Cone Beam Computed Tomography in the Differential Diagnosis of Mental Neuropathy (Numb Chin Syndrome) in Metastatic Colon Cancer

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Abstract. *Neuropathy of the mental nerve, also referred to as numb chin syndrome (NCS), is a rare finding that demands for accurate differential diagnosis and therapy. This is a report of two patients with a history of colonic cancer, who experienced a progressive hypaesthesia of one side of the corner of the mouth, lower lip and chin, associated with intermittent phases of pain some weeks prior to admission to hospital. Orthopantomograms were insufficient to disclose the relationship between the osseous lesion and the nerve canal. Cone beam computed tomography (CBCT) clearly disclosed the widely spreading, in-growing tumour of the mandible and the affection of the canal's boundary. CBCT is recommended as the imaging modality of primary choice to disclose apparent osseous affections of the mandibular canal and foramina associated with NCS, in particular in the diagnostics of outpatients admitted to specialized clinics and in the dental office.*

In dental practice, painless treatment of patients with dento-alveolar diseases is intended by application of local anaesthetics (LA). Pharmacological blockage of the mental nerve following application of LA regularly causes temporary numbness of the chin and ipsilateral side of the lower lip, indicating the terminal sensory fields of the inferior alveolar nerve in the skin. In rare cases, a numb chin is recognized by patients who were not treated for dental diseases. In patients with spontaneous neuropathy of the mental nerve, also referred to as 'numb chin' syndrome (NCS), an accurate differential diagnosis is mandatory (1). NCS in a patient with no history of maxillofacial trauma or other known dental or osseous diseases as the cause of nerve damage is more often associated with cancer as the first symptom of metastasis than with non-cancerous conditions (2-5).

The invention of cone beam computed tomography (CBCT) into the diagnostic armamentarium of dentists, oral surgeons, and maxillofacial surgeons has enormously increased the diagnostic accuracy of jaw diseases (6, 7). The implementation of CBCT has also considerably increased the requirements for diagnostic skills of users. Furthermore, the diagnostician has to weigh the advantages of multiplanar imaging carefully against the risks of increased radiation exposure in each case (6). In NCS, the conventional two-dimensional radiographic overview of the jaws as provided by an orthopantomogram (OPG) may fail to identify a tumor of the mandibular canal (5). The report intends to emphasize on the value of CBCT in the diagnostic setting of outpatients with NCS and points to the need to bear in mind jaw-related pathologies beyond the dento-alveolar complex when applying this imaging modality.

Case Reports

Case 1. A 76-year-old male patient was referred to our Outpatient Department (by his dentist) due to having a numb chin for three months. Upon admission, the patient was in a fairly good general condition, clearly orientated, and precisely chronicled his medical history. Twenty-five years earlier, he had developed colonic cancer and had successfully undergone primary tumour resection and a further four operations for treatment of local recurrences 8, 11, 15 and 22 years after the initial diagnosis. The patient reported a slightly increasing numb feeling skin field strictly confined to the right chin and lip that also intermittently caused pain. Four weeks earlier, the inferior right first molar was extracted by a dentist. This measure prompted no pain relief. The physical investigation showed a symmetrically, synergistic innervated facial musculature, disclosed no visible tumour or ulcer, neither of

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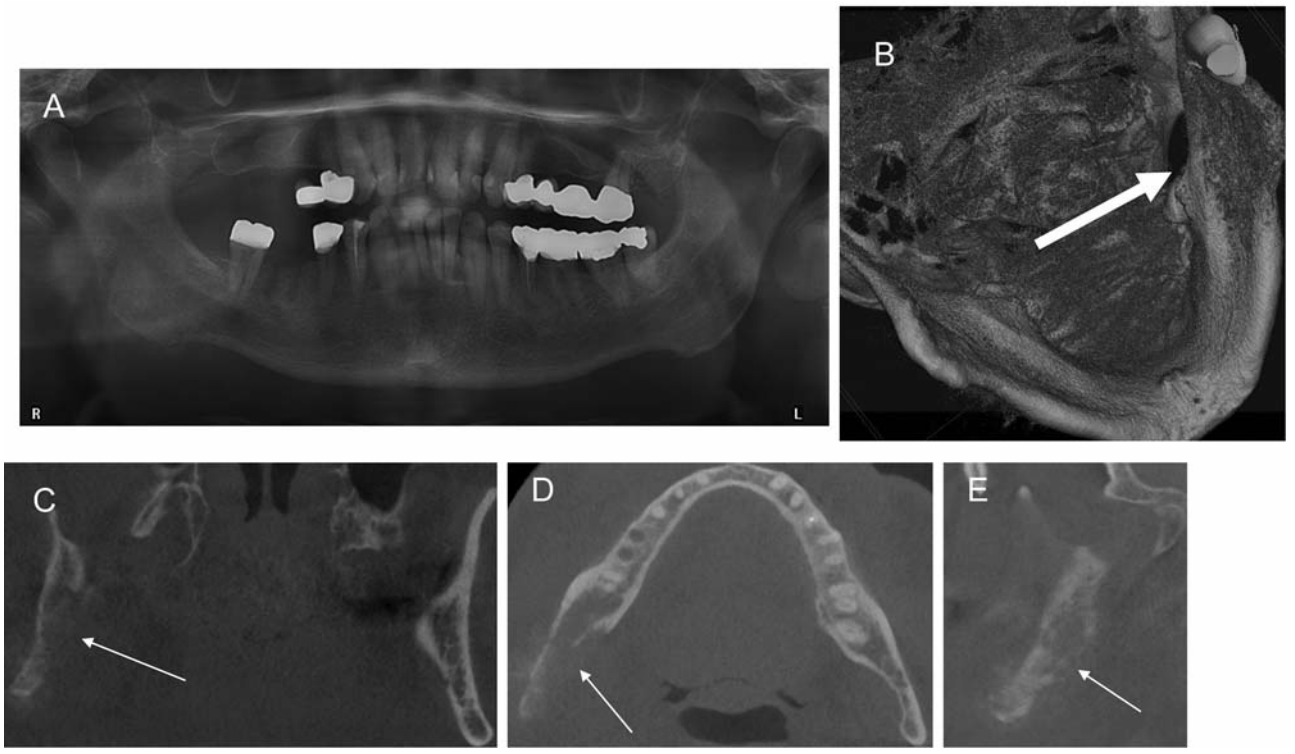

Figure 1. *A: The orthopantomogram of case 1 shows no pathological alteration of the right mandibular angle. The residual shapes of the first mandibular alveoli of the right side indicate the inefficacious extraction of this tooth shortly before the investigation. B: Three-dimensional reconstruction of the mandibular surface reveals the wide area of cortical bone loss on the lingual side of the bone (arrow). C: Coronal tomogram by cone beam computed tomography reveals extensive osteolysis of the right mandibular ramus (arrow). D: Axial tomogram discloses the invasion of the right mandibular angle and invasion into the corpus (arrow). E: Cropped image of the sagittal tomogram discloses the moth-like destruction of the mandibular angle in close proximity to the foramen (arrow).*

the skin nor intraorally, but confirmed the anaesthesia of the chin and right lip on adequate stimuli. The history of the patient and the discrete neurological findings prompted us to seek a bone lesion in the course of the mental nerve. Therefore, an OPG was taken as a screening imaging modality but this radiograph showed no pathologies, affecting the nerve canal (Figure 1). A consequent CBCT disclosed extensive osteolysis of the lingual side of the mandibular angle, with erosion of the mandibular foramen. Tentative diagnosis of distant metastasis from colonic carcinoma was performed and the patient was referred to the Department of Radiology where an extensive soft tissue tumour of the pharynx of 5×4×3.8 cm^3 was detected, infiltrating the lingual aspect of the mandible. Furthermore, bilateral pulmonal metastases were seen on computed tomograms. The patient is planned for palliative tumour resection, relief from cancer pain, and consecutive radio-chemotherapy.

Case 2. A 57-year-old female was submitted to the hospital due to a conspicuous swelling of her left anterior submandibular region. On admission to our Outpatient Clinic, the patient was in a fairly good general health condition. The medical history of the patient disclosed a colonic cancer operated for four years previously. Repeated investigations for local tumour recurrence and distant spread had not revealed any tumour up to today.

Physical investigation revealed a firm mass adhering to the lower border of the mandible in the premolar region. She reported numbness of the left side of the chin and lower lip and occasionally pain projecting into the left mandible and chin region. The reported symptom of a numb chin was objectivised by a lack of sensation of the left chin and lower lip during two-point discrimination and following gentle squeezing with forceps. The tentative diagnosis was a primary malignant tumour of the submandibular gland or a distant metastasis from colonic cancer, with invasion of the mental nerve. An OPG of the patient was obtained that revealed an interruption of the inferior border of the mandible in the left premolar region. However, the entire region of the mental nerve canal appeared to be unaffected. Subsequent CBCT revealed extensive osteolysis of the lingual mandibular aspect, with focal erosion of the nerve canal (Figure 2). Furthermore,

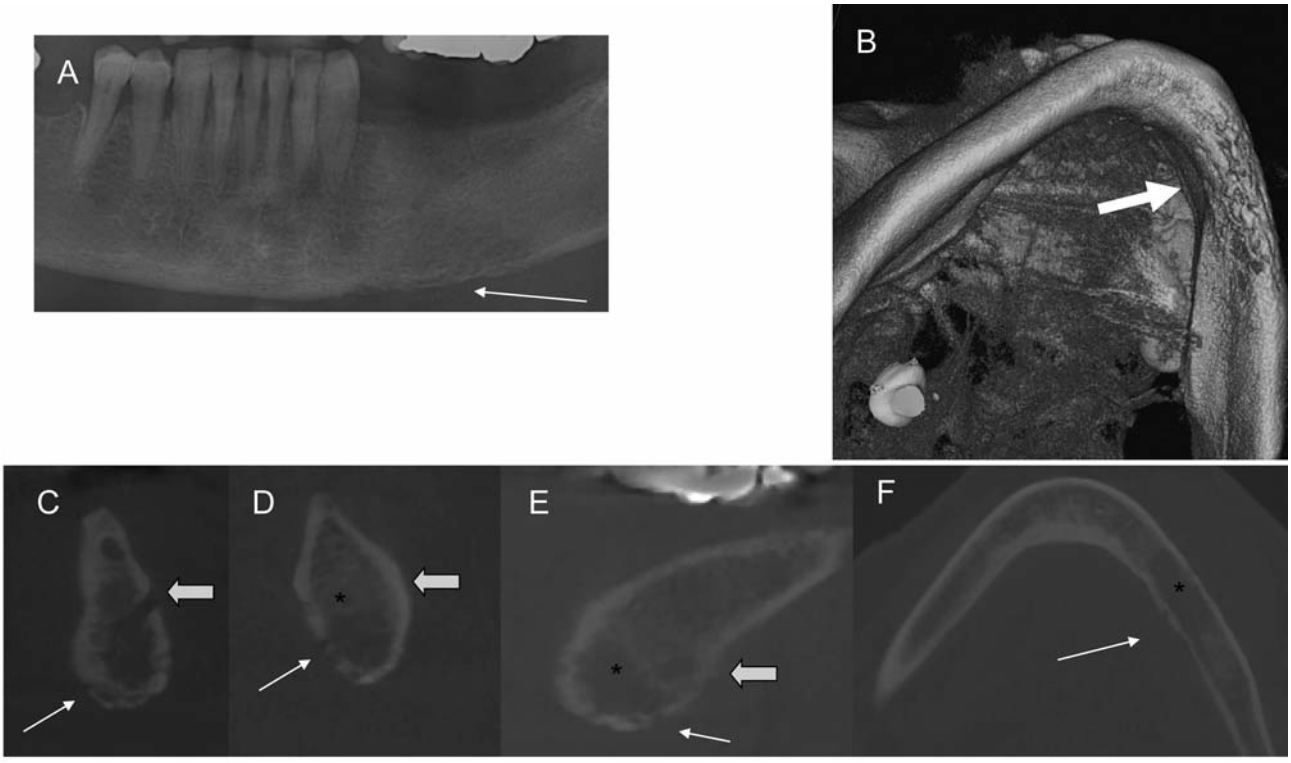

Figure 2. *A: Cropped image of an orthopantomogram of case 2 at the time of admission. The left mandibular premolar/molar region and the region of the mental foramen appear to be unaffected with the exception of a roughened lower mandibular border in the premolar region (arrow). B: Three-dimensional reconstruction of the mandible reveals the extension of cortical bone loss in the left premolar and molar region, predominantly at the base of bone and lingual aspect (arrow). C: Cropped image of the coronal mandibular tomogram reveals inhomogeneous vestibular cortex below the mental foramen (upper arrow) and sequestration of the inferior corticalis (lower arrow). D: A few millimetres distally, tomogram of the segment in the same plane reveals wide cortical osteolysis (lower arrow) and loss of mandibular internal structure (asterix), reaching the mandibular canal (upper arrow). E: Sagittal tomogram of the left mandible also shows the basal bone destruction (lower arrow) and the destruction of the spongiosa (asterix) close to the mandibular canal (upper arrow). F: The axial tomogram reveals the wide osteolysis of the left mandible affecting the cortex (arrow) and spongiosa (asterix).*

CBCT showed widespread radiotransparency of the left mandibular spongiosa in the premolar and molar region, indicating the extension of the supposed malignant neoplasm. A biopsy of the tumour revealed it to be a distant metastasis of poorly-differentiated adenocarcinoma, but there was no salivary gland neoplasm. A subsequent positron emission tomography (PET) revealed multiple metastases of the skeleton and lungs. The patient is planned for palliative partial mandibular resection with immediate reconstruction of the mandible and subsequent radiochemotherapy.

Discussion

This report describes the value of applying CBCT in the differential diagnosis of outpatients presenting with NCS. CBCT allows imaging of the facial bones in all planes and thus enables the localization of osseous lesions (6, 7).

Mental neuropathy following metastasis to the third branch of the trigeminal nerve occurs late in cancer (8). Mental neuropathy can be caused by metastases affecting the nerve at all levels of the nerve's routes by: (i) compression or invasion of the mental or inferior alveolar nerve by invasion into the mandible, (ii) metastasis to the skull base, and (iii) leptomeningeal spread (8).

NCS as the initial finding of a malignant disease has been documented for many types of cancers (8). The most frequent organs of origin in patients with NCS giving rise to these metastases are the breast, lung, kidney, thyroid, prostate and stomach (8-10). Other types of cancers might also rarely cause a numb chin by this way of action (5, 10). In patients with metastatic cancer, NCS is a well-accepted *signum mali ominis* (5, 8, 9). This is a report about two patients with NCS as the initial symptom of metastasizing colonic cancer.

In our patients, OPGs did not enable us to identify the topography of the lesion in close proximity to the canal properly. However, clinical signs and the history of both patients were suspicious for a malignancy affecting the nerve. In the first case, CBCT clearly disclosed the large osteolysis outside the dento-alveolar complex. In the second case, the true extension was hidden on the OPG by the superimposition of the cortical layer and the lingual osteolysis in the region of interest, the nerve canal. On the other hand, CBCT gave a sharp image of the osseous lesion affecting the wall of the canal and a true image of the tumour's extension. Further measures are recommended for staging in NCS with evidence of metastasis, in particular PET and magnetic resonance imaging (7). However, CBCT allowed for correct diagnosis.

Conclusion

NCS is rare and not well-appreciated as a serious finding in the fields of dentistry, oral surgery, and cranio-maxillofacial surgery (8, 10, 11). The main reason for underestimating this finding is the frequent association of a numb chin with obvious dental findings and procedures, *e.g.* poor retention of dental prosthesis, inflammatory diseases of the dental apices affecting the inferior alveolar nerve, or delayed recovery of the inferior alveolar nerve after LA. In certain cases, the signs of mandibular osteomyelitis or a history of mandibular trauma sends the differential diagnosis in the correct direction. This report demonstrates the superiority of CBCT in delineating the lesion in NCS-affected patients, as far as lesions related to the course of the inferior alveolar nerve or the mandibular foramen are concerned. CBCT is widely-used in dental practice and specialized surgical fields nowadays. Applying CBCT for differential diagnosis of jaw lesions, the diagnostician is responsible for accurately distinguishing all items depicted in the CT scans, including findings beyond the dento-alveolar region. The case of a patient with NCS has to be taken seriously and requires thorough diagnostics, including the surgical revision of the affected nerve in cases with extraordinary tumour growth inside the canal (5). CBCT is superior to OPG in disclosing mandibular lesions.

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