Int J Clin Exp Med 2015;8(1):1296-1300
www.ijcem.com /ISSN:1940-5901/IJCEM0003980

Original Article

Sternocleidomastoid muscle flap used for repairing the dead space after supraomohyoid neck dissection

Jinzhong Li, Zhengxue Han

Department of Oral and Maxillofacial-Head and Neck Surgery, Beijing Stomatological Hospital, Capital Medical University, Beijing, China

Received November 19, 2014; Accepted January 9, 2015; Epub January 15, 2015; Published January 30, 2015

Abstract: Surgical site infection (SSI) is a common complication followed neck dissection and dead space is a common reason of SSI. The present study is aimed to explore whether the sternocleidomastoid muscle (SCM) flap transposition to repair the dead space in level II of neck could decrease the postoperative SSI in patients with oral squamous cell carcinoma (OSCC) underwent supraomohyoid neck dissection (SOND). Ninety-six patients with cT2-3N0 OSCC who underwent extended resection of primary cancer combined SOND and reconstructed with free flap from March 2011 to October 2014 in our department were included. Forty-eight cases underwent SCM transposition to repair the potential dead space in level II of the neck, the other 48 cases did not. The two groups were matched at age, gender, concomitant diseases, and perioperative treatments. All the patients underwent exhaustive hemostasis and careful placement of negative pressure drainage. The wound healing was observed on 7 days postoperatively. The SSI rates of neck between the two groups were compared using Fisher's exact test. The dead space in level II was observed in all the neck wounds after SOND. The neck wounds healed by primary intention in 46 cases underwent SCM flap transposition, and in 39 cases underwent routine SOND only. Two cases with SCM flap transposition and 9 cases in the group without SCM flap transposition presented SSI in neck. There was significant difference in the SSI rate between the two groups ($P = 0.0248$). The dead space in level II could be an important cause of SSI in neck followed SOND. Repairing of the dead space in level II using SCM flap transposition reduce the SSI rate of neck followed SOND.

Keywords: Supraomohyoid neck dissection, surgical site infection, oral squamous cell carcinoma

Introduction

Head and neck cancers rank as the 6th most common cancer worldwide and oral squamous cell carcinoma (OSCC) is an important head and neck cancer. The mainstay of treatment for OSCC is surgery, with extended resections demanding restoration of form and function commonly in the form of free tissue transfer. Cervical node metastasis is an important reason of poor prognosis of OSCC. The dissemination of metastatic cancer to regional lymph nodes tends to follow a predictable pattern. Most metastases of OSCC are confined to levels I-III [1]. Recent studies demonstrate that elective neck dissection is beneficial to the outcome of OSCC patients. About 30% OSCC with clinical negative neck (cN0) would be found to have occult metastatic disease [2]. Selective neck dissection in the form of supraomohyoid neck dissection is useful as a staging procedure [3]. In our department, a "wait and see" policy is often adopted for the neck of T1N0 OSCC, the extended resection of the primary cancer combined with elective SOND and reconstructive surgery with a free flap are standard protocol for OSCC of T2-3N0 stage, while for N1 stage, functional neck dissection is often recommended. T2-T3N0 stage occupied a considerable proportion of the OSCC cases in our department.

Surgical site infection (SSI) is one of relative common complications following neck dissections for OSCC. The reported SSI rates of neck dissection ranged from 3.3% to 32.1% [4, 5]. The well known risk factors associated to neck SSI include diabetes, smoking, malnutrition [6], preoperative radiotherapy [4] and chemotherapy [7]. The treatment of such SSI is often pas-

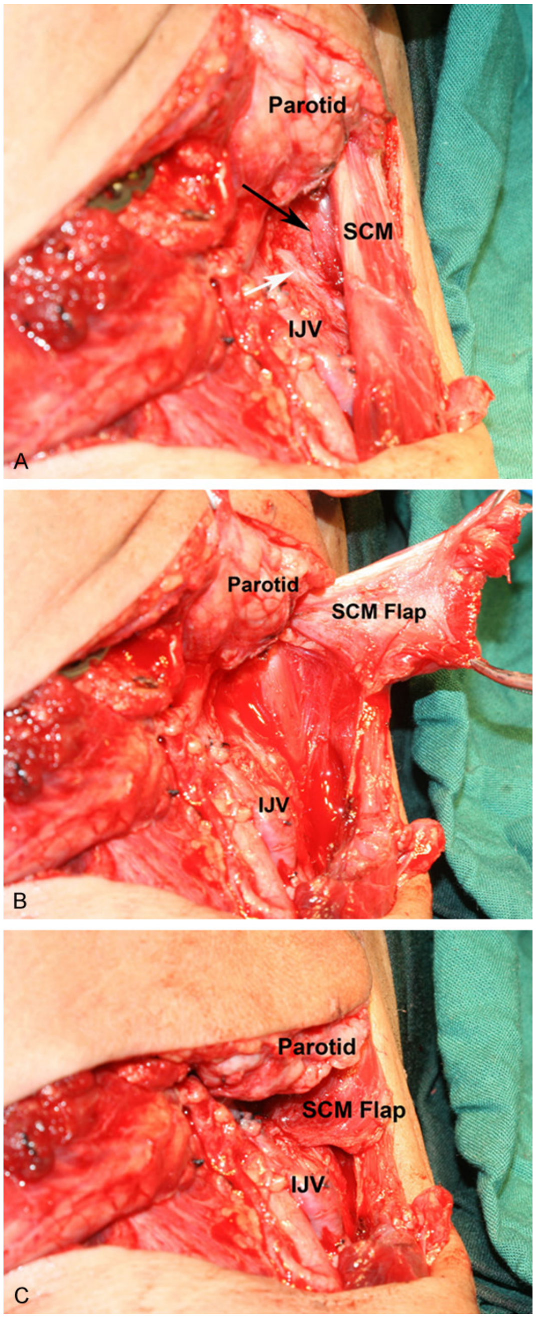

Figure 1. The dead space presented in upper cervical region and the SCM flap transposition. A: The black arrow showed the dead space, the white arrow showed the SAN; B: The development of SCM flap; C: The transposition of SCM flap.

sive drainage and dressing change. In 1980, Schantz, et al [8] reported that improved survival rates in laryngeal cancer patients who had postoperative wound infection following total laryngectomy and radical neck resection in a retrospective analysis, especially evident in the patients with stage III disease. However, infection-related events were associated with at least 5.6 longer hospital days and $49,153 charge compared with hospitalizations without such an event [9]. The worse outcome of SSI would be the free flap loss.

The common infection site following SOND located in the upper neck incision in our department, where the posterior was part of neck dissection incision and was superficial to level II of neck. The traditional explanation for SSI in this site was saliva collection from parotid tail and formation of saliva fistula. However, the parotid tail was routinely intact during SOND in our department. Potential dead space were observed in level II between the superior end of sternocleidomastoid (SCM), posterior belly of digastrics muscle and the protruding mandibular angle following SOND. There were no results when we retrieved in PubMed that the SSI following neck dissection involved level II. However, the positive relation between the SSI location and level II may suggest there were some links.

First described by Owen in 1955, the SCM myocutaneous flap is a versatile flap and remains an important tool in head and neck reconstruction [10]. Pathak et al. [11] described interposition of SCM between pharynx and carotid sheath to isolate the latter from salivary contamination in the event of salivary leak. The indications for SCM flap were extended in accordance with the recent increases in the number of SOND and functional neck dissection cases. Obliterating dead space when used as a muscle flap was also one of its indications. The blood supply to the SCM muscle can be divided into 3 parts: upper, middle, and lower. The upper third of the SCM muscle was found to be constantly supplied by branches of the occipital artery and corresponding vein [12]. With the agreement of patients, we designed a SCM flap with a pedicle superiorly to repair the potential dead space at level II. The present study will describe how we design the SCM flap and present the SSI of neck following such performance.

Material and methods

Subjects

Ninety-six patients with clinical T2-3N0M0 OSCC, who underwent reconstruction with free

Table 1. General information of included patients

		SOND[1] with SCM[2]	SOND without SCM
Gender	male	26	25
	female	22	23
Age	range	35-72	37-70
	average	61.5	59.5
Location	tongue	15	14
	mouth floor	10	7
	buccal	8	7
	gingival	12	19
	oral pharyngeal	3	1
Wound healing	primary	46	39
	secondary	2	9
SSI rate		4.17%	18.75%
Sum		48	48

1. Supraomohyoid neck dissection; 2. Sternocleidomastoid muscle flap transposition.

flap following extended resection of primary cancer and SOND from March 2011 to October 2014 in the Department of Oral and Maxillofacial-Head and Neck Surgery, Beijing Stomatological Hospital, were included. The patients with concomitant general systematic diseases like diabetes, nephropathy and hepatopathy, or ever underwent preoperative radiotherapy or chemotherapy was excluded. Forty-eight cases of them underwent SCM flap transposition to level IIB after SOND, the other 48 previous patients were chosen as historical control, which underwent routine SOND without SCM flap transposition.

Operations

Routine SOND (level IA, IB, IIA, IIB and III) were performed to all patients, the parotid tails were carefully preserved during SOND. The SAN must be carefully dissected free from the surrounding fibroadipose tissue. When the SOND was finished, the dead space was checked in level II between the levator scapula and splenius capitis muscles and SCM (**Figure 1A**). The anterior 1/3 bundles of muscle were transected at the border of the upper and the middle 1/3 SCM (**Figure 1B**), which formed a muscle flap with a pedicle superiorly. The transected muscle was packed in the potential dead space of level II and sutured for fixation (**Figure 1C**). Exhaustive hemostasis, meticulous manipulation and careful placement of active drainage were performed in all the cases. The prophylactic antibiotics were cefuroxime sodium, 1.5 g administrated intravenously 30 minutes prior to the start of surgery, and last for 3 days. The postoperative SSI rate of the neck was compared between these 2 groups of patient. The criterion for SSI of neck wound was pus formation and wound dehiscence within 7 days followed the surgery. All these operations were approved by the patient individually and by the ethics committee of Beijing Stomatological Hospital.

Statistics

The SSI rates between the two groups were compared using Fisher's exact test.

Results

The general information of included patients was showed in **Table 1**. The potential dead space in level IIB was observed in all the neck wounds after SOND. The neck wounds healed by primary intention in 46 cases underwent SOND with SCM flap transposition, in 39 cases underwent routine SOND only. Two cases with SCM flap transposition and 9 cases in the group without SCM flap transposition presented SSI in neck within 7 days postoperatively. There was significant difference in the SSI rate between the two groups according to Fisher's exact test ($P = 0.0249$).

All the 48 patients underwent SCM flap transposition were free of abnormalities of head mobility. There were no harm and adverse events encountered in the series of SCM transposition.

Discussion

The SSI rate following SOND in the control group was 18.75%, which was higher than some reported data associated with neck dissection. However, there was actually no SSI data associated with SOND alone that can be retrieved in PubMed. As an elective neck dissection, SOND was often performed in patients with OSCC of cT2-3N0M0. The OSCC with such T stage often necessitated free flap reconstruction for the defect resulted from extended resection of primary cancer. The present series of cases excluded the patients who underwent SOND alone.

Reconstructive surgery per se maybe a risk factor of SSI. Hirakawa et al. [4] reported a series of 277 cases with head and neck cancer who underwent clean-contaminated surgery for primary lesions, the overall SSI rate was 32.1%. They identified 2 independent risk factors for SSI as reconstructive surgery and chemoradiotherapy. The reconstructive surgery may lead to larger operative field, heavier inflammatory effect from tissue injury and higher blood loss, it can also prolong the operative time. Operative time itself was an independent risk factor associated with wound infection [5].

The potential dead space under the upper 1/3 SCM can be exposed when we tracted the anterior boundary of SCM posteriorly in the operative position, while it may be eliminated as the head turned ipsilaterally and muscle relaxed. However, the reconstructive surgery associated with microsurgical anastomosis of vessels often demand the head of patient turn contralaterally and immobilization for several days in order to avoid the twist of the pedicle. Such immobilization would also tight the SCM and form the dead space under the upper SCM once again. The reconstructive surgery also demand the patient lie in bed without pillow for several days, which facilitate the fluid collection in the lowest site in the neck dissection field.

There was controversies that the SSI in the upper neck following neck dissection may be relative to the saliva collection from the leak of parotid tail, since the parotid tail which containing lymphatic tissue would often be resected during neck dissection. In the present study the parotid tail was preserved and the superficial fascia was kept intact. Wound amylase assay [13] may be a method to differentiate whether saliva collection is the origin of SSI in this series of cases, it was not adopted in the present study for technical reason.

Drainage is used following neck dissection to prevent the collection of fluid and to aid healing. The placing of drainage should be carried out separately from the incision to reduce the risk of infection [14]. Although there is some controversy whether active or passive drains should be used when neck dissections are carried in conjunction with free tissue transfer, the evidence suggests that active drainage should be employed in both free flap and non-free flap cases [15]. Active drains are thought to be more effective due to their ability to assist adherence of skin flaps and the minimization of bacterial migration. The fluid collection and the dead space interact with each other and were both common reasons of SSI. In present study, active drains were used in patients of both groups. The drainage in patients with SSI of neck were often more than those in patients without SSI, and frequently turned into pus 3-5 days postoperatively. The total intraoperative blood loss was a strong predictor of postoperative drainage, the duration that the drains remain in place, and the duration of hospital stay [16].

Antibiotic prophylaxis was also a precaution to avoid SSI, the reported incidence of infection approaches 90% in clean-contaminated wounds without perioperative antibiotics, while it has been reduced to 10% with antibiotic prophylaxis [5]. Russell [17] support antibiotic prophylaxis was effective when used in clean-contaminated oncologic surgery and administered prior to the start of surgery, but there is no evidence to support the use of antibiotic prophylaxis beyond 24 hours postoperatively. In present study, all the patients were treated with cefuroxime sodium 1.5 g administrated intravenously 30 minutes prior to the start of surgery, and last for 3 days as traditionally. There were no difference in antibiotic prophylaxis between the 2 groups of patients.

Some new surgical instruments used in neck dissection like ultrasonic activated (harmonic) scalpel [18] was also reported could improve patient recovery, superior to the use of electrocoagulation. The use of the harmonic scalpel during neck dissection led to diminished bleeding, shorter operative time, lesser seroma formation and better wound healing in the postoperative period. In this present study, traditional electrocoagulation was used during the neck dissection, which may be the cause of the relative higher neck SSI rate in the control group.

The present study was not a prospective randomized controlled clinical trial. The 48 SOND without SCM transposition were performed previously. No matter how careful the intraoperative and perioperative management, including exhaustive hemostasis, careful placement of active drainage, and prophylactic administration of antibiotics, the neck wound infection could not be eliminated thoroughly. The dead space in level II was observed through cautious checking of the operation field under such conditions. So, these dead spaces were hypothesized reason of neck wound infection followed SOND, and another 48 cases SOND with SCM transposition to repair such dead space were performed. The potential dead space in level II may become actual resulted from the immobilization of head policy followed the free flap transferring. The dead space in level II may be the reason of the SSI in upper neck followed SOND. The reconstructive surgery per se may make the conditions serious through more injury to the tissue, prolonged operation time and more blood loss.

In conclusion, this present paper describes the SCM flap transposition to level II of neck to repair the potential dead space followed SOND, which could decrease the SSI rate of neck. Although its value is still restricted as the limited number of patients who underwent such a procedure, it proposes a promising problem need to be further validated by controlled randomized clinical trial.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Zhengxue Han, Department of Oral and Maxillofacial-Head Neck Surgery, Beijing Stomatological Hospital, 4 Tiantan Xili, Dongcheng District, Beijing 100050, China. Tel: 86-10-57099150; Fax: 86-10-57099150; E-mail: omsbeijing@163.com

References

[1] Shah JP, Candela FC, Poddar AK. The patterns of cervical lymph node metastases from squamous carcinoma of the oral cavity. Cancer 1990; 66: 109-113.
[2] Kowalski LP, Magrin J, Waksman G, Santo GF, Lopes ME, de Paula RP, Pereira RN, Torloni H. Supraomohyoid neck dissection in the treatment of head and neck tumors. Survival results in 212 cases. Arch Otolaryngol Head Neck Surg 1993; 119: 958-963.
[3] Lam KH. The role of neck dissection in head and neck mucosal squamous cancer. Aust N Z J Surg 1999; 69: 865-870.
[4] Hirakawa H, Hasegawa Y, Hanai N, Ozawa T, Hyodo I, Suzuki M. Surgical site infection in clean-contaminated head and neck cancer surgery: risk factors and prognosis. Eur Arch Otorhinolaryngol 2013; 270: 1115-1123.
[5] Man LX, Beswick DM, Johnson JT. Antibiotic prophylaxis in uncontaminated neck dissection. Laryngoscope 2011; 121: 1473-1477.
[6] Sepehr A, Santos BJ, Chou C, Karimi K, Devcic Z, Oels S, Armstrong WB. Antibiotics in head and neck surgery in the setting of malnutrition, tracheotomy, and diabetes. Laryngoscope 2009; 119: 549-553.
[7] Penel N, Fournier C, Lefebvre D, Roussel-Delvallez M, Sarini J, Kara A, Mallet Y, Lefebvre JL. Previous chemotherapy as a predictor of wound infections in nonmajor head and neck surgery: Results of a prospective study. Head Neck 2004; 26: 513-517.
[8] Schantz SP, Skolnik EM, O'Neill JV. Improved survival associated with postoperative wound infection in laryngeal cancer: an analysis of its therapeutic implications. Otolaryngol Head Neck Surg 1980; 88: 412-417.
[9] Lee MK, Dodson TB, Karimbux NY, Nalliah RP, Allareddy V. Effect of occurrence of infection-related never events on length of stay and hospital charges in patients undergoing radical neck dissection for head and neck cancer. Oral Surg Oral Med Oral Pathol Oral Radiol 2013; 116: 147-158.
[10] Tanaka N, Yamaguchi A, Ogi K, Kohama G. Sternocleidomastoid myocutaneous flap for intraoral reconstruction after resection of oral squamous cell carcinoma. J Oral Maxillofac Surg 2003; 61: 1179-1183.
[11] Pathak KA, Wiallet NR, Nason RW. Sternocleidomastoid muscle interposition to prevent carotid artery blowout. J Surg Oncol 2008; 98: 565-566.
[12] Kierner AC, Aigner M, Zelenka I, Riedl G, Burian M. The blood supply of the sternocleidomastoid muscle and its clinical implications. Arch Surg 1999; 34: 144-147.
[13] Larsen LR, Schuller DE. Wound amylase levels as an early indicator of orocutaneous fistulae. Laryngoscope 1984; 94: 1302-1306.
[14] Kerawala CJ, Heliotos M. Prevention of complications in neck dissection. Head Neck Oncol 2009; 1: 35.
[15] Batstone MD, Lowe D, Shaw RJ, Brown JS, Vaughan ED, Rogers SN. Passive versus active drainage following neck dissection: a non-randomised prospective study. Eur Arch Otorhinolaryngol 2009; 266: 121-124.
[16] Urquhart AC, Berg RL. Neck dissection: predicting postoperative drainage. Laryngoscope 2002; 112: 1294-1298.
[17] Russell MD, Goldberg AN. What is the evidence for use of antibiotic prophylaxis in clean-contaminated head and neck surgery. Laryngoscope 2012; 122: 945-946.
[18] Kos M, Engelke W. Advantages of a new technique of neck dissection using an ultrasonic scalpel. J Craniomaxillofac Surg 2007; 35: 10-14.