

Correlation of Radiographic and Pathologic Findings of Dermal Lymphatic Invasion in Head and Neck Squamous Cell Carcinoma

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ABSTRACT

Objectives: Patients with head and neck squamous cell carcinoma have a poor prognosis when regional or distant metastasis is present. Primary tumor characteristics such as perineural and angiolymphatic invasion also portend a poor prognosis. Squamous cell carcinoma that involves the skin has access to the dermal lymphatic system and although invasion into the dermal lymphatics has not been well studied in head and neck cancer, it is considered to have negative prognostic significance. Currently there is no way to identify patients with dermal lymphatic invasion preoperatively. The purpose of this study is to correlate CT scan findings of patients with head and neck squamous cell carcinoma with their respective dermatopathology to determine if dermal lymphatic invasion can be predicted before surgery.

Study design: Retrospective, case series

Methods: Medical records were reviewed of patients with head and neck squamous cell carcinoma who underwent surgery at our institution and who had skin resected as part of their primary treatment. Their respective CT scans were also reviewed to determine if findings suggesting dermal lymphatic invasion, defined as linear reticulations of the dermis and subcutaneous fat adjacent to the tumor was present. Finally, the pathology slides of these patients were reviewed.

Results: Fourteen patients were identified who had skin resected at the time of surgery and whose preoperative CT scans suggested dermal lymphatic invasion. The corresponding pathology slides showed only one of the fourteen patients had dermal lymphatic invasion.

Conclusions: Dermal lymphatic invasion affords a poor prognosis in patients with head and neck squamous cell carcinoma, although CT scan is not specific at detecting this finding. Further research is needed into detecting dermal lymphatic invasion and to determine prognostic significance.

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INTRODUCTION

Head and neck cancer is the fifth most common cancer in the world with more than 600,000 cases diagnosed each year.¹ The identification of clinicopathologic prognostic factors in head and neck cancer is one of the most important tools a clinician has to determine appropriate management and to properly counsel patients regarding outcomes. Probably the most significant prognostic factor is regional or distant metastasis. The presence of regional nodal spread reduces overall survival by nearly half² and distant metastasis greatly reduces survival with extremely low cure rates.

Primary tumor characteristics such as perineural spread and infiltrating borders are associated with a less favorable prognosis.³ Other factors such as invasion into cartilage, bone, the carotid artery or adjacent angiolymphatic structures have also been associated with a poor prognosis. Dermal lymphatic invasion has been studied extensively in breast cancer as a poor prognostic factor,^{4,5} and although invasion into the dermal lymphatics has not been well studied in head and neck squamous cell carcinoma, it is considered to have negative prognostic significance.⁶

Pre-treatment imaging studies are useful to more accurately stage patients and ultimately determine prognosis. Not uncommonly, computed tomography (CT) findings lead to upstaging of the disease, which may change treatment and outcome. Dermal lymphatic invasion is sometimes suspected on preoperative imaging but has not yet been correlated with pathologic findings in head and neck squamous cell carcinoma. The purpose of this study is to correlate CT scan findings of patients with head and neck squamous cell carcinoma with their respective dermatopathology to determine if dermal lymphatic invasion can be predicted before surgery.

METHODS AND MATERIALS

We assembled a retrospective case series of patients who underwent surgical treatment for pathologically confirmed squamous cell carcinoma of the head and neck. Patients were identified through the University of Michigan's Pathology Department database searching under "squamous cell carcinoma" and "skin." Additional inclusion criteria included a preoperative CT scan with findings suggestive of dermal lymphatic invasion, a pathologic specimen with skin resected and the availability of the pathology slides for review. The Institutional Review Board at the University of Michigan (HUM00032082) approved this study.

Evidence of dermal lymphatic invasion on CT scan was defined as linear reticulations of the dermis and subcutaneous fat adjacent to the tumor. Evidence of dermal lymphatic invasion on dermatopathology was defined as tumor cells that invaded a dermal lymphatic vessel adjacent to the primary tumor identified under light microscopy with routine staining.

RESULTS

Fourteen patients were identified with head and neck squamous cell carcinoma who had skin resected at the time of surgery and whose preoperative CT scans suggested dermal lymphatic invasion. Patient characteristics are presented in **Table 1**. Four patients had primary tumors of the nasal cavity/paranasal sinuses, four had primary tumors of the oral cavity, four had primary tumors that were cutaneous in origin, and two patients had neck metastasis that required skin excision during resection. 11/14 patients had T4 tumors and 7/14 developed regional metastasis.

The corresponding pathology slides showed only one of the fourteen patients had dermal lymphatic invasion. **Figures 1 and 2** show a low and high power view (respectively) of the primary tumor and invasion into the dermal lymphatics. The corresponding CT images are shown in **Figures 3 and 4**, where there are linear reticulations in the dermis and subcutaneous tissue demonstrating the tumor's invasion into the dermal lymphatics.

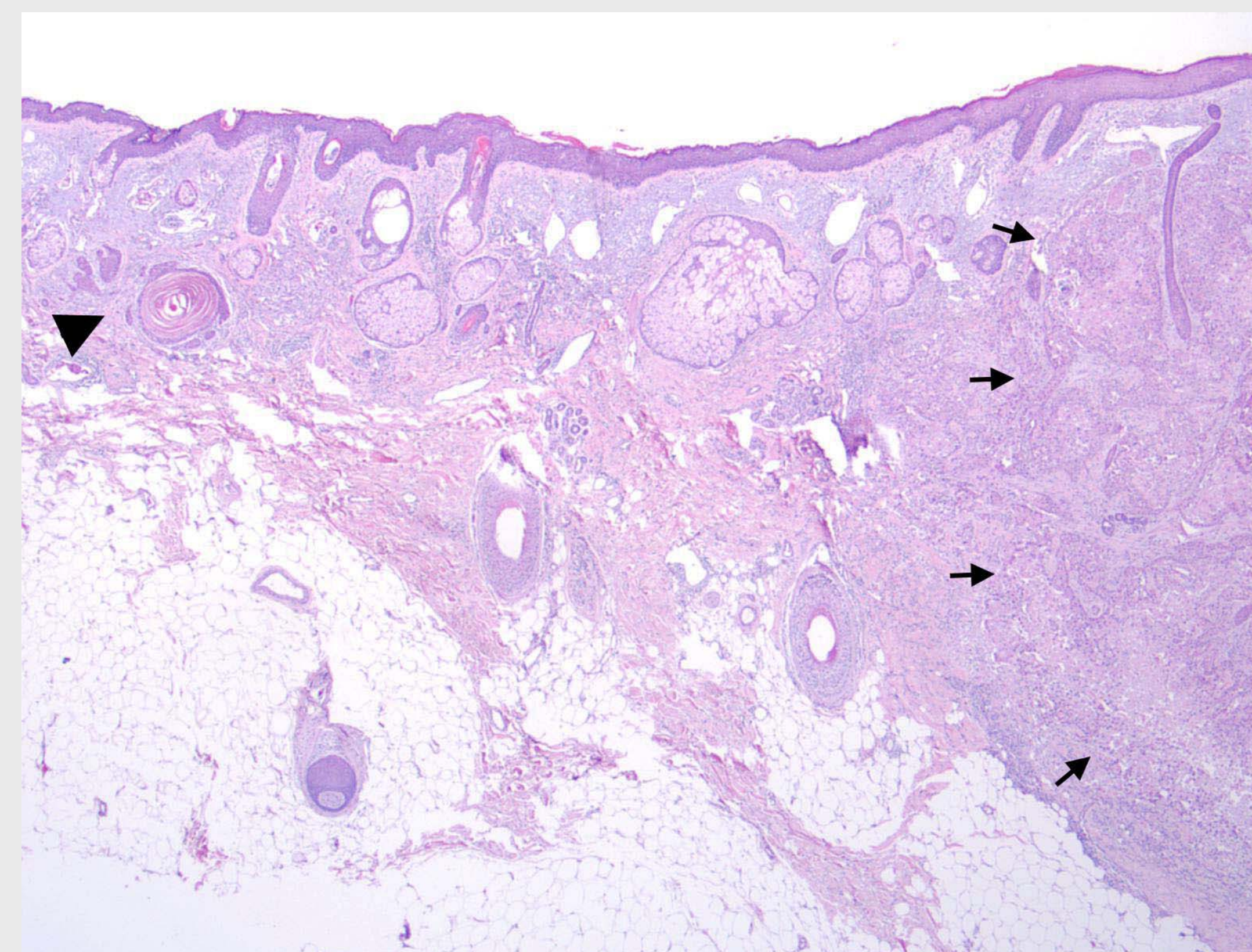


Figure 1. Low power image (4x) of a primary tumor (arrows) invading into the dermal lymphatics (arrowhead)

DISCUSSION

Correlation of pathologic findings is extremely important to confirm precise staging and guide appropriate treatment. This study shows poor correlation of dermal lymphatic invasion as suggested by preoperative CT scans compared with histopathologic specimens in head and neck squamous cell carcinoma.

Comparison of radiographic staging to pathologic staging has been well described in the literature for other risk factors with prognostic significance. Becker et al. prospectively identified patients with laryngeal carcinoma and compared pathologic specimens with preoperative CT and MRI findings to determine if they could predict invasion into the laryngeal cartilage.⁷ They found MRI to be extremely sensitive but not specific when compared to CT for cartilage invasion. This lack of specificity was thought to be due to non-neoplastic inflammatory changes seen on imaging that have a similar appearance to tumor spread. This likely explains our findings, as reticulation of the dermis and subcutaneous fat seen in our patient series is not specific for peri-tumoral spread. While only one of our cases showed dermal lymphatic invasion adjacent to the primary tumor, all specimens showed patchy chronic inflammation with associated edema and fibrosis adjacent to the tumor. We hypothesize that these non-specific reactive changes may have caused the changes on CT scans that mimicked dermal lymphatic invasion.

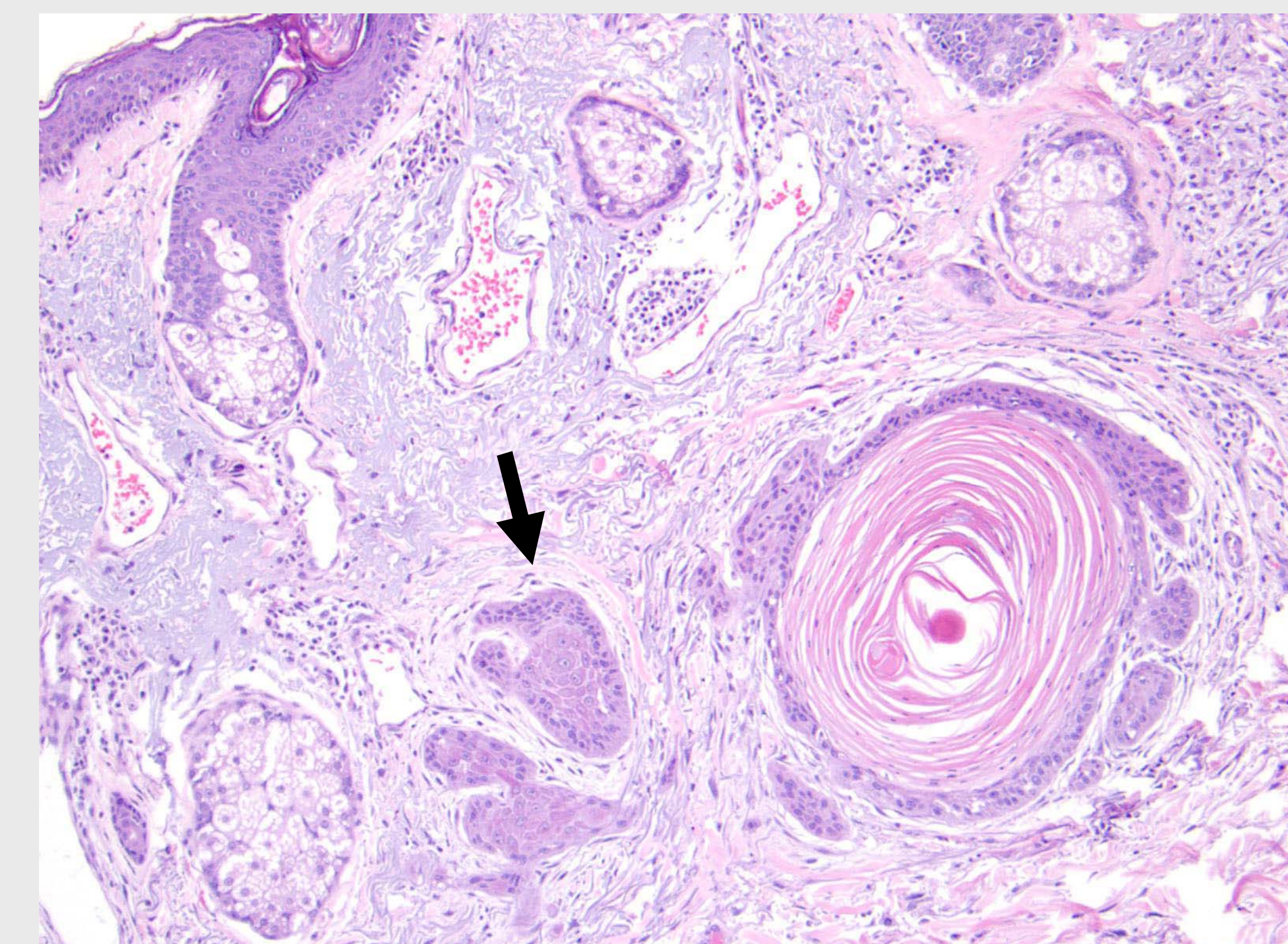


Figure 2. Higher power image (10x) of dermal lymphatic invasion (arrow)

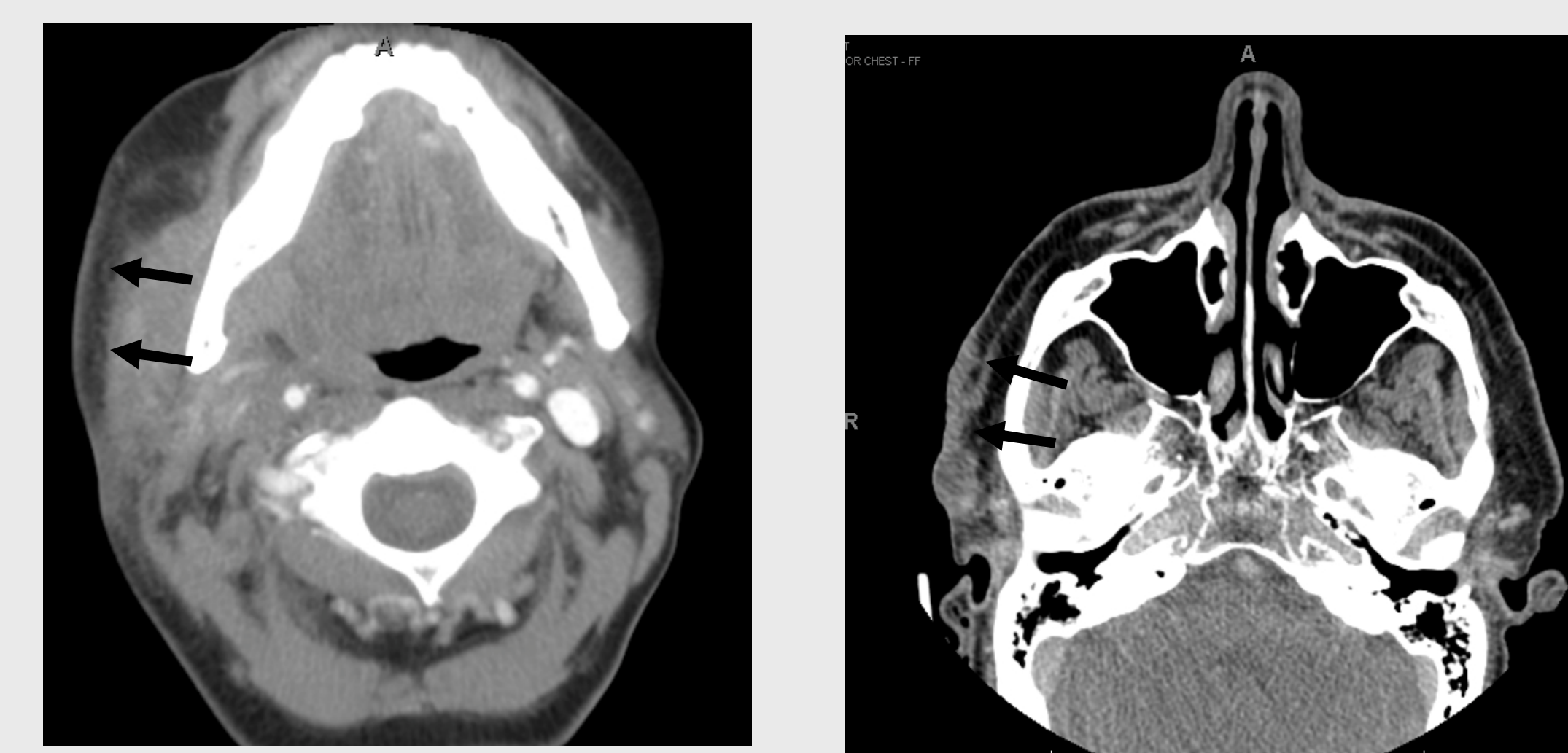


Figure 3 and 4. CT scans showing linear reticulations of the dermis and subcutaneous fat (arrows) adjacent to the tumor suggesting dermal lymphatic invasion

CONCLUSIONS

Dermal lymphatic invasion affords a poor prognosis in patients with head and neck cancer, although CT scan is poor at detecting this finding. Further research is needed into detecting dermal lymphatic invasion and to determine prognostic significance.

REFERENCES

- Parkin DM, Whelan SL, Ferlay J, Storm H. *Cancer Incidence in Five Continents*. Vol. VIII. Lyon International Agency for Research on Cancer, 2005.
- Snow GB, Annys AA, van Slooten EA, Bartelink H, Hart AA. Prognostic factors of neck node metastasis. *Clin Otolaryngol Allied Sci*. 1982 Jun;7(3):185-92.
- Brandwein-Gensler M, Teixeira MS, Lewis CM, Lee B, Roinitzky L, Hillie JJ, Genden E, Urken ML, Wang BY. Oral squamous cell carcinoma: histologic risk assessment, but not margin status, is strongly predictive of local disease-free and overall survival. *Am J Surg Pathol*. 2005 Feb;29(2):167-78.
- Abramowitz MC, Li T, Morrow M, Sigurdson ER, Anderson P, Nicolaou N, Freedman G. Dermal lymphatic invasion and inflammatory breast cancer are independent predictors of outcome after postmastectomy radiation. *Am J Clin Oncol*. 2009 Feb;32(1):30-3.
- Gruber G, Cirilo M, Altermatt HJ, Aebi S, Berclaz G, Greiner RH. Prognosis of dermal lymphatic invasion with or without clinical signs of inflammatory breast cancer. *Int J Cancer*. 2004 Mar;109(1):144-8.
- Ch'ng S, Maitra A, Lea R, Brasch H, Tan ST. Parotid metastasis - An independent prognostic factor for head and neck cutaneous squamous cell carcinoma. *Journal of Plastic, Reconstructive & Aesthetic Surgery* (2006) 59, 1288e1293
- Becker M, Zbaren P, Laeng H, Stoupis C, Porcellini B, Vock P. Neoplastic invasion of the laryngeal cartilage: comparison of MR imaging and CT with histopathologic correlation. *Radiology*. 1995 Mar;194(3):661-9.

Case #	Tumor site	Tumor subsite	T Stage	N Stage	M Stage	Overall Stage	Dermal Lymph. Inv.
1	NC/PS	Lateral Nasal Wall	T4	N2C	M0	4	No
2	NC/PS	Maxillary Sinus	T4	N0	M0	4	No
3	NC/PS	Maxillary Sinus	T4	N0	M0	4	No
4	NC/PS	Ethmoid Sinus	T4	N0	M0	4	No
5	CUT	Cheek and Temple	T4	N0	M0	3	No
6	CUT	Auricle	T4	N1	M0	3	No
7	CUT	Forehead	T4	N0	M0	3	No
8	CUT	Preauricular region	T4	N1	M0	3	Yes
9	OC	Floor of Mouth	T4	N2A	M0	4	No
10	OC	Alveolar ridge	T3	N0	M0	3	No
11	OC	Alveolar ridge	T4	N0	M0	4	No
12	OC	Lower lip	T4	N2C	M0	4	No
13	LN	Left Neck	TX	N2A	M0	4	No
14	LN	Right Neck	T1	N2B	M0	4	No

Table 1: Tumor Site and Subsite, Stage, and Evidence of Dermal Lymphatic Invasion