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Obliteration of Fat Planes by Perineural Spread of Squamous Cell Carcinoma along the Inferior Alveolar Nerve

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Summary: Squamous cell carcinoma showed perineural spread along the inferior alveolar nerve. Key CT features of this spread were foramen enlargement, resurfacing of tumor, and asymmetry of fat spaces.

Index terms: Carcinoma; Fat, computed tomography; Mandible; Mouth, computed tomography; Nerves, neoplasms

Although perineural spread has been described with various head and neck tumors and along various cranial nerves (1–4), the computed tomographic (CT) evaluation of a squamous cell carcinoma spreading along the inferior alveolar nerve is unusual. CT, by demonstrating the obliteration of fat planes at the entrance to the mandibular canal, can indicate perineural extension and subsequent local recurrence not directly contiguous with the original primary tumor.

Case Report

A 59-year-old man initially presented elsewhere with a 3 × 4-cm squamous cell carcinoma of the lower lip in December 1989. After being treated with radiation, he returned in May 1990 with a 0.5 × 1.0-cm residual ulcer. Surgical treatment was offered, but he was lost to follow-up because of other medical problems. He was referred to our institution in February 1991 with a 4.5-cm full-thickness lesion of the lower lip extending into the gingivobuccal sulcus with fixation to the anterior mandible. A CT scan at that time showed a lower-lip soft-tissue mass extending across the midline without bone destruction (Fig 1A). Submandibular adenopathy was also demonstrated. Biopsy confirmed a moderately differentiated squamous cell carcinoma, and in March 1991, a resection was performed with negative margins.

In October 1991, the patient returned with pain in the left mandibular ramus radiating to the eye and forehead. A CT scan revealed bone destruction of the left mandible.

Additionally, and only noted in retrospect, was obliteration of the fat pad of the mandibular canal along the course of the inferior alveolar nerve (Figs 1B and C). Because only mandibular destruction was noted on the October scan, treatment consisted of a segmental mandibulectomy with reconstruction.

In December 1991, the patient noted left facial numbness and left trigeminal neuralgia. A CT scan revealed a large tumor in the left masticator space with extension cephalad to the skull base, enlargement of foramen ovale (Figs 1D and E), and extension into the posterior cavernous sinus. At that time, retrospective review of the October scan showed obliteration of the fat at the entrance to the mandibular canal. This finding indicated that the tumor recurrence was caused by progression of the previously undetected perineural tumor spread along the inferior alveolar nerve.

Discussion

The trigeminal nerve has sensory and motor divisions (Fig 2). The sensory division, after forming the Gasserian ganglion in Meckel's cave, divides into three branches. The third division, the mandibular nerve, travels with the motor division through foramen ovale to enter the infratemporal fossa. Immediately below the foramen ovale, the mandibular nerve and motor division form a common trunk. The inferior alveolar nerve enters the mandibular foramen in the ramus of the mandible, travels in the mandibular canal, and emerges at the mental foramen, providing sensory innervation of the lower lip, chin, and lower teeth.

Because perineural invasion causes nerve enlargement in the area of the foramen, the foramen may show concentric enlargement or, eventually, bone destruction. Foramen enlargement is a key feature of perineural invasion and

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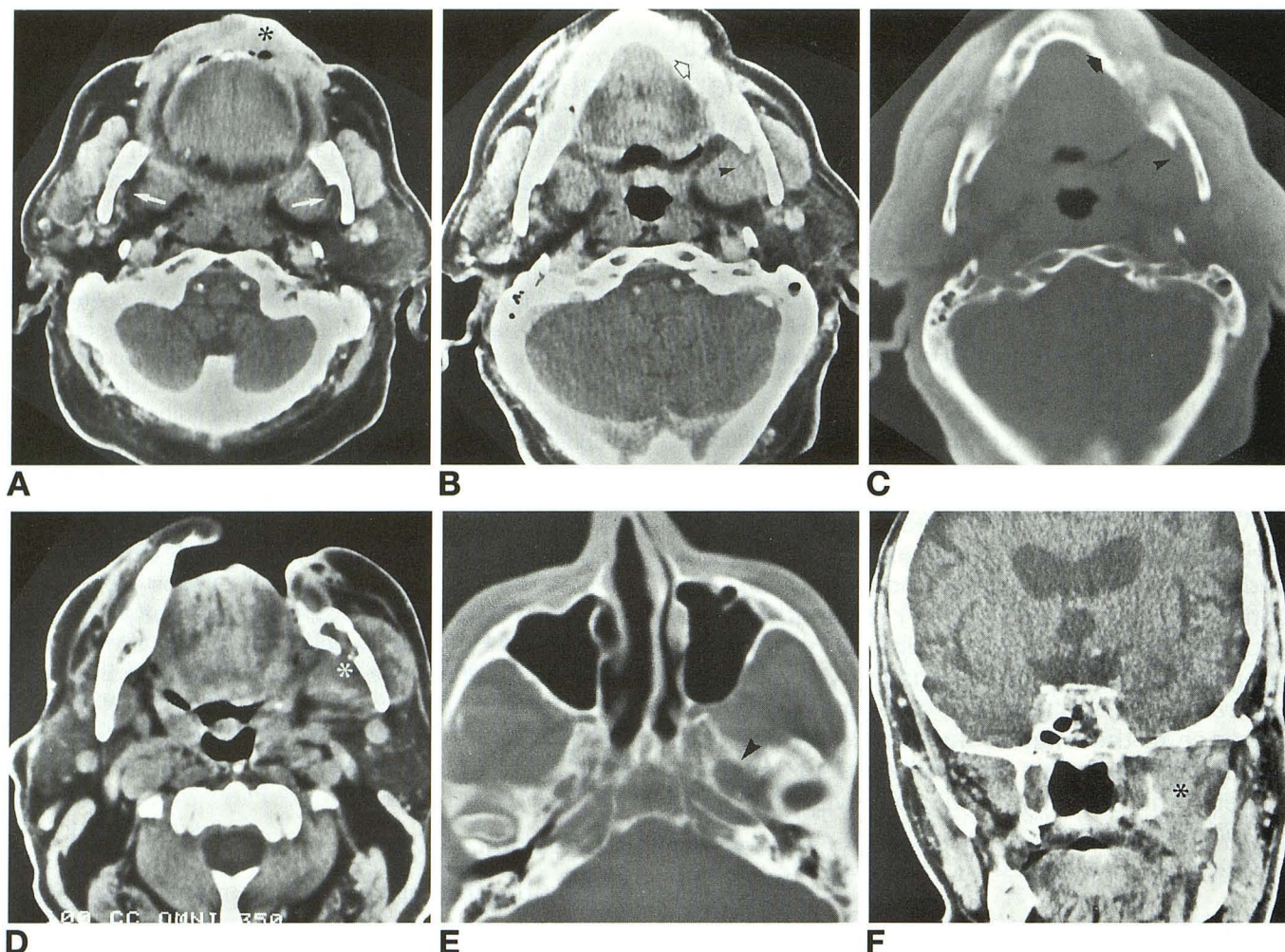


Fig 1. A, February 1991. Enhanced axial image at the level of the tongue demonstrates a soft-tissue mass in the lower lip (*asterisk*). The fat at the entrance of the mandibular canal has a normal appearance bilaterally (*arrows*). Submandibular adenopathy was present at this time (not shown). There was no bone destruction in the mandible.

B, October 1991. Enhanced axial image at the level of the symphysis of the mandible demonstrates bone destruction in the body of the mandible on the left (*open arrow*). Compared with the opposite side, there has been obliteration of the normal fat planes at the entrance to the mandibular canal (*arrowhead*).

C, October 1991. Axial image with bone settings at the level of the symphysis of the mandible demonstrates bone destruction in the body of the left mandible by tumor extension (*arrow*) and widening of the mandibular foramen (*arrowhead*).

D, December 1991. Enhanced axial image at the level of the mandibular ramus shows a mass in the left masticator space (*asterisk*) and destruction of bone along the mandibular canal. The anterior mandible had been resected in the interval.

E, December 1991. Axial image on bone settings at the level of the horizontal carotid canal demonstrates an expanded left foramen ovale caused by tumor extension (*arrowhead*, compare with normal right side).

F, December 1991. Enhanced, coronal image demonstrates the tumor extension (*asterisk*) along the course of the inferior alveolar nerve to the skull base.

is usually best seen in cross-section on axial images (Fig 1E).

Tumors may also "resurface" or reappear on the opposite side of a foramen. Potential sites for resurfacing include the gasserian ganglion in Meckel's cave for tumor extending through the foramen rotundum or ovale (5) (Figs 1E and F). This phenomenon has also been described in the pterygopalatine fossa, because here also,

nerves are not tightly confined within a canal or foramen (2).

Obliteration of the fat in the masticator space, in the pterygopalatine fossa, or along the mandibular canal also must be regarded as suspicious for tumor spread, even if there is no definite bone destruction in the area (Fig 1B). Obliteration of the fat within a fossa is abnormal (6). The vessels and nerves should appear as

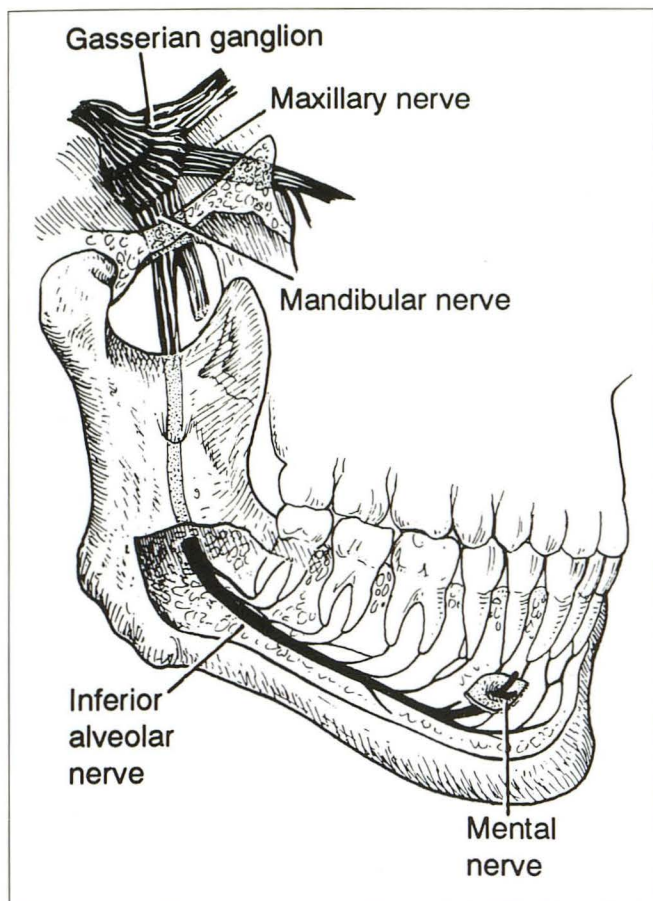


Fig 2. Path of the mandibular branch of the trigeminal nerve. After leaving the Gasserian ganglion, the mandibular branch passes through the foramen ovale. The sensory and motor branches initially travel together then divide. The inferior alveolar nerve travels in the mandibular canal in the body of the mandible, exiting anteriorly via the mental foramen (modified from Ferner and Staubesand [7]).

small densities separated by fat. In the case of unusually small fossas, the normal structures may be tightly clustered, giving the appearance that the fat has been obliterated. In this situa-

tion, the normal findings should be symmetric bilaterally and not present on all images. Otherwise, perineural invasion should be considered (2).

Conclusion

Perineural invasion of squamous cell carcinoma of the head and neck is not a common occurrence but remains an important phenomenon to consider in malignant head and neck neoplasms. This case demonstrates that squamous cell carcinoma can show perineural spread along the inferior alveolar nerve and illustrates several key radiologic features of perineural spread—foramen enlargement, resurfacing of tumor, and asymmetry of fat spaces. Prompt recognition is obviously important in patient treatment and prognosis.

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