Secretory carcinoma in the parotid gland: A case report

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Abstract. Secretory carcinoma (SC) is a rare salivary gland neoplasm characterized by the ETV6::NTRK3 gene fusion, and it has been recognized as a distinct entity in the World Health Organization Classification of Head and Neck Tumors since 2017. Case 1 involved a 21-year-old Japanese man who presented with a 1-year history of a slow-growing, painless mass in the right parotid gland. Ultrasonography and magnetic resonance imaging demonstrated a well-circumscribed, homogeneous tumor measuring 16x12x10 mm. The patient underwent superficial parotidectomy. Case 2 involved a 79-year-old Japanese man who noticed a mass in the right parotid region 3 weeks before presentation. Imaging studies revealed a tumor with irregular margins and heterogeneous internal features, measuring 21x16x15 mm. The patient underwent total parotidectomy with selective neck dissection. Histological examination revealed features consistent with SC in both cases. Immunohistochemically, the tumor cells were positive for S-100 protein, mammaglobin and cytokeratin 7. The diagnosis was further supported by detection of the ETV6::NTRK3 gene fusion using reverse transcription-polymerase chain reaction and Sanger sequencing. Both patients received postoperative radiotherapy at a total dose of 60 Gy. No evidence of local recurrence or distant metastasis has been observed during the follow-up period of 7 years in case 1 and 3 years in case 2.

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Introduction

Secretory carcinoma (SC) of the salivary gland is a rare malignant neoplasm first described by Skálová *et al* (1) in 2010. This entity shares histomorphologic and immunohistochemical features with SC of the breast, which led to its initial designation as mammary analogue secretory carcinoma (MASC). In the fourth edition of the World Health Organization (WHO) Classification of Head and Neck Tumors published in 2017, MASC was recognized as a distinct salivary gland tumor and formally renamed SC (2). The typical morphology of SC is defined by uniform, eosinophilic, variably vacuolated cells with distinct nucleoli and abundant periodic acid-positive luminal secretory material. The immunohistochemical profile of SC includes positive staining for S100 protein, mammaglobin and cytokeratin 7 (CK7), while DOG1 and p63 are usually negative (2). Most cases of salivary gland SC are characterized by the presence of the ETV6::NTRK3 gene fusion, which represents a defining molecular alteration. Given its rarity, the etiology and clinical features of parotid gland SC have not been fully elucidated. Here, we report two cases of parotid gland SC harboring the ETV6::NTRK3 gene fusion, both of which were treated with surgical resection followed by radiotherapy. These cases provide useful insights into imaging variability, management implications, and the importance of long-term follow-up.

Case report

Case 1. Case 1 involved a 21-year-old Japanese man who presented with a 1-year history of a slowly enlarging, painless mass in the right parotid gland (Table I). Ultrasonography revealed a well-circumscribed, homogeneous, isoechoic mass adjacent to a tiny cyst with posterior acoustic enhancement, measuring 16x12x10 mm (Fig. 1A). Magnetic resonance imaging (MRI) revealed a solid mass in the right parotid gland, showing low signal intensity on T1-weighted imaging (T1WI) (Fig. 1B) and high signal intensity on T2-weighted imaging (T2WI) (Fig. 1C). Fine-needle aspiration cytology (FNAC) demonstrated clusters with epithelial and spindle-shaped cells with interstitial mucin, which was interpreted as intermediate,

with features suggestive of pleomorphic adenoma corresponding to category IVA of the Milan System for Reporting Salivary Gland Cytopathology (MSRSGC).

The patient subsequently underwent a right superficial parotidectomy. Histologic examination revealed a lobulated tumor composed of microcystic and reticular growth patterns, with light basophilic secretions within the cystic lumina (Fig. 1D). The tumor cells exhibited mildly atypical, round to oval nuclei with vesicular chromatin and small nucleoli. Few mitotic figures were identified (1-2 mitoses per 10 high-power fields). These histologic findings corresponded to Grade 1 according to the histologic grading system for salivary gland SC proposed by Baněčková *et al* (3). One intraparotid lymph node was metastasized. Immunoperoxidase staining of formalin-fixed, paraffin-embedded (FFPE) tissue sections with anti-S-100 protein polyclonal antibody (Nichirei; Tokyo, Japan), anti-mammaglobin monoclonal antibody (31A5; Roche Diagnostics, Basel, Switzerland), anti-cytokeratin (CK)7 monoclonal antibody (OV-TL 12/30; Nichirei), anti-cytokeratin antibody (AE1/AE3; Nichirei), anti-p63 antibody (4A4; Nichirei), and anti-DOG1 antibody (DOG1.1; Thermo Fisher Scientific, Waltham, MA, USA) were performed using a Ventana OptiView DAB IHC detection kit (Roche Diagnostics). S-100 protein was weakly and diffusely expressed in the nucleus and cytoplasm of tumor cells (Fig. 1E). Mammaglobin was strongly expressed in the cytoplasm (Fig. 1F), whereas CK7 was expressed in both the membrane and cytoplasm (Fig. 1G). AE1/AE3 staining was positive but staining for p63 and DOG1was negative (data not shown).

Reverse transcription-polymerase chain reaction (RT-PCR) analysis was performed according to previously reported method (4) with minor modifications. Total RNA was extracted from formalin-fixed, paraffin-embedded surgical specimens using a NucleoSpin® totalRNA FFPE XS kit (Takara, Tokyo, Japan). A 110-bp fragment corresponding to the ETV6::NTRK3 fusion transcript was amplified using a OneStep RT-PCR kit (QIAGEN, Hilden, Germany) with a reverse primer specific for NTRK3 (5'-CAGTTCTCGCTT CAGCACGATG-3') and forward primer specific for ETV6 (5'-ACCACATCATGGTCTCTGTCTCCC-3'). A synthetic DNA fragment containing the ETV6::NTRK3 fusion junction was used as a positive control. The negative control consisted of RNA from tissue sections without carcinoma and no template. The amplified products were purified and bidirectionally sequenced at AZENTA Life Sciences (Tokyo, Japan). Sanger sequencing identified an ETV6::NTRK3 fusion involving exon 5 of ETV6 and exon 15 of NTRK3 (Fig. 1H). Based on the histologic features, immunohistochemical profile, and molecular findings, the tumor was diagnosed as SC and staged as pT1N1M0 (pathologic Stage III) according to the AJCC/TNM staging system, 8th edition (5). Postoperatively, the patient received radiotherapy to the parotid region with a total dose of 60 Gy. At 7 years of follow-up, the patient remains free of the disease.

Case 2. Case 2 involved a 79-year-old Japanese man who noticed a mass in the right parotid region 3 weeks prior to presentation (Table I). Ultrasonography revealed an irregularly marginated, heterogeneous, hypoechoic mass measuring

Table I. Summary of the 2 cases.

Case	Age, years	Sex	Tumor size, mm	MRI T1WI	MRI T2WI	FNAC	Surgery	RT, Gy	Histology	pTNM	pStage	Outcome
1	21	Male	16x12x10	Low	Low	Pleomorphic adenoma	Superficial parotidectomy	60	Grade I	T1N1M0	III	7 years ANED
2	79	Male	21x16x15	High	Intermediate, high	Suspicious for malignancy	Total parotidectomy, I-III neck dissection	60	Grade II	T4aN0M0	IVA	3 years ANED

ANED, alive with no evidence of disease; FNAC, fine-needle aspiration cytology; RT, radiotherapy; T1WI, T1-weighted imaging; T2WI, T2-weighted imaging.

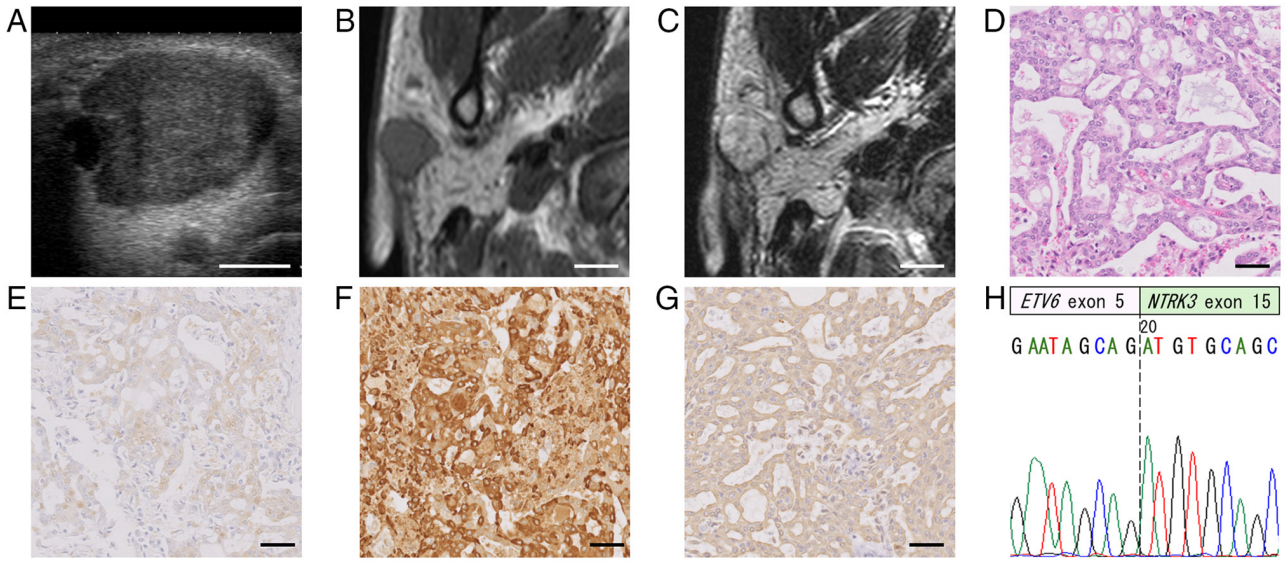

Figure 1. Imaging and histological findings of case 1. (A) Ultrasonography revealed a well-circumscribed, homogeneous, isoechoic mass adjacent to a tiny cyst with posterior acoustic enhancement, measuring 16x12x10 mm. MRI revealed a solid mass in the right parotid gland, showing (B) low signal intensity on T1-weighted imaging and (C) high signal intensity on T2-weighted imaging. (D) After superficial parotidectomy, histological examination revealed predominantly irregularly shaped microcysts of varying sizes, lined by round to oval tumor cells and containing light basophilic secretions within the lumina (hematoxylin and eosin staining). (E) Immunohistochemical examination revealed that S-100 protein was weakly and diffusely expressed in the nucleus and cytoplasm of tumor cells. (F) Mammaglobin was strongly expressed in the cytoplasm, whereas (G) cytokeratin 7 was expressed in both the membrane and cytoplasm. (H) Sanger sequencing revealed an ETV6::NTRK3 gene fusion point between exon 5 of the *ETV6* gene (NM_001987.5) and exon 15 of the *NTRK3* gene (NM_002530.4). Based on the histological features, immunohistochemical profile and molecular findings, the tumor was diagnosed as secretory carcinoma and staged as pT1N1M0 (pStage III). White scale bars, 1 cm; black scale bars, 50 μm.

21x16x15 mm (Fig. 2A). MRI revealed a solid tumor located in the anterior part of the right parotid gland, showing low signal intensity on T1WI (Fig. 2B) and a mixture of intermediate and high signal intensity with extension to the masseter muscle on T2WI (Fig. 2C). Fluorodeoxyglucose-positron emission tomography/computed tomography demonstrated increased uptake in the parotid tumor, with no evidence of neck lymph node or distant metastasis (Fig. 2D). FNAC revealed irregular clusters of atypical epithelial cells with nuclear overlapping, vesicular chromatin, and prominent nucleoli, which was interpreted as suspicious for malignancy (Milan category V) (Fig. 2E).

The patient underwent right total parotidectomy with selective neck dissection of levels I, II, and III. Due to tumor invasion, the buccal branch of the facial nerve and a portion of the masseter muscle were resected. Histologic examination demonstrated infiltrative, irregular sheets of atypical epithelial cells with vesicular chromatin. The tumor cells exhibited prominent nucleoli, admixed with microcysts containing light basophilic secretions within the lumina, set in a hyalinized stroma (Fig. 2F). Few mitotic figures were identified (4-5 mitoses per 10 high-power fields). These histologic findings corresponded to Grade 2. No histologic evidence of lymph node metastasis was found; however, the surgical margin was positive. Tumor involvement of the resected masseter muscle was also noted. Immunohistochemically, S-100 protein was diffusely expressed in the nucleus and cytoplasm of tumor cells (Fig. 2G). Mammaglobin was focally expressed in the cytoplasm (Fig. 2H), whereas CK7 was strongly expressed in both the membrane and cytoplasm (Fig. 2I). AE1/AE3 staining was positive but staining p63 and DOG1was negative (data not shown). Sanger sequencing analysis confirmed the presence of an ETV6::NTRK3 gene fusion (Fig. 2J). Based on these findings, the tumor was diagnosed as SC and staged as pT4aN0M0 (pathologic Stage IVA). Postoperatively, the patient received radiotherapy to the parotid gland and neck with a total dose of 60 Gy. As of the 3-year follow-up, the patient remains free of the disease.

Discussion

SC, previously described as MASC and classified as a low-grade malignancy, accounts for approximately 1.5% of all parotid gland carcinomas (6). The mean age at presentation is reportedly 47.5 years, with a male-to-female ratio of approximately 1.4:1 (3). Regarding anatomic distribution within the salivary glands, SC most commonly arises in the parotid gland (77.1%), followed by the submandibular gland (6.3%), with the remaining 16.6% of casas occurring in other salivary sites (7). Clinically, parotid gland SC typically presents as a painless, slowly enlarging mass (8).

On ultrasonography, SC typically presents as a predominantly cystic tumor with a solid part of the papillary projection (9). However, in both Case 1 and Case 2 of the present report, no cystic lesions with papillary projections were observed. On MRI of SC, the signal intensities of the solid components varied from low to intermediate on T1WI and from low to high on T2WI (9,10). This variation in signal intensity reflected varying degrees of histological formation of microcysts, a desmoplastic stromal reaction, and cellularity in the tumor. Wang *et al* (8) described two patterns of MRI of SC: one presenting as a partially cystic, lobulated mass that may mimic a benign tumor, and the other presenting as an irregular mass with a less cystic composition, which was

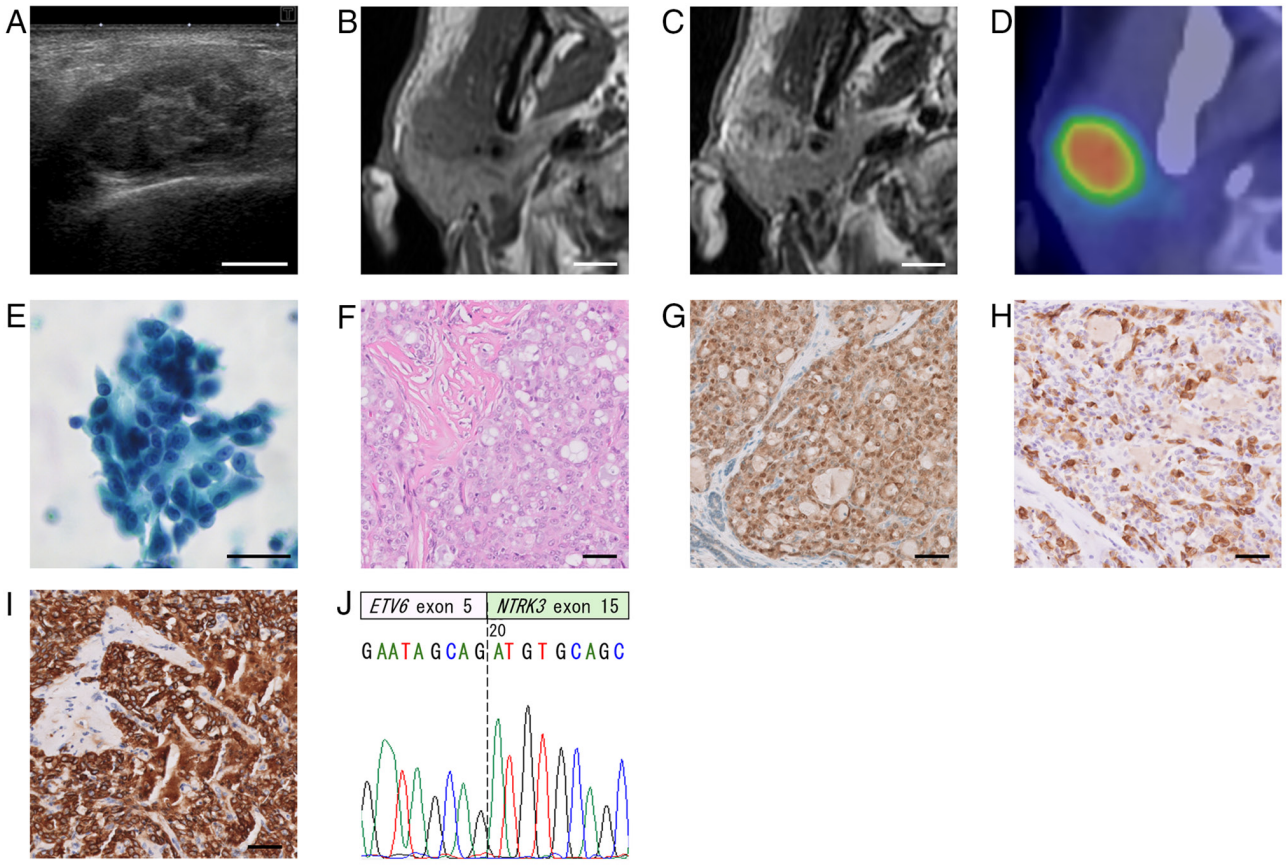

Figure 2. Imaging and histological findings of case 2. (A) Ultrasonography revealed an irregular, marginated, heterogeneous, hypoechoic mass measuring 21x16x15 mm. MRI revealed a solid tumor located in the anterior part of the right parotid gland, showing (B) low signal intensity on T1-weighted imaging and (C) a mixture of intermediate and high signal intensity with extension to the masseter muscle on T2-weighted imaging. (D) Fluorodeoxyglucose-positron emission tomography/computed tomography revealed increased uptake by the tumor. (E) Fine-needle aspiration cytology with Papanicolaou staining demonstrated an irregular cluster of atypical cells with nuclear overlap, vesicular chromatin and prominent nucleoli, which was interpreted as suspicious for malignancy. (F) After total parotidectomy with selective neck dissection, histologic examination demonstrated infiltrative, irregular sheets of atypical epithelial cells with vesicular chromatin. The tumor cells exhibited prominent nucleoli, admixed with microcysts containing light basophilic secretions within the lumina, set in a hyalinized stroma (hematoxylin and eosin staining). (G) Immunohistochemical examination revealed that S-100 protein was diffusely expressed in the nucleus and cytoplasm of tumor cells. (H) Mammaglobin was focally expressed in the cytoplasm, whereas (I) cytokeratin 7 was strongly expressed in both the membrane and cytoplasm. (J) Sanger sequencing analysis revealed the ETV6::NTRK3 gene fusion point. Based on these findings, the tumor was diagnosed as secretory carcinoma and staged as pT4aN0M0 (pStage IVA). White scale bars, 1 cm; black scale bars, 50 μm.

associated with malignant features in their series. In Case 1 of the present report, ultrasonographic and MRI findings of a well-circumscribed, homogeneous tumor were consistent with a benign tumor. In Case 2, by contrast, ultrasonographic findings demonstrated an irregularly marginated, heterogeneous mass, and MRI showed high signal intensity on T2WI with extension into the masseter muscle, suggesting a malignant tumor.

FNAC of SC typically shows moderately cellular smears composed of loosely cohesive sheets, papillary or cribriform tissue fragments, and dispersed tumor cells in a predominantly mucinous background, although hemosiderophages and blood may be present in some cases (11). The tumor cells generally exhibit a low to moderate nuclear-to-cytoplasmic ratio, abundant finely granular or vacuolated cytoplasm, and uniform round to oval nuclei with fine chromatin, distinct single nucleoli, and only mild cytologic atypia. According to the MSRSGC, FNAC specimens of SC are most frequently categorized as malignant (Category VI) (50%), followed by suspicious for malignancy (Category V) (26%), salivary gland neoplasm of uncertain malignant potential (Category IVB) (18%), and atypia of undetermined significance (Category III) (6%) (12). The reported sensitivity of FNAC for diagnosing malignancy in major salivary gland tumors ranges from 38 to 97% (11,13). However, a review by Kala *et al* (11) reported a sensitivity of FNAC specifically for diagnosing salivary gland SC of only 27.7%, indicating a considerable diagnostic limitation. In many cases, the characteristic cytologic features of SC are recognized retrospectively after a definitive histologic diagnosis, with or without confirmatory molecular analysis. In the present study, FNAC findings in Case 1 were interpreted as intermediate, with pleomorphic adenoma included in the differential diagnosis, whereas in Case 2, FNAC results were suspicious for malignancy but did not allow a specific diagnosis of SC.

Histologically, SC typically exhibits a lobulated growth pattern, with lobules separated by fibrous septa and with composition of variable architectural patterns, including microcystic or solid, tubular, follicular, and papillary-cystic structures with distinctive luminal secretions. The tumor often demonstrates an infiltrative growth pattern with occasional perineural invasion and is associated with abundant fibrosclerotic

stroma and prominent, thick, hyalinized septa (14). In 2023, Baněčková *et al* (3) proposed a 3-tiered grading system for SC featuring 4 histologic parameters: (i) architecture and fibrous septae/fibrosis; (ii) nuclear pleomorphism; (iii) perineural invasion, lymphovascular invasion, and tumor necrosis; and (iv) mitotic activity/Ki-67 index. Each parameter was scored on a scale of 1 to 3 and aggregated to yield a final grade: Grade 1=score 4-6, Grade 2=score 7-9, and Grade 3=score 10-12. Higher-grade tumors were significantly associated with poor prognosis (3). The histologic grade corresponded to Grade 1 with a score of 4 in Case 1 and Grade 2 with a score of 7 in Case 2.

Immunohistochemically, SC reportedly shows CK7 expression in 97-100% of cases (7). In both Case 1 and Case 2, the tumor cells were positive for S-100 protein, mammaglobin, and CK7 but negative for DOG1. This immunophenotypic combination is particularly useful for distinguishing SC from acinic cell carcinoma, which mimics SC and is typically negative for S-100 protein and mammaglobin but strongly positive for DOG1 (15).

SC of the salivary glands is typically characterized by a recurrent t(12;15)(p13;q25) chromosomal translocation, resulting in the ETV6::NTRK3 gene fusion, which is considered a defining molecular alteration unique among salivary gland tumors (1). The ETV6::NTRK3 fusion gene encodes a chimeric tyrosine kinase that activates downstream signaling pathways, including the Ras-mitogen-activated protein kinase and phosphatidylinositol 3-kinase-Akt pathways, thereby promoting tumorigenesis (16). The ETV6::NTRK3 gene fusion has been reported in approximately 94% of salivary gland SC cases (7). Several methods are available for detecting this fusion, including immunohistochemistry using antibodies against pan-tropomyosin receptor kinase (pan-Trk) (17), RT-PCR, fluorescence *in situ* hybridization (FISH), and DNA- or RNA-based next-generation sequencing (NGS) (18). Nuclear and cytoplasmic staining with anti-pan-Trk antibody showed an excellent sensitivity of 91% and specificity of 100% for the presence of ETV6::NTRK3 gene fusion positive salivary gland SC (17). However, we did not have the opportunity to perform staining with this antibody. RT-PCR is technically feasible, inexpensive and relatively widely accessible, and it can be effectively applied to FFPE tissue samples for the detection of ETV6::NTRK3 fusion transcripts (16). The main limitation of RT-PCR compared with FISH or NGS is the inability to determine novel fusion partners because *ETV6* can occasionally fuse with alternative non-*NTRK* gene partners, including *RET* (19), *MET* (20), and *MAML3* (21). In the present study, classical ETV6::NTRK3 fusion transcripts with a junction between exon 5 of *ETV6* and exon 15 of *NTRK3* were identified in both Case 1 and Case 2. This canonical fusion type is reportedly the most frequent in salivary gland SC and associated with less infiltrative histologic features, such as prominent thick fibrous septa, as well as more favorable clinical outcomes compared with other ETV6::NTRK3 exon junction variants (16).

With regard to treatment, the National Comprehensive Cancer Network Guidelines (version 1, 2026) recommend complete surgical excision with preservation of the facial nerve for clinically benign lesions and for T1 or T2 salivary gland carcinomas (22). For patients with T3 or T4a tumors, the guidelines recommend total parotidectomy combined with selective neck dissection for clinically N0 disease, and total neck dissection for patients with clinically evident lymph node metastasis (22). Postoperative radiotherapy is generally recommended for patients with incomplete resection, close surgical margins (<5 mm), perineural invasion, tumors classified as T3 or T4a, or regional lymph node metastasis (23). Previous reports have demonstrated that parotidectomy followed by radiotherapy with a total dose exceeding 60 Gy yields excellent local control with minimal treatment-related toxicity in patients with parotid carcinoma (24). In Case 1 of the present study, we performed superficial parotidectomy under a presumed benign diagnosis based on preoperative FNAC. After confirmation of SC, we did not consider reoperation, such as completion parotidectomy or neck dissection, because we were concerned about damage to the preserved facial nerve, and no lymph node swelling was observed in the neck on imaging studies. Postoperative radiotherapy with a total dose of 60 Gy was administered due to close surgical margins. In Case 2, by contrast, a malignant tumor was suspected based on FNAC and imaging findings, and although no cervical lymph node metastasis was observed, total parotidectomy with prophylactic, elective neck dissection of levels I, II, and III was carried out. Radiotherapy was indicated due to positive surgical margins and the presence of perineural and muscle invasion.

More than 75% of patients with salivary gland SC present with early-stage disease (stage I or II), whereas approximately 14 and 8% exhibit regional and distant metastases, respectively, at the first visit (7). The prognosis of patients with SC of the salivary glands is generally favorable. Following complete surgical excision, disease-specific survival rates of approximately 95-98% and disease-free survival rates of 87-89% have been reported (3,25). By contrast, SC with high-grade transformation is associated with a significantly poorer prognosis, with reported postoperative survival typically ranging from 2 to 6 years (26).

Recently, the efficacy and safety of Trk inhibitors have been established for the treatment of NTRK gene fusion-positive tumors, including salivary gland SC. Doebele *et al* (27) described the results of two phase I trials and one phase II trial of entrectinib involving a total of 54 patients with metastatic or locally advanced NTRK gene fusion-positive tumors, including 7 patients (13%) with salivary gland SC. Although 31 (57%) of the 54 patients showed an overall response rate, 6 (86%) of the 7 patients with salivary gland SC demonstrated an overall response rate to the treatment. A study involving 55 patients with NTRK gene fusion-positive metastatic or locally advanced tumors, including 12 patients (22%) with salivary gland SC, treated with larotrectinib demonstrated an overall response rate of 75%, and no severe side effects necessitating treatment discontinuation were observed (28). If either patient we treated develops unresectable lesions or distant metastasis in the future, these agents would represent promising therapeutic options.

In conclusion, accurate diagnosis of parotid gland SC requires a combined assessment of histologic and immunohistochemical features, with confirmation by detection of the ETV6::NTRK3 gene fusion. Recognition of this entity is important because of its potential diagnostic overlap with

other salivary gland neoplasms and its prognostic and therapeutic implications. In our cases, surgical resection followed by radiotherapy resulted in favorable clinical outcomes, with no evidence of recurrence or metastasis observed in either patient during follow-up.

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Availability of data and materials

The data generated in the present study are not publicly available due to privacy reasons but may be requested from the corresponding author.

Authors' contributions

MH, NB, TG, SH, RA, KN and MT contributed to clinical data acquisition and interpretation. MH, NB and HT drafted the manuscript. TIY and HT performed cytologic diagnosis. SB and YK performed mutational analyses. HT performed pathologic investigations. MH and NB confirmed the authenticity of all the raw data. All authors have read and approved the final version of the manuscript.

Ethics approval and consent to participate

All procedures performed on patient tumor samples in the present study were conducted in accordance with the ethical standards of the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The present study was approved by the Ethics Committee of Hokuto Hospital (approval no. 1078; Obihiro, Japan).

Patient consent for publication

Written informed consent for publication of clinical details and images was obtained from the patients and their families.

Competing interests

The authors declare that they have no competing interests.

References

1. Skálová A, Vanecek T, Sima R, Laco J, Weinreb I, Perez-Ordonez B, Starek I, Geierova M, Simpson RH, Passador-Santos F, *et al*: Mammary analogue secretory carcinoma of salivary glands, containing the ETV6-NTRK3 fusion gene: A hitherto undescribed salivary gland tumor entity. Am J Surg Pathol 34: 599-608, 2010.
2. Seethala RR and Stenman G: Update from the 4th edition of the world health organization classification of head and neck tumours: Tumors of the salivary gland. Head Neck Pathol 11: 55-67, 2017.
3. Baněčková M, Thompson LDR, Hyrcza MD, Vaněček T, Agaimy A, Laco J, Simpson RHW, Di Palma S, Stevens TM, Brcic L, *et al*: Salivary gland secretory carcinoma: clinicopathologic and genetic characteristics of 215 cases and proposal for a grading system. Am J Surg Pathol 47: 661-677, 2023.
4. Majewska H, Skálová A, Stodulski D, Klimková A, Steiner P, Stankiewicz C and Biernat W: Mammary analogue secretory carcinoma of salivary glands: A new entity associated with ETV6 gene rearrangement. Virchows Arch 466: 245-254, 2015.
5. American Joint Committee on Cancer: Major Salivary Glands. In: AJCC Cancer Staging Manual. 8th edition. Springer, New York, NY, 2017.
6. Parikh AS, Khawaja A, Puram SV, Srikanth P, Tjoa T, Lee H, Sethi RKV, Bulbul M, Varvares MA, Rocco JW, *et al*: Outcomes and prognostic factors in parotid gland malignancies: A 10-year single center experience. Laryngoscope Investig Otolaryngol 4: 632-639, 2019.
7. Yosefof E, Boldes T, Dan D, Robenshtok E, Strenov Y, Bachar G, Shpitzer T and Mizrachi A: Salivary gland secretory carcinoma; Review of 13 years world-wide experience and meta-analysis. Laryngoscope 134: 1716-1724, 2024.
8. Wang S, Peng Y, Jiang C, Lin Z, Infante-Cossio P and Li J: Case series of secretory carcinoma in the parotid glands. Gland Surg 13: 2198-2205, 2024.
9. Kashiwagi N, Nakatsuka SI, Murakami T, Enoki E, Yamamoto K, Nakanishi K, Chikugo T, Kurisu Y, Kimura M, Hyodo T, *et al*: MR imaging features of mammary analogue secretory carcinoma and acinic cell carcinoma of the salivary gland: A preliminary report. Dentomaxillofac Radiol 47: 20170218, 2018.
10. Han F, Liu F, Wang H, Qin Y, Lu Q, Wu X, Guo Z and Nan X: Clinicopathologic characterization of secretory carcinoma of salivary gland. World J Surg Oncol 22: 282, 2024.
11. Kala PS, Gupta M and Thapliyal N: Efficacy of fine-needle aspiration cytology in diagnosing secretory carcinoma of salivary gland: A systematic review and meta-analysis. Acta Cytol 68: 83-106, 2024.
12. Wiles AB, Gabrielson M, Baloch ZW, Faquin WC, Jo VY, Callegari F, Kholova I, Song S, Centeno BA, Ali SZ, *et al*: Secretory carcinoma of the salivary gland, a rare entity: An international multi-institutional study. Cancer Cytopathol 130: 684-694, 2022.
13. Stow N, Veivers D and Poole A: Fine-needle aspiration cytology in the management of salivary gland tumors: An Australian experience. Ear Nose Throat J 83: 128-131, 2004.
14. Skálová A, Gnepp DR, Lewis JS Jr, Hunt JL, Bishop JA, Hellquist H, Rinaldo A, Vander Poorten V and Ferlito A: Newly described entities in salivary gland pathology. Am J Surg Pathol 41: e33-e47, 2017.
15. Khurram SA and Speight PM: Characterisation of DOG-1 expression in salivary gland tumours and comparison with myoepithelial markers. Head Neck Pathol 13: 140-148, 2019.
16. Skálová A, Vanecek T, Simpson RH, Laco J, Majewska H, Baneckova M, Steiner P and Michal M: Mammary analogue secretory carcinoma of salivary glands: Molecular analysis of 25 ETV6 gene rearranged tumors with lack of detection of classical ETV6-NTRK3 fusion transcript by standard RT-PCR: Report of 4 cases harboring ETV6-X gene fusion. Am J Surg Pathol 40: 3-13, 2016.
17. Yamamoto H, Nozaki Y, Sugii A, Taguchi K, Hongo T, Jiromaru R, Sato M, Nakano T, Hashimoto K, Fujiwara M and Oda Y: Pan-tropomyosin receptor kinase immunoreactivity, ETV6-NTRK3 fusion subtypes, and RET rearrangement in salivary secretory carcinoma. Hum Pathol 109: 37-44, 2021.
18. Solomon JP, Benayed R, Hechtman JF and Ladanyi M: Identifying patients with NTRK fusion cancer. Ann Oncol 30 (Suppl 8): viii16-viii22, 2019.
19. Ishihara A, Kuwabara H, Yasuda E, Jinnin T, Higashino M, Nagao T, Haginomori SI and Hirose Y: Salivary gland secretory carcinoma with an ETV6::RET fusion: A case report. Biomed Rep 22: 73, 2025.
20. Rooper LM, Karantanos T, Ning Y, Bishop JA, Gordon SW and Kang H: Salivary secretory carcinoma with a novel ETV6-MET fusion: Expanding the molecular spectrum of a recently described entity. Am J Surg Pathol 42: 1121-1126, 2018.
21. Guilmette J, Dias-Santagata D, Nosé V, Lennerz JK and Sadow PM: Novel gene fusions in secretory carcinoma of the salivary glands: enlarging the ETV6 family. Hum Pathol 83: 50-58, 2019.

22. NCCN Clinical Practice Guidelines in Oncology: Head and Neck Cancers (Version 1.2026). Available from: https://www.nccn.org/guidelines/.
23. Yassin-Kassab A, Gainor D and Sufyan AS: Atypical presentation of mammary analogue secretory carcinoma of the lip. Ear Nose Throat J 101: NP212-NP217, 2022.
24. Al-Mamgani A, van Rooij P, Verduijn GM, Meeuwis CA and Levendag PC: Long-term outcomes and quality of life of 186 patients with primary parotid carcinoma treated with surgery and radiotherapy at the Daniel den Hoed Cancer Center. Int J Radiat Oncol Biol Phys 84: 189-195, 2012.
25. Cipriani NA, Blair EA, Finkle J, Kraninger JL, Straus CM, Villaflor VM and Ginat DT: Salivary gland secretory carcinoma with high-grade transformation, CDKN2A/B loss, distant metastasis, and lack of sustained response to crizotinib. Int J Surg Pathol 25: 613-618, 2017.
26. Xu B, Viswanathan K, Umrau K, Al-Ameri TAD, Dogan S, Magliocca K, Ghossein RA, Cipriani NA and Katabi N: Secretory carcinoma of the salivary gland: A multi-institutional clinicopathologic study of 90 cases with emphasis on grading and prognostic factors. Histopathology 81: 670-679, 2022.
27. Doebele RC, Drilon A, Paz-Ares L, Siena S, Shaw AT, Farago AF, Blakely CM, Seto T, Cho BC, Tosi D, *et al*: Entrectinib in patients with advanced or metastatic NTRK fusion-positive solid tumours: Integrated analysis of three phase 1-2 trials. Lancet Oncol 21: 271-282, 2020.
28. Drilon A, Laetsch TW, Kummar S, DuBois SG, Lassen UN, Demetri GD, Nathenson M, Doebele RC, Farago AF, Pappo AS, *et al*: Efficacy of larotrectinib in TRK fusion-positive cancers in adults and children. N Engl J Med 378: 731-739, 2018.