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Factors influencing internal jugular vein patency after neck dissection in oral cancer

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Abstract. The objective was to investigate factors influencing internal jugular vein stenosis or occlusion after neck dissection, including the reconstructive procedure. The subjects were 73 patients (81 veins) who underwent a modified radical neck dissection, in which the internal jugular vein was preserved, or an extended supraomohyoid neck dissection (E-SOHND). All procedures were performed by the same surgeon. Internal jugular vein patency was evaluated by contrast-enhanced computed tomography. Patency was evaluated in relation to gender, side of dissection, number of pathological lymph node metastases, extracapsular spread of lymph node metastases, radiotherapy, and the reconstruction method (no reconstruction, free flap, or pedicle flap). All internal jugular vein occlusions were on the left side and all except one of these patients underwent radiotherapy. Thus, radiotherapy and left side dissection were significant risk factors for occlusion. Free flap reconstruction was not a risk factor for vein stenosis or occlusion. Patients undergoing reconstruction with pedicled musculocutaneous flaps or E-SOHND were less likely to have vein occlusion. Particular care is required for left neck dissection in patients who have undergone radical neck dissection on the right side. This study suggests that covering the internal jugular vein with the muscle might prevent vein occlusion.

Key words: neck dissection; reconstruction; internal jugular vein; thrombosis; stenosis and obstruction.

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The incidence of internal jugular vein stenosis or occlusion after modified radical neck dissection (MRND) or selective neck dissection ranges from 0% to approximately 30%.[1–10] Resection, occlusion, or stenosis of the bilateral internal jugular veins is likely to induce serious complications such as elevated intracranial pressure, facial oedema, visual impairment, and the syndrome of inappropriate antidiuretic hormone secretion (SIADH), and can lead to death.[11–14] Internal jugular vein thrombosis associated with pulmonary embolism is also a frequent complication[15] and may lead to anastomotic thrombosis in free flap reconstruction.[16–18]

Risk factors for internal jugular vein occlusion and stenosis include technical problems associated with vessel dissection, such as the method of branch ligation, thermal injury to the vein caused by electrocautery, and dryness after outer membrane detachment,[1,8] and aspects of the reconstructive procedure, including pressure in internal jugular veins in the musculocutaneous flap.[1,5–7] However, there are few reports on the relationship

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between the reconstructive procedure and internal jugular vein patency, and no consensus on this issue has been reached. Therefore, the aim of this study was to investigate factors influencing internal jugular vein stenosis or occlusion after neck dissection, including the reconstructive procedure.

Patients and methods

The subjects were 73 patients (81 veins) who underwent MRND, in which the internal jugular vein was preserved and the sternocleidomastoid muscle was resected, or an extended supraomohyoid neck dissection (E-SOHND), in which neck dissection of regions I, II, III, and IV was carried out. All procedures were performed by the same surgeon at the university hospital in Gunma, Japan, between August 2009 and July 2013. Surgical invasion of the internal jugular veins in the neck dissection procedures was almost the same for MRND and E-SOHND. MRND was performed for 35 sides and E-SOHND for 46 sides. One patient who underwent E-SOHND had undergone a previous radical neck dissection on the contralateral side. Exposed internal jugular veins were prevented from becoming dry: the internal jugular vein was covered with a sponge dampened with normal saline solution and the wetness of the internal jugular vein was maintained by frequent dousing with saline during the dissection. Electrocautery was not used to detach tissues around the internal jugular veins. The same approach was applied to branches, with the goal of eliminating as many differences among surgical procedures as possible.

Table 1. Details of the study subjects.

Number of subjects	73 patients (81 veins)
Age, years	31–90 (mean 66.1)
Gender, *n* patients	
Male	40
Female	33
Neck dissection, *n* patients	
Unilateral	65
Bilateral	8
Method, *n* veins	
MRND	35
E-SOHND	46
Primary location of the tumour, *n* patients	
Tongue	41
Mandibular gingiva	22
Maxillary gingiva	4
Floor of oral cavity	2
Buccal mucosa	3
Lips	1

MRND, modified radical neck dissection; E-SOHND, extended supraomohyoid neck dissection.

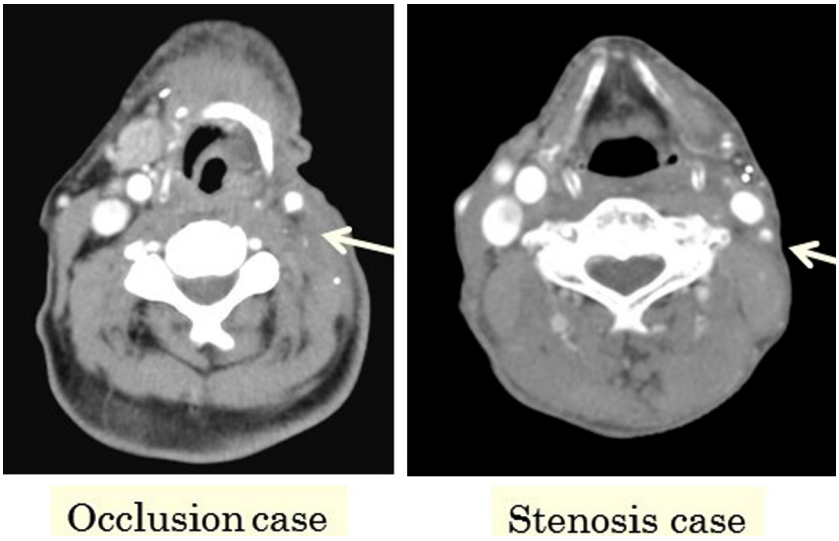

Fig. 1. Assessment of internal jugular vein patency using contrast-enhanced CT. The slice with the most severe stenosis at 3 months or later postoperatively was compared with the same slice on the preoperative CT. 'No stenosis': longest × shortest diameter >25% that on the preoperative CT; 'occlusion': internal jugular vein not detectable; 'stenosis': longest × shortest diameter <25% that on the preoperative CT.

The patients included 40 males and 33 females; they were aged 31 to 90 years (mean age 66.1 years). The primary location of the tumour was the tongue in 41 patients, mandibular gingiva in 22, maxillary gingiva in four, floor of the mouth in two, buccal mucosa in three, and lips in one patient (Table 1). Internal jugular vein patency was evaluated by contrast-enhanced computed tomography (CT). The slice with the most severe stenosis at 3 months or later postoperatively was compared with the same slice on the preoperative CT. A judgement of 'no stenosis' was made if the longest × shortest diameter was >25% of that on the preoperative CT; 'occlusion' if the internal jugular vein was not detectable; and 'stenosis' if the longest × shortest diameter was <25% of that on the preoperative CT (Fig. 1). Postoperative CT was performed for restaging. Axial CT scans were obtained using an Aquilion scanner (Toshiba, Tokyo, Japan) with a routine slice thickness of 5 mm. Non-ionic contrast medium (Omnipaque 300 from Daiichi Pharmaceutical Co. Ltd, Tokyo, Japan, or Iomeron 300 from Eisai Co. Ltd, Tokyo, Japan) was administered intravenously. In this procedure, 50 ml of contrast medium was injected over 15 s, followed by an interval of 25 s, further injection of another 50 ml of medium over 15 s, and then acquisition of CT scans after an interval of 5 s. During the postoperative CT scans, no patient was receiving high pressure ventilation, oscillator ventilation, bilevel positive airway pressure (BiPAP), or airway pressure release

Table 2. Number of subjects with internal jugular vein occlusion/stenosis by factor.

Total	Veins with dissection (*n* = 81)	Occlusion (*n* = 6; 7.4%)	Stenosis (*n* = 11; 13.6%)	Occlusion + stenosis (*n* = 17; 21.0%)
Gender				
Female	37	2	5	7 (18.9%)
Male	44	4	6	10 (22.7%)
Vein with dissection				
Left	49	6	7	13 (26.5%)
Right	32	0	4	4 (12.5%)
Extracapsular spread	12	1	3	4 (33.3%)
Radiation	27	5	3	8 (29.6%)
Number of pNs				
0	42	2	5	7 (16.7%)
1	23	2	5	7 (30.4%)
2 or more	16	2	0	2 (12.5%)

pNs, pathological lymph node metastases.