Perineural Spread of Cutaneous Head and Neck Malignancies: Imaging Manifestations and Therapeutic Management

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Objectives

The key objectives of this study are to identify critical radiographic features of perineural invasion (PNI) and perineural spread (PNS) and their implications regarding therapeutic treatment.

Introduction

Skin cancer is the most common cancer occurring in the United States, with 80% occurring in the head and neck.1 Perineural involvement is associated with more aggressive tumors and poor survival rates.2,3 Patients with perineural invasion (PNI) have a nearly three-fold increase in rate of locoregional recurrence and decreased five-year survival rates of approximately 30% to 40%. Because PNI can be clinically silent, adequate radiographic assessment with clinical attention to the potential neural pathways for possible perineural involvement is essential.

In perineural spread (PNS), cutaneous carcinomas extend along the endo- or perineurium of the nerve, and this may be identified radiographically prior to development of clinical symptoms.4,5 The important radiographic features include loss of fat planes surrounding the nerve, nerve enhancement and thickening, and neural foramina widening.4 Recognition of PNI and PNS is crucial for surgical mapping, radiation port planning, and determining feasibility of surgical resection.

Methods

This study retrospectively reviewed 50 patients with cutaneous head and neck malignancies over the past three years with 14 of these patients meeting inclusion criteria. These criteria included histopathologically proven PNI in head and neck skin cancer patients with preoperative MR, CT, or PET/CT scans. Images were assessed as to whether findings of PNI in perineural nerve branches, including loss of the adjacent fat planes and thickening and enhancement of the nerve along its course or associated foramina. In addition, primary tumor location in proximity to the expected cutaneous course of the associated nerve was assessed. All CT, MRI, and PET/CT scans were correlated with multiplanar views, which were cross referenced with each other.

Results

Fifteen of the 100 patients met inclusion criteria. Four patients were female and ten were male, with a mean age of 61 years. Primary malignancy sites were: left ear = 3, right cheek = 1, left cheek/orbit = 2, right ear/cheek = 1, left eyelid = 1, left lower lip = 2, right nose = 1, left nose = 1, bilateral scalp = 2, left temple = 1. Histologically, eleven patients exhibited squamous cell carcinoma and three patients had basal cell carcinoma. Radiographically, 10 patients had MRIs, 5 had CTs, and 2 had PET/CTs. Four of the patients had multiple radiographic studies.

When reviewing preoperative radiological reports, only two reports specifically identified PNS (14.3%). This was noted on a CT temporal bone of a basal cell carcinoma with squamous differentiation of the left ear with involvement of the bone and extension to V3, and MRI of a squamous cell carcinoma of the right cheek extending to V2 and V3. (Figures 3 and 4.) However, 12 of the 14 preoperative radiology reports (85.7%) for patients with histologically proved PNI did not address PNS in the report.

When the films were retrospectively analyzed, independently of the reports, 13 of 14 films (92.9%) were noted as potentially exhibiting PNI, radiographic determination of PNS could not be identified even on retrospective review. In five patients, PNS was identified in multiple cutaneous neural branches on careful retrospective radiographic review. More specifically, careful attention must be paid to the nerves and neurovascular bundles in the proximity of the cutaneous head and neck carcinomas.

Discussion

In this study, evidence of PNS was identified in 92.9% of the films when identification of the adjacent cutaneous neural pathway was assessed retrospectively. Patients with multiple neural involvement were also noted predominantly in the temporal and auricular region.

If PNI is identified early, multimodality treatment, including surgery, radiation and chemotherapy may be administered. However, surgical options may not be available for patients with late or missed diagnoses if the tumor extends beyond skull base foramina and in addition, if the tumor was inadequately treated, the tumor may recur along the neural pathways requiring possible additional treatment, including postoperative radiation therapy.

Our data indicate that a heightened awareness of PNI and PNS is crucial for surgical mapping, radiation port planning, and determining feasibility of surgical resection.

Conclusions

Cutaneous malignancies of the head and neck may exhibit asymptomatic PNI and PNS. This important preoperative finding was noted prospectively in only 14.0% of patients, but in 92.9% of patients retrospectively and in multiple neural pathways retrospectively. Therefore, an awareness of the cutaneous neural pathways and the radiographic appearance of PNS are essential for guiding both surgical and adjuvant treatment planning and have significant prognostic implications for morbidity and mortality.

References