tomography (PET-CT) in addition to panendoscopy and targeted biopsies with consideration for diagnostic tonsillectomy in diagnostic work-up.

Conclusion. Like other salivary gland cancers, primary therapeutic surgical resection is recommended with low threshold for adjuvant radiotherapy to regions at high risk for harbouring the primary malignancy, especially in cases of high-grade histopathology.

Introduction

Mucoepidermoid carcinoma (MEC) is the most common salivary gland malignancy, characterized by a mixed histological pattern of epidermoid, mucous-producing and intermediate cells.^{1–3} While often found in the parotid glands, primary tumours can arise in any major or minor salivary glands.^{4,5} Prognosis in MEC is variable, with studies showing five-year survival rates between 87 and 98 per cent and 22 and 67 per cent in low-grade and high-grade tumours, respectively.^{6–9}

Cancers of unknown primary (CUP) present as metastatic lesions without any known primary site despite investigative work-up.¹⁰ CUPs represent 3–5 per cent of all malignant epithelial tumours, carry a worse prognosis than their counterparts with known primary and can be aggressive with a poor response to empiric treatment.^{11–14} They are estimated to comprise around 5 per cent of head and neck cancers, with five-year overall survival rates reported around 30–40 per cent.¹⁵ Current literature detailing management of head and neck CUP is mostly in the context of squamous cell carcinoma, with little information on the management of MEC-UP available.^{16,17} Hence, MEC-UP presents a unique clinical challenge, with only a handful of case reports detailing management and outcomes.

To guide clinical decision making in this rare presentation of head and neck cancer, we embarked on the first systematic review of the MEC-UP literature for additional cases to present alongside our two (Appendix 1). This resulted in nine total cases of MEC-UP, the largest number of MEC-UP cases presented in a single article to date.

Methods

We performed a database search of Medline (Ovid) and Embase from database inception to April 2024 (Appendix 1). This revealed 1560 unique citations that underwent screening and full-text review in duplicate (K.C. and P.S.). We identified five case reports that investigated MEC-UP of the head and neck (Table 1).

Table 1. Summary of published cases of MEC-UP in the head and neck

Study	Age and sex	Diagnostic work-up	Site of tumour presentation	Pathology details	Initial staging	Pertinent medical comorbidities	Management	Adjuvant/salvage therapy	Clinical outcome
1. Friedrich <i>et al.</i> (2016) ⁴⁷	48M	US, MRI, PET-CT, open LN biopsy	Left level II neck mass	Low grade MEC, 2.4cm, 1/3 lymph nodes positive for MEC	TxN1M0	None reported	Ipsilateral MRND	CRT to primary site candidate and neck (details not specified)	No disease recurrence 43-months after primary treatment
2. Prabhu <i>et al.</i> (2011) ⁴⁸	67M	CT, MRI, FNAB, PE	Right level II neck mass	Low grade MEC, 3.5cm, "extensive" nodal involvement	Not reported	51 PY smoking history	Ipsilateral RND	RT: 60 Gy over six weeks to right neck	Distant metastases within 24 months of primary treatment
3. Ghazali <i>et al.</i> (2017) ⁴²	66M	CT, PET-CT, FNAB, PE	Right level II neck mass	High grade MEC, 3 cm, 51/61 lymph nodes positive for MEC	TxN3M1	Smoking history, history of resected oral tongue CIS	Concurrent CRT (i.e., 70 Gy and weekly cisplatin)	Ipsilateral MRND, contralateral SND	Death 2 months after primary treatment
4. Trosman <i>et al.</i> (2014) ⁴⁹	43M	CT, PET-CT, open LN biopsy	Right level II neck mass	Intermediate grade MEC, 7cm, multiple lymph nodes with ENE	TxN3M0	None listed	Ipsilateral SND	RT to primary site candidate and right neck (details not specified)	Disease free after 1 year
5. Wani <i>et al.</i> (1998) ⁵⁰	59F	CT, open LN biopsy, PE	Left level II neck mass	Intermediate grade MEC, 3cm, one positive node	TxN2M0	None listed	Total parotidectomy, ipsilateral MRND	None	Disease free after 1 year
47M		CT, FNAB, open LN biopsy, PE	Left neck mass	No details reported	TxN3M0	Heavy smoking, alcohol abuse	Primary lesion resection and ipsilateral neck dissection	Brachytherapy (details not specified)	Regional recurrence 9 months after primary treatment
52M		CT, PET-CT, MRI, US	Right axillary lump 2.5 years post-non MEC-UP in neck	High grade MEC, 3.9 cm, LVI	Not reported	6 PY smoking history	Prior to MEC diagnosis - Primary: Bilateral RND; adjuvant: CRT with 30 fractions and 7 cycles of cisplatin	Axillary dissection	None reported
41F		CT, MRI, PET-CT, FNAB, PE	Left level II neck mass	Low grade MEC, 1.2cm, one positive node excised	TxN1M0	Lyme disease, EBV, HSV2+	Clinical surveillance	None	No documented recurrence 18 months after initial presentation
65F		CT, MRI, FNAB, PE	Left level II neck mass	Low grade MEC, 3.2cm, 1/19 lymph nodes positive	TxN1M0	Hypothyroidism, hypertension, GERD	Left level I-III and partial IV neck dissection	Did not undergo RT due to clear margins, low grade MEC, no primary site	No documented recurrence 7 months after primary treatment

CRT = chemoradiotherapy; EBV = Epstein-Barr virus; ENE = extranodal extensions; FNAB = fine needle aspiration biopsy; GERD = gastroesophageal reflux disease; HSV = herpes simplex virus; LN = lymph node; LVI = lymphovascular invasion; MEC = mucoepidermoid carcinoma; MEC-UP = mucoepidermoid carcinoma of unknown primary; MRI = magnetic resonance imaging; MRND = modified radical neck dissection; PE = panendoscopy; PET = positron emission tomography; PY = pack-year; RND = radical neck dissection; RT = radiotherapy; SND = selective neck dissection; US = ultrasound.

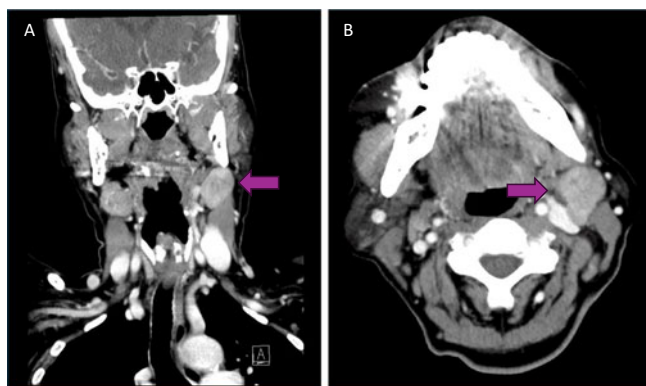


Figure 1. CT neck with contrast in coronal (A) and transverse (B) demonstrating a 2.2 x 2.3 x 3.2 cm heterogeneous mass between left submandibular gland and left SCM.

Case report

Case one

A 41-year-old female presented with an asymptomatic left-sided lateral neck mass and an otherwise unremarkable physical exam. She is a never-smoker with a history of Lyme disease, Epstein-Barr virus and herpes simplex virus. Her fine needle aspiration biopsy (FNAB) demonstrated cellular atypia but was negative for carcinoma and so she underwent an excisional biopsy that demonstrated low-grade MEC. She underwent panendoscopy with base of tongue biopsies and ipsilateral diagnostic tonsillectomy that was negative for any malignancy. She was staged as TXN1M0. Her imaging post-excisional biopsy did not demonstrate any additional lesions of concern. Her case was presented at multidisciplinary tumour boards who recommended ongoing oncological surveillance with consideration for neck dissection if any changes were to arise. The patient decided against an ipsilateral neck dissection and instead chose regular surveillance. She has had subsequent ultrasound, MRI and PET-CT that did not demonstrate any pathological features consistent with a primary site. Presently, she has not developed any recurrent disease or lesions consistent with a primary tumour within 18 months of her initial presentation.

Case two

A 65-year-old female presented with an asymptomatic left-sided neck mass. Three years prior to presentation, she underwent a FNAB of this neck mass outside of Canada that suggested Warthin's tumour. She is a never-smoker, and her past medical history included hypothyroidism, hypertension and gastroesophageal reflux disease (GERD). Due to continued growth, the mass was investigated by repeat FNAB, which showed atypical cells. CT neck with contrast showed a heterogeneous high-density mass in the left neck (Figure 1). A subsequent core needle biopsy indicated low-grade MEC, and an MRI neck with gadolinium enhancement showed an intermediate-enhancing lesion in the left upper cervical area and a small mixed solid/cystic lymph node (Figure 2). Panendoscopy revealed no obvious mucosal lesions and left tonsillectomy and direct biopsy of the left, central and right tongue base were negative for malignancy. She was staged as TXN1M0.

Primary management was ipsilateral selective neck dissection of levels I–III with partial level IV and resection of peri-facial nodes and the tail of the parotid gland. Surgical pathology showed 1/19

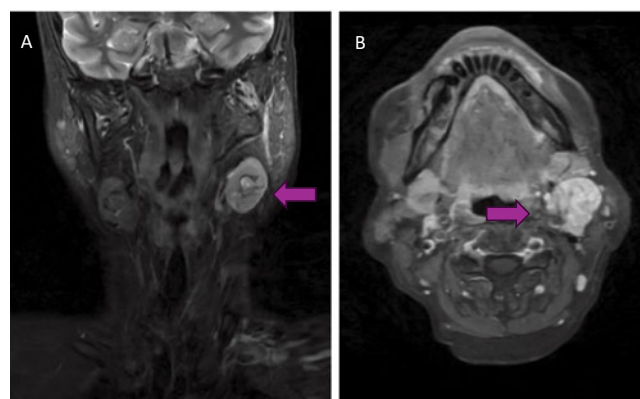


Figure 2. MRI neck with gadolinium contrast in coronal (A) and axial (B) demonstrating the same left sided level IIA neck mass measuring alongside a small mixed solid/cystic lymph node.

lymph nodes were positive for MEC alongside negative margins and no extranodal extension. The patient was referred for consideration for adjuvant radiotherapy (RT), but due to the lack of high-risk pathological features, the team instead opted for ongoing surveillance. Presently, she does not have any disease recurrence within 7 months of primary treatment.

Discussion

To the best of our knowledge, this report is the largest published series of patients with MEC-UP of the head and neck (Table 1). Across these studies, the median age at presentation was 54 years (range: 43–67 years), and most patients were male, presenting with asymptomatic neck masses. We found that 44 per cent of these patients had a history of smoking, but smoking status remains an unclear risk factor in MEC despite being associated with other salivary gland malignancies.^{18,19} In one case, we found that MEC was diagnosed three years following a FNAB suggestive of Warthin's tumour. Warthin's tumour rarely presents outside of the parotid gland, but cases of MEC developing in a Warthin's tumour have been reported.^{20–22} There are also described cases of Warthin's tumour-like MEC, which are MEC tumours that possess cellular features similar to Warthin's tumour.²³ These uncommonly described tumours may represent malignant transformation of Warthin's tumour, or “tumour-to-tumour” metastasis from a distant primary, which is a phenomenon that has been described in other cancers.^{23,24} Zhang and colleagues suggested that testing for the MAML2 gene via fluorescence in situ hybridization can identify Warthin's tumour-like MEC and prevent cytological misdiagnosis.²⁵ In summary, head and neck MEC-UP often presents as an asymptomatic neck mass wherein initial diagnosis is often guided by FNAB with consideration for core needle and/or open biopsy if FNAB results are unclear.

Further diagnostic work-up of the primary site in MEC-UP should be modelled after head and neck mucosal CUP. We propose that clinicians consider employing imaging modalities such as CT, MRI and fluorodeoxyglucose (FDG)-PET/CT, in addition to panendoscopy and biopsies of any suspicious mucosal sites. In our review, four studies performed an FDG-PET/CT scan to help localize and stage the primary site following initial work-up with CT and MRI. In oncology, FDG-PET/CT scans are recommended to identify and stage CUPs for any anatomic region.^{26–29} Moreover,

FDG-PET/CT scans are better than CT alone in detecting primary sites, nodal deposits and distant metastases in salivary gland cancer.^{30,31} Hence, we recommend that clinicians consider FDG-PET/CT in cases of suspected MEC-UP when CT and MRI do not identify any sites suspicious for a primary cancer. Diagnostic tonsillectomy is often considered for head and neck mucosal CUP.^{32,33} Although rare, authors have reported primary MEC affecting minor salivary glands within subsites of the oropharynx, including the palatine tonsils.^{34–37} Hence, clinicians should consider panendoscopy, targeted biopsies and diagnostic ipsilateral tonsillectomy for MEC-UP of the head and neck, especially if any suspicious areas are noted on diagnostic work-up.

Primary salivary gland malignancies are typically treated via primary surgery addressing the primary site and any nodal metastases with indications for adjuvant treatment reserved for high-risk pathological features.^{9,38} When accounting for high-risk pathological features, survival in salivary gland MEC is associated with histological grade, with five-year survival ranging from 26 per cent to 95 per cent in high and low histological grade disease, respectively.^{39,40} In MEC-UP, we found neck dissection to extirpate any gross nodal disease was most often performed as primary treatment.⁴¹ One study reported primary chemoradiotherapy (CRT) followed by salvage neck dissection for a patient presenting with distant metastases who did succumb to his advanced disease within two months of primary treatment.⁴² The use of adjuvant RT in MEC varies based on pathological features and grade of disease, with one case series of MEC reported an overall rate of RT of 41 per cent, where most low-grade disease was treated with surgery alone and most high-grade disease was treated with surgery and adjuvant RT.⁴³ This is supported by another case series, which reported the rate of adjuvant RT in salivary gland MEC as 7 per cent in low-grade disease and 70 per cent in high-grade disease.⁴⁴ Studies suggest improved locoregional control with adjuvant RT in MEC patients with high histological grade, positive surgical margins, peri-neural invasion, and/or in advanced stage disease, but this remains controversial.^{9,38,43,45} Most MEC-UP patients in this series received adjuvant CRT, which was typically indicated due to advanced nodal disease.^{42,46–50} While no difference in overall survival has been shown in MEC patients receiving adjuvant RT versus CRT, studies suggest that adjuvant CRT confers a greater locoregional control, especially in those with high-risk pathological features.^{9,40,51} In cases of MEC-UP, survival may be worsened due to the lack of treatment to the primary site, so, clinicians should have a low threshold for recommending adjuvant RT to affected nodal sites and sites at risk for harbouring the MEC primary site.⁵²

- MEC-UP is a head and neck cancer that is poorly described in the literature
- We detail the largest number of cases and management of MEC-UP through the introduction of two cases and a review of the literature
- Work-up of MEC-UP tends to include PET-CT, panendoscopy, targeted biopsies and consideration for diagnostic tonsillectomy
- Primary management of MEC-UP is complete surgical excision
- There is a lower threshold for consideration of adjuvant RT or CRT than in salivary gland malignancies with known primary
- MEC-UP outcomes may be worse due to incomplete identification and removal of a primary site, if one exists

Conclusion

Herein, we reported the largest review of MEC-UP of the head and neck, which is a rare but challenging surgical diagnosis. From the

cases reported, clinicians perform PET-CT in addition to panendoscopy and targeted biopsies with consideration of diagnostic tonsillectomy. As with other salivary gland cancers, primary surgical resection of gross disease is the most common treatment with low threshold for considering adjuvant RT to regions at risk for harbouring the primary malignancy, especially in cases of high-grade histopathology.

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Ethical approval. Our institution does not require approval from an ethics board for the reporting of case series or individual cases.

Statements of informed consent. Written consent was obtained from the patients for their anonymised information and photos to be used for educational purposes.

References

- 1 Stewart FW, Foote FW, Becker WF. Muco-epidermoid tumors of salivary glands. *Ann Surg* 1945;**122**:820–44
- 2 Sood S, McGurk M, Vaz F. Management of salivary gland tumours: United Kingdom National Multidisciplinary Guidelines. *J Laryngol Otol* 2016;**130**:S142–9
- 3 White VA, Hyrcza MD, Lennerz JK, Thierauf J, Lokuhetty D, Cree IA, *et al.* Mucoepidermoid carcinoma (MEC) and adenosquamous carcinoma (ASC), the same or different entities? *Mod Pathol* 2022;**35**:1484–93
- 4 Brenner DR, Gillis J, Demers AA, Ellison LF, Finley C, Fitzgerald N, *et al.* Canadian Cancer Statistics Advisory Committee in collaboration with the Canadian Cancer Society, Statistics Canada and the Public Health Agency of Canada. *Canadian Cancer Statistics 2023*. Toronto, ON: Canadian Cancer Society, 2023
- 5 Young A, Okuyemi OT. *Malignant Salivary Gland Tumors*. StatPearls Publishing; 2023
- 6 Boahene DKO, Olsen KD, Lewis JE, Pinheiro AD, Pankratz VS, Bagniewski SM. Mucoepidermoid carcinoma of the parotid gland: The Mayo Clinic Experience. *Arch Otolaryngol Head Neck Surg* 2004;**130**:849–56
- 7 Alvi S, Chudek D, Limaem F. *Parotid Cancer*. StatPearls Publishing; 2023
- 8 Ullah A, Khan J, Waheed A, Karki NR, Goodbee M, Yasinzai AQK, *et al.* Mucoepidermoid carcinoma of the salivary gland: demographics and comparative analysis in U.S. children and adults with future perspective of management. *Cancers (Basel)* 2022;**15**:250
- 9 Sama S, Komiya T, Guddati AK. Advances in the treatment of mucoepidermoid carcinoma. *World J Oncol* 2022;**13**:1–7
- 10 Kolling S, Ventre F, Geuna E, Milan M, Pisacane A, Boccaccio C, *et al.* “Metastatic Cancer of Unknown Primary” or “Primary Metastatic Cancer”? *Front Oncol* 2020;**9**:1546
- 11 Pavlidis N, Pentheroudakis G. Cancer of unknown primary site. *Lancet* 2012;**379**:1428–35
- 12 Fizazi K, Greco FA, Pavlidis N, Daugaard G, Oien K, Pentheroudakis G. Cancers of unknown primary site: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol* 2015;**26**:v133–8
- 13 Massard C, Loriot Y, Fizazi K. Carcinomas of an unknown primary origin—diagnosis and treatment. *Nat Rev Clin Oncol* 2011;**8**:701–10
- 14 Kim CS, Hannouf MB, Sarma S, Rodrigues GB, Rogan PK, Mahmud SM, *et al.* Survival outcome differences based on treatments used and knowledge of the primary tumour site for patients with cancer of unknown and known primary in Ontario. *Curr Oncol* 2018;**25**:307–16

- 15 Grau C, Johansen LV, Jakobsen J, Geertsen P, Andersen E, Jensen BB. Cervical lymph node metastases from unknown primary tumours: results from a national survey by the Danish Society for Head and Neck Oncology. *Radiother Oncol* 2000;**55**:121–9
- 16 Ota I, Kitahara T. Cancer of unknown primary in the head and neck: diagnosis and treatment. *Auris Nasus Larynx* 2021;**48**:23–31
- 17 Mackenzie K, Watson M, Jankowska P, Bhide S, Simo R. Investigation and management of the unknown primary with metastatic neck disease: United Kingdom National Multidisciplinary Guidelines. *J Laryngol Otol* 2016;**130**:S170–5
- 18 Sawabe M, Ito H, Takahara T, Oze I, Kawakita D, Yatabe Y, *et al.* Heterogeneous impact of smoking on major salivary gland cancer according to histopathological subtype: a case-control study. *Cancer* 2018;**124**:118–24
- 19 Broadbush VC, Mason RJ, Ernst JD, King TE, Lazarus SC, Murray JF, *et al.* Murray & Nadel's Textbook of Respiratory Medicine. In: *Murray and Nadel's Textbook of Respiratory Medicine: Volume 1*, 2, 7th edn. 2015;**1–2**:1–1849.e8
- 20 Yu C, Song Z, Xiao Z, Lin Q, Dong X. Mucoepidermoid carcinoma arising in Warthin's tumor of the parotid gland: clinicopathological characteristics and immunophenotypes. *Sci Rep* 2016;**6**:30149
- 21 Nagao T, Sugano I, Ishida Y, Tajima Y, Furuya N, Kondo Y, *et al.* Mucoepidermoid carcinoma arising in Warthin's tumour of the parotid gland: Report of two cases with histopathological, ultrastructural and immunohistochemical studies. *Histopathology* 1998;**33**:379–86
- 22 Williamson JD, Simmons BH, el-Naggar A, Medeiros LJ. Anatomical pathology/mucoepidermoid carcinoma involving Warthin tumor. A report of five cases and review of the literature. *Am J Clin Pathol* 2000;**114**:564–70
- 23 Balasubramanian V, Sultania M, Sable M, Muduly D, Kar M. Warthin-like mucoepidermoid carcinoma of the parotid gland: a diagnostic and therapeutic dilemma. *Autops Case Rep* 2019;**9**:e2019122
- 24 Minezaki S, Misawa T, Tsukayama H, Shibuya M, Wada K, Sano K, *et al.* Tumor-to-tumor metastasis: an extremely rare combination with renal cell carcinoma as the donor and a pancreatic neuroendocrine tumor as the recipient. *Surg Case Rep* 2022;**8**:8
- 25 Zhang D, Liao X, Tang Y, Meyer RG, van Dyke DL, Liu X, *et al.* Warthin-like mucoepidermoid carcinoma of the parotid gland: unusual morphology and diagnostic pitfalls. *Anticancer Res* 2019;**39**:3213–17
- 26 Nissan E, Amit U, Baron L, Zabatani A, Urban D, Barshack I, *et al.* The usefulness of [18F]FDG-PET/CT in detecting and managing cancers with unknown primary site depends on histological subtype. *Sci Rep* 2021;**11**:17732
- 27 Bicakci N. Diagnostic and prognostic value of F-18 FDG PET/CT in patients with carcinoma of unknown primary. *North Clin Istanbul* 2022;**9**:337–46
- 28 Kwee TC, Basu S, Cheng G, Alavi A. FDG PET/CT in carcinoma of unknown primary. *Eur J Nucl Med Mol Imaging* 2010;**37**:635–44
- 29 Yoo J, Henderson S, Walker-Dilks C. Evidence-based guideline recommendations on the use of positron emission tomography imaging in head and neck cancer. *Clin Oncol (R Coll Radiol)* 2013;**25**:e33–66
- 30 Nakajima R, Patel SG, Katabi N, Flukes S, Mauguen A, Ganly I, *et al.* Diagnostic and prognostic utility of 18F-FDG PET/CT in recurrent salivary gland cancers. *AJR Am J Roentgenol* 2021;**216**:1344–56
- 31 Roh J-L, Hwan Ryu C, Choi S-H, Seung Kim J, Hyun Lee J, Cho K-J, *et al.* Clinical utility of 18 F-FDG PET for patients with salivary gland malignancies. *J Nucl Med* 2007;**48**:240–6
- 32 Podeur P, Mancini J, Delgrande J, Santini L, Salas S, Wong S, *et al.* Role of tonsillectomy in the management of carcinomas of unknown primary of the head and neck: A retrospective study based on p16 analysis. *Front Oncol* 2020;**10**:594168
- 33 Randall DA, Johnstone PA, Foss RD, Martin PJ. Tonsillectomy in diagnosis of the unknown primary tumor of the head and neck. *Otolaryngol Head Neck Surg* 2000;**122**:52–5
- 34 Talani C, Fränlund K, Unguras C. A rare case of tonsillar mucoepidermoid carcinoma. *Acta Otolaryngol Case Rep* 2023;**8**:44–6
- 35 Teixeira LN, Montalli VA, Teixeira LC, Passador-Santos F, Soares AB, de Araújo VC. Mucoepidermoid carcinoma of the palatine tonsil. *Case Rep Oncol Med* 2015;**2015**:827560
- 36 Vaddi A, Renapurkar S and Khurana S. Benign and malignant tumors of the tonsils. In: Singh Gendeh B, eds. *Tonsils and Adenoids*. IntechOpen 1–8, 2023.
- 37 Ramael M, Van Steelandt H, Puls T, Ramael M. Very rare tumour of the palatine tonsil: a molecular approach. *BMJ Case Reports* 2024;**17**:e255864
- 38 Chen AM, Lau VH, Farwell DG, Luu Q, Donald PJ. Mucoepidermoid carcinoma of the parotid gland treated by surgery and postoperative radiation therapy: clinicopathologic correlates of outcome. *Laryngoscope* 2013;**123**:3049–55
- 39 Pires FR, de Almeida OP, de Araújo VC, Kowalski LP. Prognostic factors in head and neck mucoepidermoid carcinoma. *Arch Otolaryngol Head Neck Surg* 2004;**130**:174–80
- 40 Peraza A, Gómez R, Beltran J, Amarista FJ. Mucoepidermoid carcinoma. An update and review of the literature. *J Stomatol Oral Maxillofac Surg* 2020;**121**:713–20
- 41 Gogna S, Kashyap S, Gupta N. *Neck Cancer Resection and Dissection*. Treasure Island, FL: StatPearls Publishing, 2023
- 42 Ghazali N, Flashburg A, Ord RA. Extensive regional metastasis of high-grade mucoepidermoid carcinoma of an unknown primary tumor. *J Oral Maxillofac* 2017;**75**:874.e1–e7
- 43 Taylor ZC, Kaya EA, Bunn JD, Guss ZD, Mitchell BJ, Fairbanks RK, *et al.* Overall and cause-specific survival for mucoepidermoid carcinoma of the major salivary glands: analysis of 2210 patients. *World J Clin Oncol* 2020;**11**:102944
- 44 Nance MA, Seethala RR, Wang Y, Chiosea SI, Myers EN, Johnson JT, *et al.* Treatment and survival outcomes based on histologic grading in patients with head and neck mucoepidermoid carcinoma. *Cancer* 2008;**113**:20829
- 45 Olsen MP, Mitchell AO, Miles EF. Postoperative radiation therapy for parotid mucoepidermoid carcinoma. *Case Rep Oncol Med* 2014;**2014**:345128
- 46 Friedrich RE, Zustin J. Mucoepidermoid carcinoma - unknown primary affecting the neck. *Anticancer Res* 2016;**36**:3169–71
- 47 Prabhu V, Johnston J, Ingrams D, Passant C. Mucoepidermoid carcinoma - unknown primary and late distant metastasis: an unusual course of the disease. *Clin Pract* 2011;**1**:e97
- 48 Trosman S, Chute D, Wood B, Lamarre E. Unknown primary mucoepidermoid carcinoma: diagnosis and treatment. *Head Neck* 2015;**37**:E22–5
- 49 Wani MK, Robbins KT, Wong FS, Stiles TE. Isolated mucoepidermoid carcinoma in the neck. *Otolaryngol Head Neck Surg* 1998;**119**:398–9
- 50 Yulian ED, Hwei LRY, Tambun R, Siswoyo AD, Ham MF, Suroyo I. Comprehensive evaluation on cancer of unknown primary site and how we managed it: a case report. *Int J Surg Case Rep* 2022;**93**:106954
- 51 Onderdonk BE, Vokes EE, Gwede M, Blair E, Agrawal N, Haraf DJ. Adjuvant treatment for high-risk salivary gland malignancies and prognostic stratification based on a 20-year single institution experience. *Health Sci Rep* 2020;**3**:e195
- 52 Pinkiewicz M, Dorobisz K, Zatoński T. A systematic review of cancer of unknown primary in the head and neck region. *Cancer Manag Res* 2021;**13**:7235–41