

Surgical Anatomy of the Vascularized Submental Lymph Node Flap: Anatomic Study of Correlation of Submental Artery Perforators and Quantity of Submental Lymph Node

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Background: Harvesting the submental flap for vascularized lymph node transfer (VLNT) presents a challenging procedure because of, the topographic variation of the submental artery (SA) and the marginal mandible nerve (MMN) and the limited pedicle length for a free tissue transfer. The aim of this study was to evaluate surgical anatomical landmarks and variations of the submental lymph node flap (SLNF).

Methods and Materials: The authors examined the characteristics and landmarks of 18 SLNF in nine fresh cadavers. The diameter, length, and caliber of the SA and its relation to bony anatomic landmarks were measured. In addition, the number of lymph nodes (LNN) was evaluated through dissection and ultrasound.

Results: Within the designated SLNF ($10 \times 5 \text{ cm}^2$), the number of LNN was on average 3 ± 0.6 , with an average size of $4.5 \pm 1.8 \text{ mm} \times 2.9 \pm 1.2 \text{ mm}$. Projection of the LNN on the mandible, measured from the gnathion (GT, median-sagittal-plane) toward the gonion (GN, mandibular angle), was at $63.4 \pm 5.8 \text{ mm}$ (e.g., 65%) of the mandible for the first lymph node (LN), and for the following LNN was at $50.4 \pm 7.7 \text{ mm}$ (e.g., 52%), $44.0 \pm 8.6 \text{ mm}$ (e.g., 45%), and $40.50 \pm 2.1 \text{ mm}$ (e.g., 42%). The MMN consistently crossed the mandible body and the facial artery (FA) from dorso-caudal to ventro-cranial at $72 \pm 5.2 \text{ mm}$, e.g., 75% of the mandible's length. Here, the nerve always lay superficial to the FA and was on average $0.96 \pm 0.14 \text{ mm}$ in diameter. Submental artery was located on average at 64 mm (e.g., 66%) of the mandible, with an average diameter of $1.34 \pm 0.2 \text{ mm}$.

Conclusion: The submental lymph node flap has a constant vascular supply by the submental artery. Lymph node count is on average three. Lymph nodes are close to the submental artery and its perforators. Marginal mandibular nerve lies superficial to the facial artery and crosses the artery at 75% of the mandible body length (gnathion to gonion = 100%).

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KEY WORDS: submental lymph node flap; SLNF; VLNT; lymphedema; lymph nodes; breast cancer; facial nerve; marginal mandible nerve; vascularized lymph node transfer; anatomy; surgical anatomy

INTRODUCTION

Lymphedema of the extremities decreases patients' quality of life significantly [1,2]. Despite improved understanding of the pathogenesis of lymphedema and its standard treatment (multicomponent decongestive physiotherapy), lymphedema remains incurable [3]. Recent surgical therapies of lymphedema applied after long-term stagnating conservative therapies have shown promising results [4–10].

Two common surgical treatment options are lympho venous anastomosis (LVA) [11–13] and vascularized lymph node transfer (VLNT). Each treatment provides venous shunting of lymphatic fluid, reducing interstitial fluid accumulation in the affected extremity [4–7,14–19].

The popularity in VLNT has been mirrored by increased descriptions of new donor sites for lymph node (LN) flap harvest. The groin region has been the most popular because of its reliability and proven success, but in instances of lower extremity lymphedema, alternative flaps are needed to avoid the possibility of inducing iatrogenic lower extremity lymphedema [20]. As a result, the submental-, axillary-, and supraclavicular-/transverse cervical artery flaps [21–23] have been described as alternative sources for VLNTs. Further, knowledge of the characteristics of the submental lymph node flap (SLNF) will benefit surgeons in making decisions regarding flap choice. Therefore, the goal of the study is to describe the surgical anatomical characteristics,

Abbreviations: ABDM, anterior belly of the digastric muscle; ECA, external carotid artery; FA, facial artery; GN, gonion = mandibular angle; GT, gnathion = median sagittal plane of mandible; LN, lymph node; LNN, lymph nodes; LVA, lympho venous anastomosis; MMN, marginal mandibular nerve (branch of facial nerve); SA, submental artery; SLNF, submental lymph node flap; VLNF, vascularized lymph node flap; VLNT, vascularized lymph node transfer.

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Conflict of interest: The authors hereby declare that they have no conflict of interest in any products used or tested in this study and have nothing to declare.

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