The Journal of Laryngology and Otology
April 1996, Vol. **110,** pp. 394–396

Radiology in Focus

Trigeminal neuralgia in nasopharyngeal carcinoma

V. F. H. CHONG, F.R.C.R.

Abstract
Tumours at the skull base may show perineural infiltration of the mandibular nerve. Subsequent retrograde spread into the cavernous sinus, Gasserian ganglion, the trigeminal nerve and the pons may be seen. The patient, a known and treated case of nasopharyngeal carcinoma (NPC), complained of trigeminal neuralgia and difficulty in chewing. Magnetic resonance imaging (MRI) revealed a Gasserian ganglion and trigeminal infiltration with resultant atrophy of the muscles innervated by the mandibular nerve. Proximal cranial nerve involvement should be suspected in patients with skull base malignancy presenting with trigeminal neuralgia. MRI is the modality of choice in delineating the pathological process.

Key words: Nasopharyngeal neoplasms; Carcinoma; Trigeminal nerve; Mandibular nerve; Trigeminal ganglion

Introduction

Nasopharyngeal carcinoma (NPC) occurs in high frequencies in Southern China and Southeast Asia. The risk does not diminish among the Chinese migrants outside this region. Skull base erosion is common and may be seen in one-third of patients. The incidence of intracranial spread is 12.2 per cent (Sham *et al.*, 1990). Intracranial extension may involve the foramen ovale and the mandibular nerve (Laine *et al.*, 1990). Infiltration of the trigeminal ganglion or further proximally can lead to trigeminal neuralgia.

The trigeminal nerve leaves the lateral pons (the root entry zone, REZ) at the level of the fourth ventricle. It passes through the prepontine cistern to the Gasserian ganglion in Meckel's cave. The mandibular division exits through the foramen ovale and enters the masticator space where it gives rise to two motor nerves, the masticator and the mylohyoid nerves. The masticator nerve supplies the muscles of mastication (temporalis, masseter, medial and lateral pterygoid) while the mylohyoid nerve innervates the mylohyoid and anterior belly of the digastric muscles located in the floor of the mouth. Injury to these nerves may result in muscle atrophy and fatty infiltration.

Case report

The patient, a 44-year-old Chinese female, first presented with epistaxis and was diagnosed to have NPC. She was treated with radiotherapy and given two cycles of chemotherapy. She tolerated the treatment well. However, six months later she presented with right trigeminal neuralgia. MRI was obtained which showed intracranial spread with enlargement of the cavernous sinus and encasement of the right carotid artery. There was also enhancement in Meckel's cave. She was subsequently referred to the pain clinic for further management. The patient was relatively pain free and well over the next two years. Her problem was reappraised and radiosurgery was considered a management option. MRI was obtained for further assessment.

FIG. 1

Axial contrast-enhanced MRI shows atrophy and increased signal intensity as a result of fatty infiltration in the masseter (arrowheads) temporalis (T) and lateral pterygoid (L) muscles. Compare with the normal muscle bundles on the left. No tumour recurrence seen in the nasopharynx. Note the normal torus tubarius (asterisk), fossa of Rosenmuller (F) and Eustachian tube opening (arrow).

From the Department of Diagnostic Radiology, Singapore General Hospital, Singapore.
Accepted for publication: 13 January 1996.

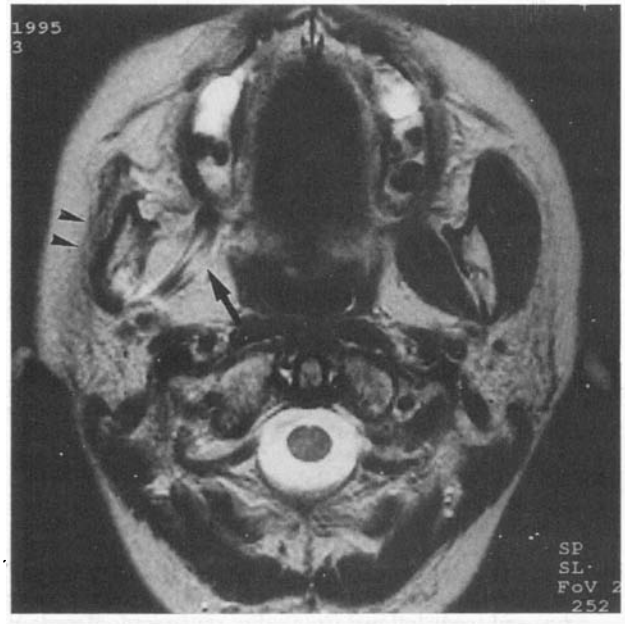

FIG. 2

Axial fast spin-echo T2-weighted image shows gross atrophy of the right masseter (arrowheads) and medial pterygoid muscles (arrow).

The MRI showed the nasopharynx to be tumour-free but the right masticator muscles appeared atrophic (Figures 1 and 2). There was also atrophy of the right mylohyoid and the anterior belly of the digastric muscles (Figure 3). Enlargement of the right cavernous sinus and enhancement of the Gasserian ganglion could be seen. Retrograde tumour spread to the trigeminal nerve and spread into the pons was demonstrated (Figure 4). Sagittal contrast-enhanced MRI also showed tumour invading the pons (Figure 5).

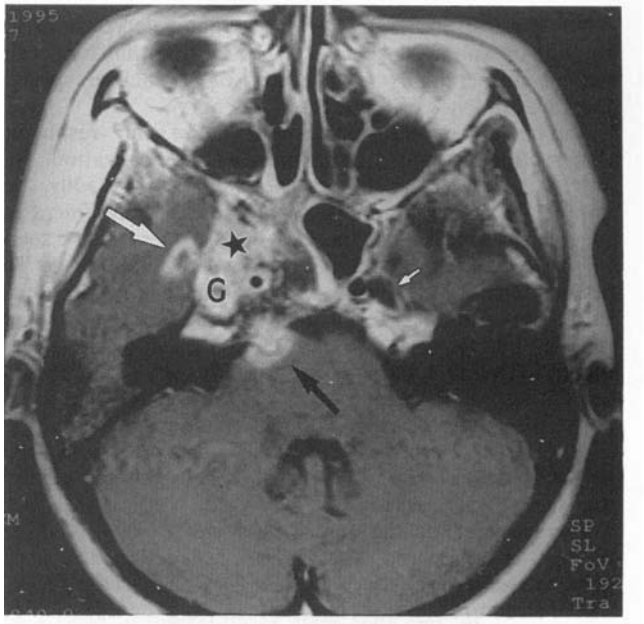

FIG. 4

Axial contrast-enhanced MRI shows a bulging right cavernous sinus (star) with tumour involvement of the right temporal lobe (large white arrow). There is enlargement and enhancement of the right Gasserian ganglion (G). Compare with the contralateral normal Gasserian ganglion (small white arrow). There is tumour infiltration of the right trigeminal nerve and the pons (black arrow).

Discussion

Malignant tumours of the head and neck may gain access to the middle cranial fossa through perineural spread (Curtin *et al.*, 1984; Daniels *et al.*, 1986; Hardin and Harnsberger, 1987). Perineural spread refers to tumour that follows the nerve pathway by using the perineural or endoneural spaces (Ballantyne *et al.*, 1963; Dodd *et al.*,

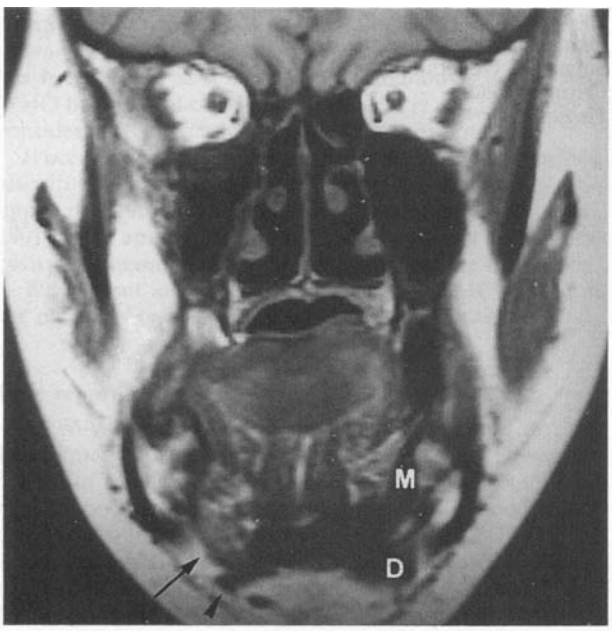

FIG. 3

Coronal T1-weighted MRI shows the normal left mylohyoid (M) and anterior belly of the digastric muscle (D). Note fatty replacement and atrophy of the right mylohyoid (arrow) and anterior belly of the digastric (arrowhead).

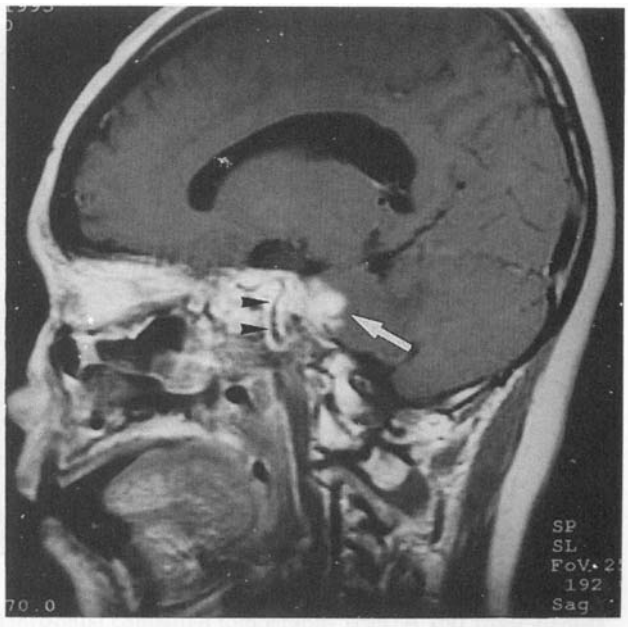

FIG. 5

Sagittal contrast-enhanced MRI shows enlargement of the cavernous sinus with tumour encasing the right carotid artery (arrowheads). Note the tumour infiltration of the pons at the root entry zone (arrow).

https://doi.org/10.1017/S0022215100133742 Published online by Cambridge University Press

1970). Neural fibres are, however, relatively resistant to tumour invasion. Ginsberg (1992) reported that NPC can extend intracranially as a result of perineural spread through branches of the fifth cranial nerve.

Infiltration of the mandibular nerve can result in denervation atrophy of the muscles of mastication. By MRI, the decrease in muscle bulk can readily be appreciated. There is also associated fatty replacement in the muscle bundles. The increase in fat content can be seen in T1-weighted images as an increase in signal intensity. In conventional T2-weighted spin-echo images, the presence of fat shows an increase in signal intensity in the affected muscles but to a lesser extent compared to T1-weighted images. The affected muscles on fast spin-echo (FSE) images show a higher signal intensity compared to conventional T2-weighted spin-echo imaging (Fulbright *et al.*, 1994). In the imaging of head and neck lesions, fast spin-echo is preferred as it provides better image quality and superior lesion visibility.

Involvement of the mandibular nerve may lead to retrograde infiltration. The Gasserian ganglion is located posterolateral to the cavernous sinus within Meckel's cave. These structures do not enhance following the injection of intravenous contrast. When the Gasserian ganglion is infiltrated, enlargement and contrast-enhancement is seen. Further proximal infiltration of the trigeminal nerve and the pons may ensue. The patient may, therefore, experience trigeminal neuralgia. The pathological anatomy of trigeminal neuralgia is best demonstrated by MRI.

Evaluation of skull base malignancy should include the basal foramina, cavernous sinus, Gasserian ganglion and the trigeminal nerve. A failure to identify cranial nerve infiltration especially the proximal portion may result in inadequate treatment. This may lead to 'early intracranial recurrence' (Harnsberger, 1990). We speculate the patient in this report may be such an instance. She had trigeminal neuralgia only six months after completion of radiation therapy and chemotherapy. Unfortunately, we could not review the initial imaging study as it was done in another country.

Conclusion

NPC may infiltrate the mandibular nerve and spread retrogradely into the cavernous sinus, Gasserian ganglion, trigeminal nerve and the pons. This may result in trigeminal neuralgia and denervation atrophy of the muscles of mastication. The pathological process is best identified by MRI.

References

Ballantyne, A. J., McCarten, A. B., Ibanez, M. L. (1963) Extension of cancer of the head and neck through peripheral nerves. *American Journal of Surgery* **106:** 651–667.

Curtin, H. D., Williams, R., Johnson, J. (1984) CT of perineural tumor extension: Pterygopalatine fossa. *American Journal of Neuroradiology* **5:** 731–737.

Daniels, D. L., Pech, P., Pojunas, K. W., Kilgore, D. P., Williams, A. I., Haughton, V. M. (1986) Trigeminal nerve: anatomic correlation with MR imaging. *Radiology* **159:** 577–583.

Dodd, D. G., Dolan, P. A., Ballantyne, A. J., Ibanez, M. L., Chau, P. (1970) The dissemination of tumors of the head and neck via the cranial nerves. *Radiologic Clinics of North America* **8:** 445–461.

Fulbright, R., Panush, D., Sze, G., Smith, R. C., Constable, R. T. (1994) MR of head and neck: Comparison of fast spin-echo and conventional spin-echo sequences. *American Journal of Neuroradiology* **15:** 767–773.

Ginsberg, L. E. (1992) Neoplastic disease affecting the central skull base: CT and MR imaging. *American Journal of Roentgenology* **159:** 581-589.

Hardin, C. W., Harnsberger, R. (1987) The radiographic evaluation of trigeminal neuropathy. *Seminars in Ultrasound CT and MR* **8:** 214–236.

Harnsberger, H. R. (1990) In *Head and Neck Imaging.* Handbook in Radiology series, Year Book Medical Publishers, Chicago, pp 46–60.

Laine, F. J., Braun, I. F., Jensen, M. E., Nadel, L., Som, P. M. (1990) Perineural tumor extension through the foramen ovale: Evaluation with MR imaging. *Radiology* **174:** 65–71.

Sham, J. S. T., Cheung, Y. K., Choy, D., Chan, F. L., Leong, L. (1990) Nasopharyngeal carcinoma: CT evaluation of patterns of tumor spread. *American Journal of Neuroradiology* **12:** 265–270.

Address for correspondence:
Dr Vincent Chong,
Department of Diagnostic Radiology,
Singapore General Hospital,
Outram Road,
Singapore 169608.