Oral Radiology (2019) 35:331–334
https://doi.org/10.1007/s11282-018-0355-7

CASE REPORT

Abnormal positioning of the common carotid artery clinically diagnosed as a submandibular mass

Takashi Nakamoto[1] · Yoshikazu Suei[1] · Masaru Konishi[1] · Taku Kanda[2] · Rinus G. Verdonschot[3] · Naoya Kakimoto[3]

Received: 29 August 2018 / Accepted: 30 September 2018 / Published online: 30 October 2018

Abstract

The common carotid artery (CCA) usually runs along the long axis of the neck, although it is occasionally found in an abnormal position or is displaced. We report a case of an 86-year-old woman in whom the CCA was identified in the submandibular area. The patient visited our clinic and reported soft tissue swelling in the right submandibular area. It resembled a tumor mass or a swollen lymph node. Computed tomography showed that it was the right CCA that had been bent forward and was running along the submandibular subcutaneous area. Ultrasonography verified the diagnosis. No other lesions were found on the diagnostic images. Consequently, the patient was diagnosed as having abnormal CCA positioning. Although this condition generally requires no treatment, it is important to follow-up the abnormality with diagnostic imaging because of the risk of cerebrovascular disorders.

Keywords Common carotid artery abnormal positioning · Diagnostic imaging · Radiography

Introduction

The common carotid artery (CCA) normally runs along the long axis of the neck, although sporadically it takes an abnormal route or is displaced, resulting in variant appearances. In such cases, the chief complaints from patients typically come from awareness of an unknown cervical mass, as well as discomfort, in the neck or pharynx [1–4]. Erroneous diagnoses (especially in the maxillofacial area) include a swollen lymph node, salivary gland disease, and swelling due to inflammation. Hence, unusual positioning of the CCA must be distinguished from other head and neck irregularities. Although an unusually located CCA often does not require treatment, several reports suggest that there is a strong link with certain cerebrovascular disorders [5–9]. Several case studies have reported morphological variations of the CCA, but few have reported abnormal progression of the CCA into the submandibular area. This case study aims to augment the available literature by reporting such a case.

Case report

Clinical findings

The patient was an 86-year-old woman whose chief complaint was swelling throughout the right submandibular area. She became aware of the swelling following extraction of the right mandibular second molar at a dental clinic. The practicing dentist suspected swollen lymph nodes due to lymphadenitis and referred the patient to our university hospital. Her past history included hypertension, valvular heart disease, arrhythmia, hyperactive bladder, and femoral fracture. At her intraoral clinical observation, cutting traces were found in the second molar. Neither observable inflammatory findings nor a tumor mass was found in the gingiva, buccal mucosa, or oral floor around the second molar. An approximately 3×2 cm soft tissue swelling resembling a tumor or a swollen lymph node was found in the right submandibular area (Fig. 1).

✉ Takashi Nakamoto
tnk@hiroshima-u.ac.jp

[1] Department of Oral and Maxillofacial Radiology, Hiroshima University Hospital, 1-2-3 Kasumi, Minami-ku, Hiroshima 734-8553, Japan

[2] Department of Oral Maxillofacial Surgery, Hiroshima University Hospital, 1-2-3 Kasumi, Minami-ku, Hiroshima 734-8553, Japan

[3] Department of Oral and Maxillofacial Radiology, Institute of Biomedical and Health Science, Hiroshima University, 1-2-3 Kasumi, Minami-ku, Hiroshima 734-8553, Japan

Fig. 1 Photographs of the skin on the patient's neck. **a** Skin elevation resembling a tumor mass is seen in the right submandibular area. **b** Its size is about 3 × 2 cm

Imaging findings

The patient underwent panoramic radiography, intraoral radiography, computed tomography (CT), and ultrasonography. The panoramic radiography and intraoral radiography results showed only cutting traces at the second molar of the right mandible. There were no apical or periodontal radiolucent areas on the images, nor were there any significant radiolucent or radiopaque areas around the right mandible (Fig. 2). Contrast-enhanced CT showed that the CCA was bent forward and proceeded into the submandibular area, with the subcutaneous tissue and skin extrusion toward the surface layer. The proximal submandibular gland also seemed to be extruded toward the surface of the body (Fig. 3). Toward the upper area, the CCA branched into the external and internal carotid arteries. There was no evidence of inflammation around the jawbone or lymph node swelling in the proximal area. The CT bone mode image revealed calcification inside the CCA near the site of the branching into the internal and external carotid arteries (Fig. 3d). Three-dimensional reconstructed CT images clearly show the positioning of the bent CCA (Fig. 4). Especially, a stenosed shape was found in an area of the bent CCA. Finally, ultrasonography showed only a large blood vessel running in the area where the patient felt swelling (Fig. 5). There were no other relevant findings, such as swollen lymph nodes, tumor mass formation, or a lesion of the submandibular gland. Overall, there was no evidence of disease (e.g., lymph node swelling, inflammation, tumor) other than the arterial malformation When the affected area of the patient's skin was clinically reevaluated, pulsation was found at the site where the patient felt the swelling. Based on these findings, this patient was diagnosed as having abnormal positioning of the CCA. This condition does not require treatment, although the patient should undergo follow-up diagnostic imaging.

Discussion

Several reports have stated that abnormal positioning of the carotid artery is most often seen on the right side, and that it is most common in elderly patients with hypertension [4, 7, 10–12]. The current case was in an elderly woman with hypertension on the right side. There are reasons why this anomaly occurs mainly on the right side of hypertensive patients [7, 10–12]. The right CCA is fixed in the longitudinal direction through soft tissues, such as the surrounding muscles and other arteries, and the ascending aorta arises because of arteriosclerosis and hypertension. Furthermore, the fixed right CCA becomes prolonged, causing it to be more prone. It must therefore bend because it is cannot move in the direction of the long axis—although a relatively recent

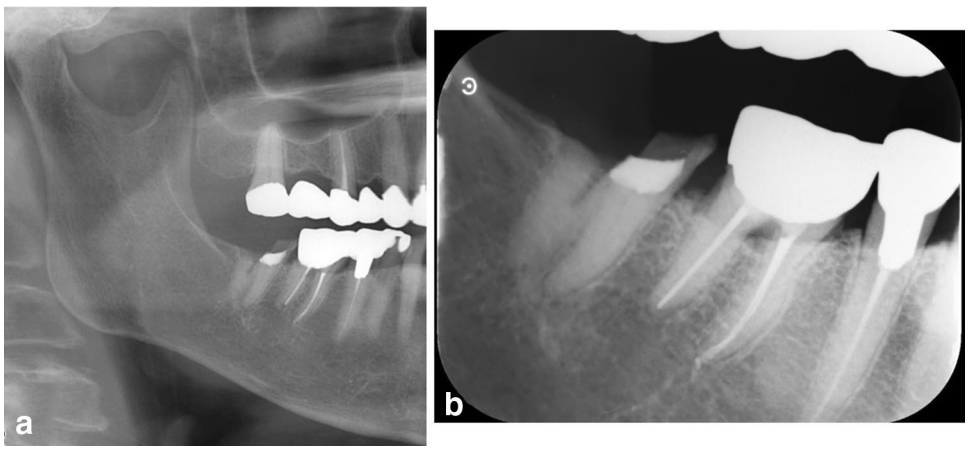

Fig. 2 Panoramic and intraoral radiographs of the patient. **a** Cropped panoramic radiograph around the right mandible. **b** Intraoral radiograph. There were no obvious lesions except for second molar cutting traces in both radiographs

Fig. 3 Contrast-enhanced computed tomography (CT). **a** Axial view. **b** Coronal view. **c** Sagittal view. The common carotid artery protrudes forward and displays bending. **d** Sagittal view of the bone mode. Calcified bodies were found inside the common artery near where it branches into the internal and external carotid arteries

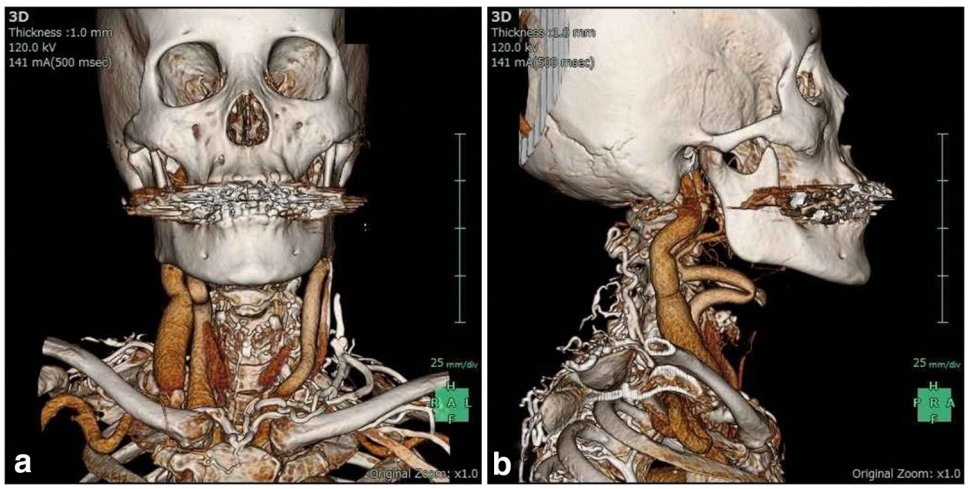

Fig. 4 Three-dimensional reconstructed CT images. **a** Frontal view. **b** Lateral view. The course of the bending carotid artery is clearly seen. A stenosis was also found in the area of the bend

report stated that no lateralization difference was found [13]. In addition, others have reported congenital dislocation of the carotid artery [14]. Therefore, the origin of the abnormal positioning in our case study is unknown.

A seminal report [15] concluded that abnormal positioning of the internal carotid artery (ICA), not the CCA, can be classified into three basic patterns according to its form: (1) tortuous: the presence of S- or C-shaped elongations or undulations during the course of the ICA; (2) coiled: elongation or redundancies in the ICA resulting in an exaggerated S-shaped curve or in a circular configuration; (3) kinked: angulation of one or more segments of

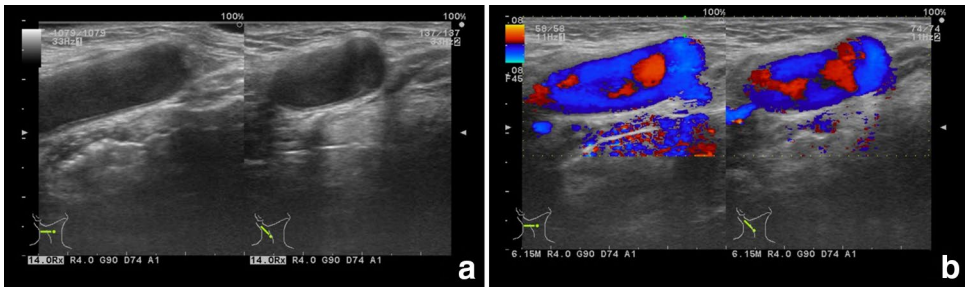

Fig. 5 Ultrasonographic images. **a** Right submandibular area. **b** Color Doppler image of the same area. Only a blood vessel with pulsation is seen

the ICA associated with stenosis in the affected segment. Among these three variations, it was reported that tortuosity was the most frequent, followed by coiling and kinking.

Although our patient underwent investigation of the abnormal positioning of the CCA, with no attention paid to the ICA, her CCA seems to best classify as having the "kinking" form because it resembled an exaggerated S-shaped curve, and stenosis was seen in the bent portion. In addition, some reports have suggested a strong correlation of this phenomenon with cerebrovascular disorders, including transient cerebral ischemic attacks due to thrombus formation in cases where there are calcification deposits and stenosis in the bent portion of the artery [5–9, 13]. In the present case, the risk of a cerebrovascular disorder, such as cerebral ischemic attacks, may be high as calcified materials were observed in the portion of the carotid artery that branches into the external and internal carotid arteries. In addition, stenosis was apparent in the bent portion of the carotid artery.

Although this condition does not require treatment, considering the risk of cerebrovascular disorders, it is important to monitor the patient's condition actively by controlling the hypertension and conducting follow-up diagnostic imaging.

We report a case of abnormal positioning of the CCA that was initially diagnosed as swollen lymph nodes due to lymphadenitis. Subsequent investigation, however, revealed abnormal positioning of the CCA in the submandibular area. The right CCA had an exaggerated S-shaped curve (i.e., defined as kinking), and stenosis was apparent in the bent portion. Additionally, calcified materials were seen in the area of the CCA that branches into the external and internal carotid arteries. Our results show that when soft tissue swelling in the right submandibular area (i.e., resembling a tumor mass or a swollen lymph node) is observed, the possibility of abnormal positioning of the CCA should be considered and investigated before making a final diagnosis.

Compliance with ethical standards

Conflict of interest Nakamoto T, Suei Y, Konishi M, Kanda T, Verdonschot RG, and Kakimoto N declare that they have no conflict of interest.

Human rights statement All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Informed consent Informed consent was obtained from the patient for her involvement in this study.

References

1. Del Corso LD, Moruzzo D, Conte B, Agelli M, Romanelli AM, Pastine F, et al. Tortuosity, kinking, and coiling of the carotid artery: expression of atherosclerosis or aging? Angiology. 1998;49:361–71.
2. Ozcan KM, Ozcan I, Selcuk A, Pasaoglu L, Hatipoglu HG, Dere H. Tortuous internal carotid artery narrowing pyriform sinus: two cases. Clin Imaging. 2008;32:220–2.
3. Hosokawa S, Mineta H. Tortuous internal carotid artery presenting as a pharyngeal mass. J Laryngol Otol. 2010;124:1033–6.
4. Matsumoto Y, Yokoi H, Kohno N. [A case report of dislocation of the common carotid artery.]. J Jpn Soc Head Neck Surg. 2012;22:169–72. **(in Japanese)**.
5. Metz H, Murray-Leslie RM, Bannister RG, Bull JWD, Marshall J. Kinking of the internal carotid artery in relation to cerebrovascular disease. Lancet. 1961;1:424–6.
6. Weibel J, Fields WS. Tortuosity, coiling, and kinking of the internal carotid artery. II. Relationship of morphological variation to cerebrovascular insufficiency. Neurology. 1965;15:462–8.
7. Leipzig TJ, Dohrmann GJ. The tortuous or kinked carotid artery: pathogenesis and clinical considerations: a historical review. Surg Neurol. 1986;25:478–86.
8. Koskas F, Bahnini A, Walden R, Kieffer E. Stenotic coiling and kinking of the internal carotid artery. Ann Vasc Surg. 1993;7:530–40.
9. Phan TG, Beare RJ, Jolley D, Das G, Ren M, Wong K, et al. Carotid artery anatomy and geometry as risk factors for carotid atherosclerotic disease. Stroke. 2012;43:1596–601.
10. Deterling RA. Tortuous right common carotid artery simulating aneurysm. Angiology. 1952;3:483–92.
11. Vannix RS, Joergenson EJ, Carter R. Kinking of the internal carotid artery: clinical significance and surgical management. Am J Surg. 1977;134:82–9.
12. Mukherjee D, Inahara T. Management of the tortuous internal carotid artery. Am J Surg. 1985;149:651–5.
13. Nagata T, Masumoto K, Hayashi Y, Watanabe Y, Kato Y, Katou F. Three-dimensional computed tomographic analysis of variations of the carotid artery. J Craniomaxillofac Surg. 2016;44:734–42.
14. Kelly AB. Tortuosity of the internal carotid in relation to the pharynx. J Laryngol Otol. 1925;40:15–23.
15. Weibel J, Fields WS. Tortuosity, coiling, and kinking of the internal carotid artery. I. Etiology and radiographic anatomy. Neurology. 1965;15:7–18.