Depicting multiple schwannomas—a tale of two magnetic resonance neurogram techniques

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A 40-year-old female with unremarkable past health and no known family history of neurofibromatosis presented with a 3-year history of non-specific discomfort at the right submandibular region and upper neck. No facial nerve dysfunction was evident clinically. Ultrasound of the major salivary glands revealed a soft tissue nodule posterior to the right submandibular gland. Fine needle aspiration cytology findings were compatible with schwannoma. Subsequent magnetic resonance imaging (MRI) revealed a cluster of nodules within the deep lobe of the right parotid gland with a linear orientation. Further delineation with high-resolution MRI and neurography sequences with acquisition of double-echo steady state (DESS) [Fig 1] and post-contrast constructive interference in steady state (CISS) [Fig 2] sequences delineated these nodules arising eccentrically from the main trunk, inferior division and the marginal mandibular branch of the facial nerve, respectively. The patient continues with imaging surveillance while awaiting workup of underlying neurofibromatosis or schwannomatosis.

In the early era of MRI imaging, depiction of the extracranial intraparotid portion of the facial nerve was difficult, if not impossible, with conventional sequences. With advances in technology, higher resolution and newer imaging protocols allow clear delineation of intraparotid facial nerves. The use of high-resolution, three-dimensional and gradient echo–based techniques such as DESS[1] and CISS[2] allows clear delineation of the facial nerve from the parotid parenchyma and any adjacent facial nerve tumours, with a reasonable acquisition time of around 5 minutes. Both sequences have been proven useful in depicting the facial nerve and its branches,[1,2] although there has not been any direct comparison

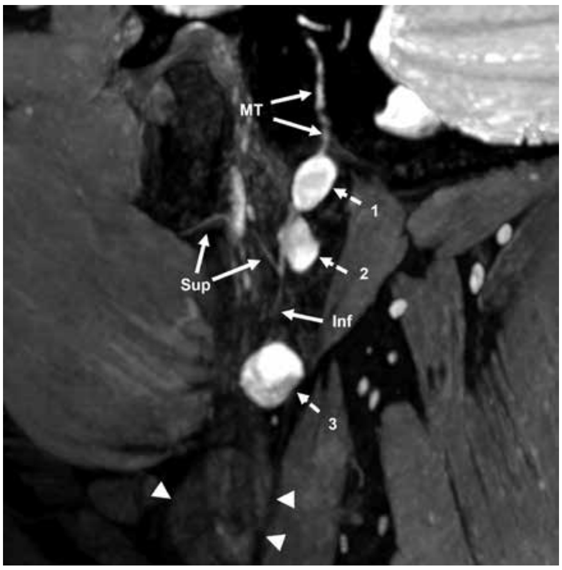

FIG 1. Double-echo steady state sequence of the right parotid gland with maximal intensity projection reconstruction, demonstrating a cluster of facial nerve schwannomas (dashed arrows 1-3) closely related to the facial nerve (solid arrows) at the main trunk (MT) and inferior division (Inf) of the facial nerve. The superior division (Sup) is not involved. A fourth schwannoma is identified more inferiorly (arrowheads) and shows a distinct low signal as a result of previous intratumoural haemorrhage. The facial nerve demonstrates positive contrast compared with the background low-signal parotid gland

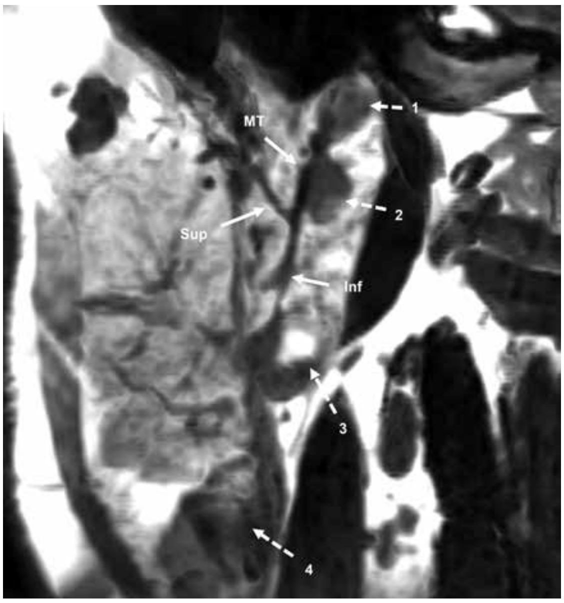

FIG 2. Non-contrast constructive interference in steady state sequence of the right parotid with minimum intensity projection reconstruction, also demonstrating the facial nerve and its tributaries (solid arrows) and the facial nerve schwannomas (dashed arrows 1-4). A hyperintense cystic component is also depicted in the more inferior schwannoma (dashed arrow 3). The facial nerve demonstrates negative contrast compared with the background high-signal parotid gland
Abbreviations: Inf = inferior division; MT = main trunk; Sup = superior division

of the efficacy of these sequences in facial nerve depiction. Nonetheless these two sequences are synergistic in the delineation of the facial nerve tributaries due to their differences in contrast characteristics. For DESS sequence, the facial nerve demonstrates positive contrast compared with the low-signal parotid gland; while in CISS, the facial nerve shows negative contrast compared with the high-signal parotid gland that is accentuated after contrast injection. The use of reconstruction techniques such as maximal intensity projection for DESS, or minimum intensity projection for CISS, can further improve visualisation of the peripheral nerve branches.

Dedicated magnetic resonance neurogram sequence for facial nerves is especially important in patients with salivary gland neoplasms, since facial nerve injury and consequent facial nerve weakness remain an important postoperative complication,[3] and prior understanding of facial nerve anatomy is potentially helpful in reducing its incidence. It is also useful in predicting histology of nerve sheath tumours since schwannomas, as in our case, typically arise eccentrically from a nerve with displacement of its fascicles.[4] Furthermore, such techniques can be applied to other extracranial nerves[5] in the diagnosis of cranial neuropathies or in interventional planning for tumours in the head and neck region. Gradient echo–based DESS and CISS sequences partially overcome the problem of long acquisition time in conventional spin echo–based magnetic resonance neurogram; nonetheless images can be significantly compromised by susceptibility artefacts if adjacent implants are present. The latter remains a major obstacle that needs to be addressed.

Author contributions

Concept or design: All authors.
Acquisition of data: All authors.
Analysis or interpretation of data: HS Leung, JM Abrigo.
Drafting of the manuscript: HS Leung.
Critical revision of the manuscript for important intellectual content: JM Abrigo, EHL Lau, WCW Chu.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

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Ethics approval

Ethics approval has been obtained from the Joint Chinese University of Hong Kong–New Territories East Cluster Clinical Research Ethics Committee (CREC Ref No.: 2021.639). Patient consent for publication was obtained.

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