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CASE REPORT

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# When to sweat: A history of chemotherapy in malignant sweat gland tumors. A unique case report and literature review

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**Abstract**

Sarcomatoid sweat gland carcinomas are rare among cutaneous cancers, with less than 20 cases described. A 54-year-old woman with sarcomatoid sweat gland carcinoma of the right upper extremity suffered extensive recurrence at 15 months, unresponsive to chemotherapy. There is no standard treatment or chemotherapy regimens for metastatic sweat gland carcinoma.

**KEYWORDS**

cutaneous adnexal cancer, sarcomatoid, sweat gland carcinoma

## 1 | BACKGROUND

Sarcomatoid sweat gland carcinomas are rare among cutaneous cancers, with less than 20 cases described. A 54-year-old woman with sarcomatoid sweat gland carcinoma of the right upper extremity suffered extensive recurrence at 15 months, unresponsive to chemotherapy. There is no standard treatment or chemotherapy regimens for metastatic sweat gland carcinoma.

Tumors arising from sweat glands, or cutaneous adnexal tumors, comprise a small number of cutaneous tumors. 0.005%–0.01% of all cutaneous tumors are eccrine porocarcinomas, the most common type of cutaneous adnexal tumor.[1] Sarcomatoid carcinoma is an exceedingly rare biphasic malignancy consisting of an epithelial, carcinomatous component and a mesenchymal, sarcomatous component.[2] It has been known through publication history by other names, including carcinosarcoma, metaplastic carcinoma, and malignant mixed tumor.[3] It arises more commonly from primary visceral sites such as the uterus, ovaries, breast, bladder, and lungs, and much less commonly as a primary skin lesion.[4] When it does occur as a primary skin lesion, its epithelial component most often occurs as an epidermal-derived carcinoma or skin adnexal carcinoma.[2,5,6] Epidermal-derived carcinomas are more common and include basal or squamous cell carcinomas which tend to occur on sun-exposed skin of the head and neck, involve older patients, and yield more favorable prognoses with 5-year survival of 70%.[2,5,6] Skin adnexal carcinomas are much rarer and include spiradenocarcinoma, malignant proliferating trichilemmal tumors/cysts, porocarcinomas, and pilomatrical carcinomas.[2,5,6] These lesions tend to involve younger patients, grow from long-standing tumor nodules over many years, and are associated with aggressive behavior and poorer prognosis with 5-year survival of 25%.[2,5,6]

Treatment for sarcomatoid carcinoma can vary depending on whether it is local or metastatic. Local disease is treated with wide local excision and Mohs micrographic surgery in several cases.[7] There is limited evidence on the efficacy of radiation in local disease.[7] Chemotherapy for metastatic sweat gland carcinoma are guided based on limited case reports. Even then, only modest responses have been shown.[7]

## 2 | CASE REPORT

A 54-year-old female presented with an ulcerating mass of the right medial upper arm and underwent biopsy at an outside hospital. Pathology revealed poorly differentiated carcinoma with foci of squamoid and glandular differentiation as well as sarcomatoid features. The mass had previously been slow growing and subcutaneous without overlying skin changes for 8 years. The patient was referred to our institution shortly after for a more comprehensive evaluation of her biopsy, and for re-excision of the lesion with more surgically appropriate margins. Upon presentation, a PET-CT showed a 1.9 cm soft tissue density of the right medial upper arm, but no distal metastatic disease or lymphadenopathy. She then underwent wide local excision of the mass which measured 2 × 1 cm with a 1.5 cm margin.

Formalin-fixed, paraffin-embedded tissue blocks from all cases were examined by H&E-stained sections and immunohistochemistry. Immunohistochemical stains were performed using the following commercially available antibodies: CK 5/6, CK7, CK20, CAM5.2, vimentin, S-100, S-100 red, p63, TTF-1, ER, PR, chromogranin, synaptophysin, glypican-3, Ki67 from Roche/Ventana; and Sox10, GATA-3, CEA, Napsin-A, Pax8, and IMP3 from Cell Marque. Appropriate positive and negative controls were used throughout the study.

Pathology revealed a biphasic malignant neoplasm consistent with sarcomatoid sweat gland carcinoma. The epithelial component contained glandular and squamoid epithelial cells with pleomorphic spindled myoepithelial cells. The margins were negative and there was no sentinel lymph node biopsy performed. H&E slides can be seen in Figure 1, taken from a portion of the same slides found in Figure S2, images A and B. Original excisional biopsy images can also be reviewed in Figure S1.

The patient returned for frequent MRI surveillance of the arm over the next 10 months which showed consistent enhancement of the surgical site, thought to be secondary to skin changes and less likely residual tumor.

Fifteen months after the initial resection, the patient presented to the emergency department twice. The first time was for abdominal pain thought to be dyspepsia, then several weeks later for chest pain and 12-pound weight loss over the previous month. Radiography with CT scan of chest, abdomen, and pelvis showed multiple new masses measuring up to 9 cm in size in the right and left lungs, as well as the right hilar and subcarinal areas. New masses measuring 1.2 and 2.2 cm in size were also, respectively, detected in the liver and pancreas. These masses are shown in Figure 2. Bronchoscopy with biopsy of the pulmonary masses revealed metastatic sarcomatoid sweat gland carcinoma. Pathologic images and descriptions can be found in Figures S3 and S4. The patient was to be referred for outpatient palliative radiation of the lung metastases.

However, several days later the patient presented again to the emergency department for dizziness, left sided weakness, right facial droop, bifrontal throbbing headache, and altered mental status. CT scan of the head showed a large right frontal lobe mass measuring 4.2 cm, associated vasogenic edema, petechial hemorrhage, leftward midline shift, and mild subfalcine herniation. The mass is shown in Figure 3. Patient underwent right frontal craniotomy for tumor resection with symptomatic relief and resolution of the above symptoms. Pathology was consistent with previous results. Pathology slides and descriptions can be seen in Figure S5.

Her condition continued to deteriorate over the next few weeks with the development of hypoxemic respiratory failure secondary to worsening pulmonary metastases. Next-generation sequencing did not reveal

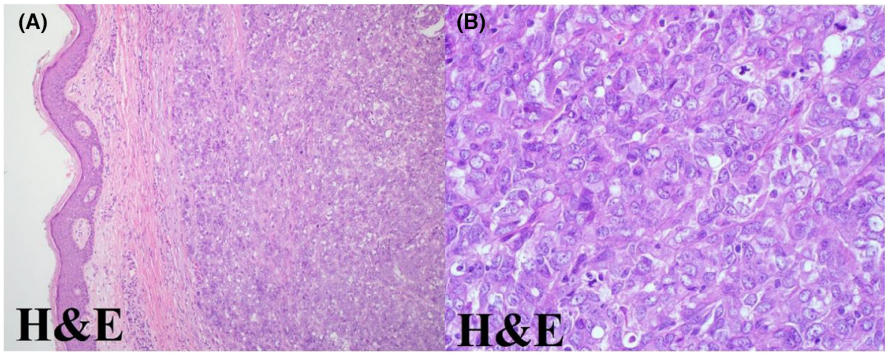


**FIGURE 1** Wide local excision of patient's right upper arm lesion reveals a large sheet of tumor cells encapsulated by a fibrous sheath on (H&E) at intermediate power (A). On H&E stain at high power (B), one population of tumor cells show enlarged, pleomorphic, vesicular nuclei with irregular contours, anisonucleosis, coarse clumped chromatin, and prominent nucleoli. The second population of tumor cells are spindle-shaped with hyperchromatic nuclei and can be seen scattered in smaller numbers between the squamoid cells. Mitotic figures can be seen in the background. (Please note Figure 1 is the same images from Figure S2 images (A and B), prepared by our pathology department).

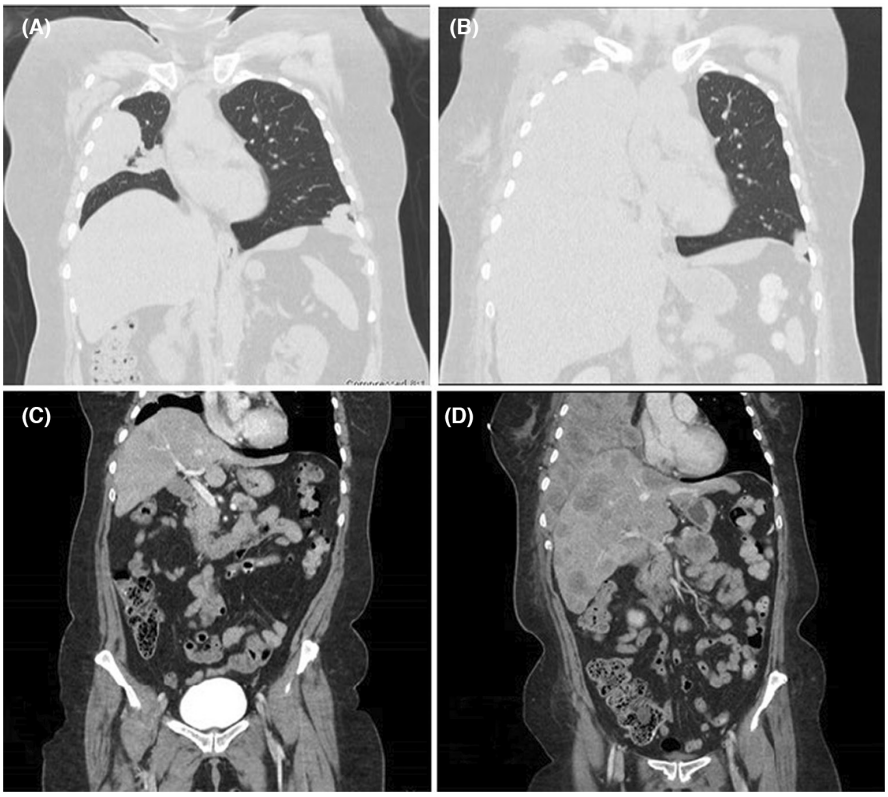


**FIGURE 2** CAT scans of thorax (A, B) and abdomen (C, D). Images (A) and (C) were taken at 15 months from diagnosis. Images (B) and (D) were taken at 17 months.

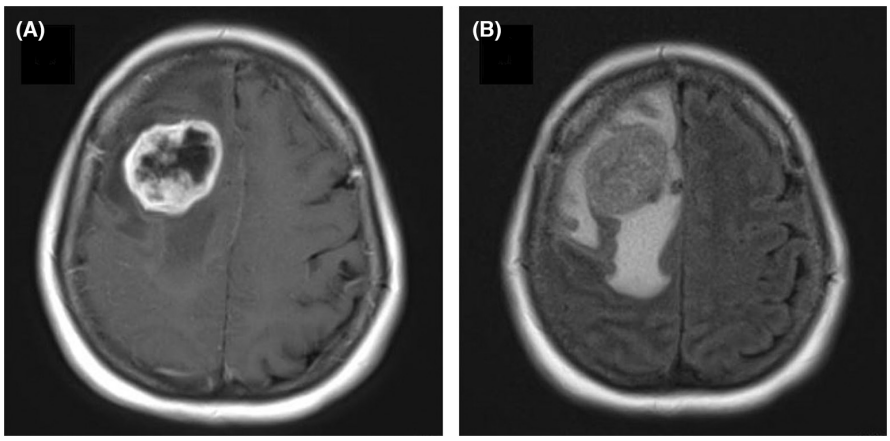


**FIGURE 3** MRI of the brain with metastatic lesion (A) and local edema (B) taken at 17 months.

targetable mutations, and ER and HER2 staining was negative. Without actionable mutations for targeted therapy, she received carboplatin and paclitaxel and was referred to radiation oncology for external beam radiation therapy of the pulmonary mass; however, the patient elected for best supportive care and expired.

## 3 | DISCUSSION

Here we present a case that was both diagnostically challenging from a pathological perspective as well as clinically challenging with no standard treatment. Cutaneous sarcomatoid carcinomas are diagnostically challenging in that they are a very rare entity that can be easily confused with other diseases. A poorly differentiated carcinomatous element may be missed if ductal or glandular structures that hint at an epithelial origin are poorly formed.[5,8] The sarcomatoid carcinoma can potentially be confused with a wide variety of tumors including squamous cell carcinoma, breast ductal carcinoma, other skin adnexal carcinomas, and a variety of other mixed tumors of the skin which is why staining is vital to a correct diagnosis.[5,8,9–13]

Metastases of cutaneous sarcomatoid carcinomas may consist predominantly or exclusively of the sarcomatous element, carcinomatous element, or both.[5,8] In our patient's case, the metastases to the lung and brain consisted predominantly of the sarcomatous population. This is in contrast to the primary cutaneous lesion in which the carcinomatous and sarcomatous populations were

**TABLE 1** Sarcomatoid Cases. Key: EPC eccrine porocarcinoma. NR: not reported. FU-fluorouracil.

| Case reference | Age, Gender | Site | Duration | Dx | Systemic Dx | Radiation | Chemo Regimen | Follow-up (months) | Outcome |
|---|---|---|---|---|---|---|---|---|---|
| Debska 1972[33] | NR | NR | NR | Sarcomatous Spiradenoma | Unknown | No | No | NR | NR |
| Debska 1972[33] | NR | NR | NR | Sarcomatous Spiradenoma | Brain, lung bone | No | NR | 11 | Death |
| Merrigi 1989[34] | NR | NR | NR | Sarcomatous Spiradenoma | Lung | No | NR | 2 | Death |
| McCluggage 1997[35] | 60 M | Perineum | 10 years | Sarcomatous Spiradenoma | Nodal, Lung | No | None | 3 | NR |
| Ishikawa 2001[36] | 37 F | Axilla | 20 years | Sarcomatous Spiradenoma | Nodes, lung, abdominal, brain | Yes | 5-FU, epirubicin, vincristine, carboplatin. Then cyclophosphamide, methotrexate and 5-FU | 7 | Death |
| Goh 2007[37] | 82 F | Chest | Many years | Sarcomatoid EPC | None | No | None | 2 | Alive |
| Goh 2007[37] | 74 F | Lower L Leg | Long-standing | Sarcomatoid EPC | None | No | None | 48 | Alive |
| Kazakov 2008[3] | 89 F | Buttock | NR | Sarcomatoid Apocrine Porocarcinoma | NR | NR | NR | NR | NR |
| Le 2016[13] | 84 F | Scalp | Several months | Biphasic Sarcomtaoid Porocarcinoma | None | No | None | 60 | Alive |
| Parra-Medina 2016[12] | 75 M | Right hallux | 29 months | Sarcomatoid EPC | None | No | None | NR | NR |
| Panse 2017[2] | 80 F | Right leg | NR | Sarcomatoid Porocarcinoma | None | No | None | NR | NR |
| Ponzetti 2017[6] | 58 M | Left parietal | 35 years | Sarcomatoid EPC | Diffuse | Yes | Cetuximab | 52 | Death |
| Val-Bernal 2019[5] | 42 M | Left laterocervical | 5 months | Sarcomatoid EPC | Nodes | No | None | 2 | Alive |
| Present | 54 F | R medial arm | 5 years | Sarcomatoid sweat gland carcinoma | Diffuse, brain | No | Paclitaxel +carboplatin | 1 | Death |

**TABLE 2** Regional and Lymph Nodal Disease. Key: ?: unspecified value. EPC eccrine porocarcinoma. NR: not reported. FUfluorouracil. IFN: interferon. IL: interleukin.

| Case reference | Age, Gender | Site | Duration | Diagnosis | Systemic Dx | Regional lymph node bx | Radiation | Chemo Regimen | Stains | Follow-up | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dummer 1992[38] | 74 M | Digit | 18 months | Eccrine Porocarcinoma | Cutaneous and lymph nodes | No | No | Recombinant IL2 and alfa-2b | | 20 weeks | Remission |
| Huet 1996[39] | 55 M | Scrotum | 4 years | EPC | lymph, cutaneous | No | Yes | IFN-alpha, isotretoin | | 9 months | Remission |
| Duke 2000[40] | 48 ? | Digit | NR | Digital Papillary | Lymph nodes | No | No | Adryamycin, dTIC | | 8 years | Remission |
| Chu 2001[41] | 64 M | Parotid | NR | Adenoid cystic | Nodes | Yes | Yes | None | | 2 years | Remission |
| Mirza 2002[29] | 70 M | Arm | 1 year | Spiroadenocarinoma | Nodes | No | No | Tamoxifen x 5 years | ER+ | 41 months | Remission |
| Ban 2003[42] | 63 M | Axilla | | MAC | Nodes | Yes | No | None | | 31 months | Remission |
| Gonzalez-Lopez 2003[43] | 71 M | Thigh | 2 years | EPC | Nodes and cutaneous | No | Yes | Isotretoin then tegafur | | 5.6 years | Remission |
| Brickhov 2004[44] | 72 M | R calf | 1 year | Sweat gland carcinoma | Nodes | No | No | None | | NR | NR |
| Gutermerth 2004[45] | 67 M | Neck | NR | EPC | Local nodes and cutaneous | No | No | Paclitaxel + interferon-alpha | | 15 months | Remission |
| Shroeder 2004[30] | 64 F | Scalp | 8 years | Ductal adenocarcinoma | Nodes, cutaneous, partotid | No | No | Tamoxifen | ER and PR+ | 3 years | Remission |
| Nash 2007[46] | 44 M | Chest | 8 years | Hiradenocarcinoma | nodes | No | Yes | Traztusumab | | NR | Remission |
| Shiohara 2007[47] | 64 M | Leg | 5 years | EPC | Nodes | No | Yes | Mitomycin, vincristine, epirubicin, cisplatin, 5-FU, pepleomycin | | 5 years | Death |
| Shiohara 2007[47] | 75 M | Leg | 20 years | EPC | None | No | No | Tegafur-uracil | | 2 years | Remission |
| Yamatashita 2008[48] | 61 M | Crus | 25 years | EPC | nodes | No | Yes | Cisplatin +5-FU | | 1 year | Remission |
| Perez-Garcia 2010[49] | 69 M | Lower Leg | unknown | EPC | Nodes | No | No | Cisplatin + docletaxel induction | | 12 months | Remission |
| Marone 2011[50] | 42 M | Arm | NR | EPC | Cutaneous and lymph nodes | No | No | Bleomycin via electrochemotherapy | | 5 months | Remission |
| Guerro-Ramos 2013[51] | 73 M | Nose | 8 months | EPC | Nodes | No | No | None | | 12 months | Remission |
| Rocas 2014[52] | 47 F | Breast | 25 years | Adenoid cystic carcinoma | Nodes | No | Yes | None | | 9 months | Remission |
| Joseph 2015[53] | 56 M | Abdomen and Chest | NR | EPC | Nodes, cutaneous | No | No | Doxorubicin, mitomycin, vincristine, and 5-fluorouracil (5-FU) alternating with cisplatin and bleomycin then paclitaxel +carboplatin | | 14 months | Death |
| Otuska 2016[28] | 50 M | Axilla | NR | Apocrine adenocarcinoma | Local nodes and cutaneous | Yes | Yes | Traztusumab + pertuzemab + docetaxel | HER2+ | 11 months | Remission |
| Hibler 2017[31] | 60 M | Scalp | Many years | Apocrine adenocarcinoma | Nodes | No | Yes | Cisplatin + paclitaxel | ER and PR+ | 16 months | Remission |
| Velugals 2012[27] | 59 F | Arm | 3 years | EPC | Noes | Yes | Yes | None | | 6 months | Remission |
| Zeidan 2010[54] | 76 M | Scalp | Years | EPC | Parotid | No | Yes | None | | 10 months | Remission |

**TABLE 3** Widespread Metastatic Disease. Key: ?: unspecified value. EPC eccrine porocarcinoma. NR: not reported. FUfluorouracil. IFN: interferon. IL: interleukin. ER: estrogen receptor. PR: progesterone receptor. HER2: human epidermal growth factor receptor 2.

| Case Reference | Age, Gender | Site | Duration | Diagnosis | Follow-up | Systemic Dx | Radiation | Chemo Regimen | Stains | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|
| Briscoe 1978[23] | 60 M | R toe | 2 years | Eccrine porocarcinoma | 15 months | Diffuse cutaneous, lymph | None | Fluorouracil and melphalan w/ limb hyperthermia, maintenance chemo with flurouracil and cyclophosphamide | | Remision |
| Coonley 1985[24] | 20 cases | | | Sweat gland carcinoma | | | 8% | 17 patients, various agents, avg 10 month survival | | |
| Piedbois 1987[25] | 45 F | L labia majora | NR | Sweat gland carcinoma | 50 months | Diffuse | none | Doxorubicin, mitomycin, vincristine, 5-fluorouracil q4 weeks in rotation with cisplatin and bleomycin- 9 cycles | | Initial remission, then death |
| Swanson 1989[26] | 78 M | L forearm | NR | EPC | 3 months | Nodes, mediastinum | Yes | 5- FU | | Death |
| Bellman 1995[55] | 68 M | Eyelid | 10 years | Poorly differentiated sweat gland carcinoma | 2 years | Skin, bone marrow | No | 5-FU × 15 cycles | | Death |
| Tay 1997[56] | 72 F | Shin | 50 years | Spiroadenocarinoma | 20 months | Nodes, bone, lung | Yes | Hyperthermic melphalan, 5-FU | | Death |
| Muraki 1997[57] | 83 M | Penile Shaft | NR | EPC | 4 months | Diffuse | No | Methotrexate, cisplatin, adriamycin, and bleomycin | | Death |
| Sigal 1996[58] | 54 F | Scalp | 9 years | EPC | 2.5 years | Diffuse | Yes | VP-16 + cisplatin then interferon and roaccutane | | Death |
| Grimme 1999[59] | 47 M | Scalp | 6 weeks | EPC | 4 weeks | Diffuse | Yes | Bleomycin, 5-FU then IL2, carboplatin | | Death |
| Biondi 2000[60] | 52 M | Mandibular region | NR | EPC | 5 months | Diffuse | No | Cisplatin, doxirubicin and cyclophosphamide | | Death |
| Duke 2000[40] | 38? | Digit | NR | Digital Papillary | 9 years | Lung | No | Etoposide + Cisplatin, then adriamycin | | Remission |
| Duke 2000[40] | 58? | Digit | NR | Digital Papillary | 4 years | Axillary and Lung | No | Etoposide cisplatin | | Death |
| Plunkett 2001[61] | 45 F | Shoulder | 3 years | EPC | 5 months | Nodes, bone, lung | Yes | Epirubicin- no improvement, then docetaxel x12 cycles | | Remission |
| Goel 2003[62] | 40 M | Foot | NR | EPC | 10 months | Diffuse | Yes | Interferon alfa, isotretoin, carboplatin, taxol, vincristine, and irinotecan | | Death |
| Chou 2004[63] | 50 M | Thigh | 30 years | Eccrine spiradenoma | 4 months | Nodes, pulm | No | Epirubicin and ifosimide | | Death |
| deBree 2004[64] | 69 M | L leg | 15 years | EPC | 25 months | Local, lung, lymph | No | Topical 5-FU + docetaxel | | Remission |
| Nishizawa 2006[65] | 65 M | Abdomen | 20 years | Syringoid eccrine carcinoma | 6 months | Nodes, lung, ileum | No | 5-fluorouracil, epirubicin, mitomycin C, vincristine, carboplatin | | Stable Disease |
| Kim 2007[66] | 42 M | Palm | NR | EPC | 8 years | diffuse | Yes- palliative | Cyclophosphamide, cisplatin, and doxorubicin | | Death |
| Shiohara 2007[47] | 62 F | Scalp | 3.5 years | EPC | 2 years | lung, brain, bone | Yes | Cisplatin, adriamycin, VDS | | Death |
| Shiohara 2007[47] | 81 F | Buttock | 1 year | EPC | 3.8 years | Nodes, bone | No | Cisplatin, 5-FU | | Death |
| Ishida 2009[67] | 72 M | Thigh | 3 years | EPC | 8 months | nodes, liver, bone | No | Carboplatin + farmarubicin | | Death |
| Yi 2010[68] | 63 F | Thigh | NR | Trichilemmal carcinoma | 7 months | Nodes, lung, bone | No | Cisplatin +cyclophosphamide | | Death |

**TABLE 3** (Continued)

| Case Reference | Age, Gender | Site | Duration | Diagnosis | Follow-up | Systemic Dx | Radiation | Chemo Regimen | Stains | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|
| Hidaka 2012[69] | 62 M | Scalp | 3 years | Cutaneous apocine carcinoma | 6 months | Lymph and liver | Yes | Cisplatin +5-FU, then traztusumab-initial remission, then lapatinib and capecitabine | | Remission |
| Kurashige 2013[70] | 50 M | Arm | 6 months | Eccrine porocarcinoma | 8 months | Diffuse | Yes | Docetaxel + cisplatin | | Death |
| Arslan 2014[71] | 76 M | Scalp | NR | Pilomatrix Carcinoma | 6 months | Nodes, Lung | No | Cyclophosphamide +etoposide x6 | | Remission |
| Miller 2015[32] | 32 M | Axilla | 2 years | Apocrine Hiradenocarcinoma | 18 months | Diffuse | Yes x 2 | Carboplatin+ paclitaxel + Tamoxifen, then vismodegib and anti-LAG3 monoclonal ab | ER and PR+ | Remission |
| Brown 2016[14] | 54 M | Scalp | Many years | Cutaneous adnexal carcinoma | 43 months | Skin, nodes, parotid | Yes | Carboplatin, paclitaxel, traztusumab | HER2+ | Remission |
| Mandilaya 2016[15] | 66 F | Forearm | NR | EPC | unknown | Nodes, cutaneous and lung | Yes x 2 | Cisplatin and docetaxel | | Disease Free |
| Godillot 2017[16] | 64 F | Pubic Region | NR | EPC | 6 months | Lymph nodes, lung, bone, uterus | Yes | Cetuximab + paclitaxel | | Death |
| Larson 2018[17] | 66 F | Calf | NR | EPC | 12 months | diffuse | Yes | Melphalan and actinomycin D and hyperthermia, then paclitaxel and carboplatin, then Capecitabine | HER2+ | Death |
| Khaja 2019[18] | 67 M | Scalp | 4 months | EPC | 4.5 years | Nodes, cutaneous, ear | No | Docletaxel + carboplatin | | Death |
| Fernandez-Ferrara 2020[19] | 67 M | Intergluteal | NR | EPC | NR | Nodes and lung | No | Etoposide, vincristine, carboplatin. | | NR |
| Gupta 2020[20] | 75 F | Scalp | NR | Eccrine porocarcinoma + chondroid syringoma | 39 months | Brain, bone | 1 × treatment, 1 × palliative | Paclitaxel + carboplatin, then pembrolizumab palliative | | Death |
| Gupta 2020[20] | 79 M | Cheek | NR | Poorly differentiated eccrine carcinoma | 19 months | Bone, diffuse abdomen and chest | 2 treatments | Doclitaxel | | Death |

of comparable proportions. This finding may signify that sweat gland carcinomas with sarcomatous components may become more aggressive or metastasize more easily.[5,8] In our patient's case, the metastasis occurred and spread very rapidly.

Our decision to treat the patient with palliative carboplatin and paclitaxel was based on several previous cases receiving a combination of platinum-based and taxol chemotherapy.[14–20] Given the rarity of this case, we wanted to perform an extensive literature search to compare treatments of previous cases.

At first our literature search included only sweat gland tumors with sarcomatoid differentiation. However, this yielded minimal results as cases number less than 20 and many had local disease only. We widened our search to all malignant sweat gland tumors to grasp a better understanding of treatment outcomes. Key words included "malignant sweat gland carcinoma" which yielded 25 relevant articles out of 214 in total. We excluded articles pertaining to the breast or vaginal ductal carcinoma. Another literature search with keywords "metastatic sweat gland carcinoma" yielded 16 results, 7 of which were relevant. Six articles were excluded due to foreign language text. Given the variety in nomenclature of sweat gland carcinomas, references of included articles were used to identify many additional case reports dating back to the 1960s.

In our literature review, we found 15 distinct cases of specifically spindle cell sarcomatoid differentiation in various sweat gland tumors. However, this number is given with a degree of uncertainty due to the lack of consistent nomenclature in the literature. These are outlined in Table 1. Three additional cases were noted in Robson et al.; however, it is unclear if these overlap with previous cases as no source was tied to these in their review.[1] Patel et al. and McKee et al. described sweat gland tumors with mesenchymal elements that were non spindle cell and were therefore not included in Table 1.[21,22]

Cases with local spread and lymph nodal disease are outlined in Table 2. Cases with diffuse metastatic disease are outlined in Table 3. As many cases as possible were included, but given the variety in nomenclature of sweat gland carcinomas, the tables are not exhaustive, but represent a majority.

Much of the early literature describes metastatic sweat gland carcinoma as both radio and chemoresistant, with poor prognosis.[23–26] Most data on prognosticating factors and mortality comes from eccrine porocarcinomas (EPC) as the most common sweat gland tumor. The most recent meta-analysis of 116 cases of EPC by Le et al. found negative prognosticating factors to include: ulceration, high mitotic activity, absence of surgery, use of chemotherapy, and distant metastasis.[7] The 1-year overall survival rate was 93.0% versus 3 year of 70.3%.[7] Patients with a positive lymph node status had a mortality rate of 39.1% versus 11.4% in those without.[7] Those with distant metastases had a 1-year survival rate of 42.9% and 3-year overall survival of 0% versus >90% for both without metastasis.[7]

For nonmetastatic disease, most reports described wide local excision as the surgical choice. There is one report describing Mohs surgery, but there is no formal comparison of the two different surgical techniques and outcomes.[27] Neoadjuvant chemotherapy prior to excision has been reported once.[28] Very few cases performed initial sentinel lymph node biopsies as there has been no clear evidence of a mortality benefit; however, it is worth noting that this has also not been specifically studied.[27]

There were seven cases that had some combination of ER, PR, or HER2 positivity, five of which used more targeted therapy with either traztusumab or tamoxifen. All of these five cases achieved remission at the end of designated time points.[14,17,28–32]

In conclusion, we have described the clinical and pathologic features of sweat gland carcinoma, particularly those with a spindle cell sarcomatous element. Sarcomatous sweat gland carcinomas are rare entities with less than 20 cases on literature review. The sarcomatous elements seem to increase with metastasis. Metastatic survival rates are poor, cited as low as 39.5% three-year overall survival.[7] These statistics are also limited to eccrine porocarcinoma, as other subytpes are more rare. There are no standard guidelines for type of surgical excision, the use of sentinel lymph node biopsy, radiotherapy, or chemotherapy regimen.[7] Given the success of endocrine or HER2-targeted therapy in four cases, checking all tumors for ER, PR, and HER2 positivity could provide treatment options withlower risks of toxicity.[29] Overall, there are many opportunities for further research into the treatment of metastatic sweat gland tumors of all subtypes, particularly those with sarcomatous elements.

## AUTHOR CONTRIBUTIONS

**Jessica Matthiesen:** Conceptualization; data curation; formal analysis; writing – original draft; writing – review and editing. **Richard Chiu:** Conceptualization; data curation; writing – original draft. **Tiffanie Do:** Conceptualization; writing – review and editing. **Sepideh Bamdad:** Writing – review and editing. **Jennifer Lee:** Resources; supervision; writing – review and editing. **Shi-Kaung Peng:** Resources; supervision; writing – review and editing.

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None.

## CONFLICTS OF INTEREST STATEMENT

The authors of this manuscript have no conflicts to disclose.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Clinical Case Reports at http://doi.org/10/1002/ccr3.7182. (Data openly available in a public repository that issues datasets with DOIs).

## 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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