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Hardware complications in oromandibular defects: Comparing scapular and fibular based free flap reconstructions

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ABSTRACT

Background: Despite improvements in surgical technique and technology, hardware complications occur relatively frequently. This study analyzes hardware complications in patients undergoing oromandibular reconstruction using scapular (SFF) or fibular (FFF) free flaps.
Methods: Retrospective data for 178 patients was obtained (1999–2014) at University Hospital Network (Toronto, Canada). Univariable and multivariable analyses were performed to identify risk factors for hardware complications.
Results: Patients with FFF reconstruction (n = 129) had significantly more hardware complications than those with SFF (n = 49) (16% vs. 2%;$p = 0.01$). Surgical site infection (SSI) (OR = 7.05; $p < 0.01$), defect type (OR = 2.63; $p < 0.01$) and flap (OR = 0.12; p = 0.01) were significant predictors of hardware complications on univariable analysis. Flap type (OR = 0.12; p = 0.04) was an independent predictor of plate complication after adjusting for SSI. A subgroup analysis suggested a trend towards fewer hardware complications with SFF stratified by mandibular defect type.
Conclusions: Scapular free flaps are associated with a lower rate of hardware-related complications in oromandibular reconstruction.

Introduction

The advent of microvascular free tissue transfer has revolutionized oromandibular reconstruction. The combination of osseocutaneous or osseomyogeneous free flaps in addition to advances in instrumentation with locking screw technology and low profile plates has greatly improved the functional and cosmetic outcomes for patients with mandibular defects [1]. Despite these advances, hardware complications remains a significant challenge with roughly 15% of patients experiencing hardware related complications [2]. Plate exposure, plate fracture, plate infection, and loose screws are some of the more common hardware complications which in turn can lead to further operative procedures, prolonged antibiotic use, and reduced quality of life (Fig. 1) [3]. Many factors such as previous radiation therapy, smoking status, diabetes, and types of hardware have been identified as factors that can contribute to hardware complications [3–6].

Although there are well established patient and disease related risk factors that are associated with hardware related complications, there is a paucity of data on donor site choice. Contemporary free tissue choices for oromandibular reconstruction often include fibula (FFF), iliac crest, osseocutaneous radial foream osseocutanous (OCRFFF), and the scapular system (SFF) [7]. Some studies comparing the FFF and OCRFFF have reported an increased risk of hardware complications with OCRFFF reconstructions [6,10,11]. No studies to date, however, have compared complications between the FFF and SFF.

The FFF is commonly considered the standard in many centers for oromandibular reconstruction due to its length of bone, caliber of bone stock for dental rehabilitation, predictable anatomy, pedicle length, and ability to harvest simultaneous with the ablative procedure [8,9]. It is, however, limited in patients with large soft-tissue defects, advanced age, peripheral vascular disease, and with

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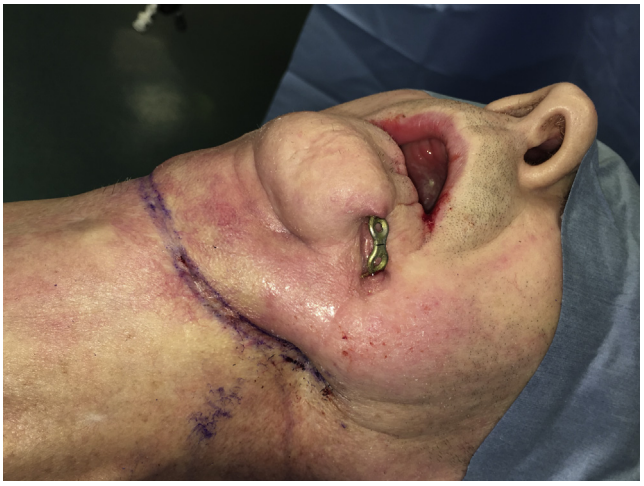

Fig. 1. Hardware complication (plate exposure) in patient who has undergone previous oromandibular reconstruction for squamous cell carcinoma of the oral cavity.

pre-existing ambulatory limitations. The osseous SFF can be harvested either based on the circumflex scapular vessels or based on the angular branch of the thoracodorsal artery, the latter of which provides longer pedicle length and are generally spared of microvascular disease. The SFF similarly provides good bone stock particularly when the crest of the scapula is utilized, a large volume of soft tissue particularly when chimeric flaps are utilized. This system of flaps, however, is limited by the inability to perform simultaneous harvest as well as the length of available bone. Overall, the soft tissue abundance combined with great versatility makes the SFF an excellent potential donor site for oromandibular reconstruction particularly to augment soft tissue defects that may predispose patients to hardware related complications such as plate exposure. This study aims to compare the risk of hardware complications between patients reconstructed with FFF and SFF for oromandibular defects.

Methods

This study was approved by the research ethics board at the University Health Network (04-0648-CE).

Patients

Patients were identified in an oral cavity registry of patients treated with osseous free flap reconstruction for oromandibular defects between 1999 and 2014 at the University Health Network in Toronto, Ontario, Canada.

Inclusion criteria

Patients who had: (1) composite oromandibular resection for pathology primarily originating from the oral cavity or bony mandible, (2) reconstruction with either a SFF or FFF, (3) had a minimum of at least one documented follow up visit after surgery, and (4) 18 years of age or older at the time of surgery.

Exclusion criteria

Patients with the following were excluded: (1) oromandibular resection not related to malignancy (e.g. osteoradionecrosis or osteomyelitis, craniofacial syndromes, osteomyelitis, pathological fracture unrelated to presence of a primary pathology, trauma, and Gorham's syndrome), (2) total flap loss including the osseous segment (3) incomplete records, (4) plate exposure secondary to tumor recurrence. In the comparison of patients undergoing SFF or FFF reconstruction, patients with external skin involvement in their primary resections were excluded for this part of the analysis. Total flap loss was excluded from data collection because these patients (n = 5) either required reconstruction with another flap or left hospital with hardware exposed secondary to the flap loss.

Data collection

Demographic, complications, hardware information, and clinicopathologic data was extracted from operative, clinical, and pathology notes as well as operating room instrumentation inventory datasets. Variables collected include: age adjusted Charlson Comorbidity Index (CCI), surgical site infection, presence of intraoral or external wound dehiscence, radiation exposure, diabetes, active smoking history, and hardware (plate profile height) details. Age adjusted-Charlson Comorbidity Index (CCI) scores, were calculated using relevant comorbidities [12]. Surgical site infection (SSI) were defined using the Center for Disease Control criteria and categorized based on perioperative clinical data [13,14]. Intraoral or external skin dehiscence were distinguished from SSI if no clinical evidence of infection was present. Radiation exposure was defined as any prior radiation therapy taking place before the hardware complication event. Active smoking history was defined as smoking up to four weeks prior to the surgical date (hardware insertion date). Oromandibular defects were classified using the Shaw Classification [15]. Where available, post-operative computed tomography scans were used to confirm defect sizes and classification.

Outcomes

The primary outcome for this study was the proportion of hardware complications. These included infection in the hardware site requiring antibiotics and with or without hardware removal, hardware exposure, pain or symptoms as associated with hardware requiring hardware removal, and device failure such as plate fracture [2,16].

Data analysis

Statistical analysis was performed using SPSS Statistics (v.24.0 Armonk, NY:IBM Corp.). An alpha level of 0.05 was set for statistical significance. Demographic data was summarized using descriptive statistics and groups were compared for baseline differences using the student *t*-test, Chi-Square test, and Mann Whitney *U* test depending on the type of variable and whether or not it was parametrically distributed. Univariable analysis of hardware complications was done with either Chi-Square test or with binomial logistic regression. Multivariable analysis was done with a multivariable binomial logistic regression. Two independent variables were selected for the multivariable binomial logistic regression based on the statistical rule of thumb recommending 10 events per variable included in the model. Subgroup analysis was performed based on patients stratified into defects and compared using Fisher's exact test.

Results

Demographics

A total of 178 patients from the database met inclusion criteria and were included in the analysis. 72.4% (n = 129) of patients received a FFF and 27.5% (n = 49) patients had a SFF. There were