Oral Oncology 75 (2017) 61–66

Contents lists available at ScienceDirect

Oral Oncology

journal homepage: www.elsevier.com/locate/oraloncology

Head and neck free flap reconstruction: What is the appropriate post-operative level of care?

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ARTICLE INFO

Keywords:
Head and neck cancer
Head and neck reconstruction
Free flap
Critical care
ICU

ABSTRACT

Patients undergoing head and neck reconstruction require complex, multidisciplinary postoperative care which may include wound care, flap monitoring, tracheostomy management, and management of comorbid conditions. Historically, patients undergoing major resection of a head and neck or aerodigestive tract malignancy with regional or free flap reconstruction were routinely admitted to the ICU. Although head and neck cancer patients may have multiple medical comorbidities that may require postoperative critical care, the current trend in many institutions is to transfer stable and less medically complex patients to non-intensive care-level units with specialty trained nursing staff. These units have been shown to decrease the total cost of care without compromising the quality of care, length of stay, or postoperative complications.

Introduction

Postoperative care of the head and neck free flap patient requires close free flap monitoring, airway management, parenteral feeding, and management of medical comorbidities [1,2]. Patients undergoing head and neck reconstructive surgery may be admitted to an intensive care unit (ICU), a step-down (or other intermediate care) unit, or an in-patient ward after surgery. Head and neck oncologic surgery may predispose patients to infections and poor wound healing due to medical comorbidities, exposure to radiotherapy and the proximity of the aerodigestive tract to neurovascular structures and soft tissue planes [3]. ICU admission may facilitate immobilization which limits mechanical disruption of microvascular anastomoses and allows more invasive hemodynamic monitoring [4]. The disadvantages of post-operative ICU admission include nosocomial infections, limited bed availability, and increased cost. Head and neck cancer patients have been identified as a population who is at high risk for utilizing health care resources [5]. This article discusses the common indications for postoperative critical care for head and neck reconstruction patients and reviews current trends in postoperative management.

Critical care after head and neck reconstruction

Garantziotis et al. described three main categories of head and neck surgical patients requiring perioperative critical care: the head and neck cancer patient, the head and neck trauma patient, and patients requiring critical care as a result of a medical or surgical complication after a procedure [3]. Patients with advanced head and neck cancer may have multiple comorbidities that increase the risk for post-operative complications [6]. Many centers therefore routinely admit patients to the ICU after major head and neck oncologic / free flap surgery [7,8]. The reported postoperative ICU admission rates after head and neck reconstruction vary widely in the literature. Downey et al. reported a low (1.5%) incidence of postoperative ICU admission after head and neck surgery [1]. To et al. performed a retrospective analysis of ICU admission after major head and neck surgery and found that 3 of 47 patients (6.3%) undergoing regional or free flap reconstruction underwent planned admission to the ICU after surgery [9]. The decision for ICU admission was determined by the anesthesia team based on concerns for airway stability. Most of the ICU level care was reserved for craniofacial patients requiring postoperative ventilator support to avoid hypercarbia and cerebral edema or in surgeries affecting the thorax or abdomen (e.g. gastric pull-up procedure). De Melo reported that 42.7% of patients undergoing radical surgery for oral cavity squamous cell carcinoma were admitted to an ICU level care setting after surgery [10]. The average ICU length of stay (LOS) for head and neck free flap patients varies in the literature between 0 (for institutions with high-dependency or specialty units) and 2–11 days in studies describing postoperative ICU admission [1,4,11–14]. Many surgeons routinely admit head and neck free flap patients to the ICU for

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http://dx.doi.org/10.1016/j.oraloncology.2017.10.022
Received 30 June 2017; Received in revised form 22 October 2017; Accepted 23 October 2017

24–72 h for a high level of nursing care availability [12,9,15–17]. In 2007, Spiegel and Polat's survey of head and neck reconstructive surgeons revealed that most (88.9%) free flap patients are admitted to an ICU postoperatively for an average of 2.4 days [18].

Most authors agree that the first 24 h after surgery is the most common time period for acute complications to occur [19]. Historically, planned postoperative intubation and/or mechanical ventilation in the ICU was routinely performed after major head and neck reconstruction to allow for edema resolution and airway stabilization. This practice has been associated with difficulty weaning from mechanical ventilation, respiratory insufficiency, and ventilator associated pneumonia [13]. Sedation may also decrease flap perfusion pressures by decreasing systemic blood pressure. Immediate postoperative extubation in patients undergoing head and neck surgery has been shown to reduce ICU LOS without affecting flap-or wound-related complications [11].

Microvascular reconstruction has been identified as a significant determinant of cost and length of stay after head and neck surgery cases [20]. There is wide practice variability among surgeons regarding postoperative free flap care and controversy regarding immediate postoperative disposition. The fear of developing complications should not necessitate postoperative ICU admission [21]. Several patient factors must be considered when determining postoperative disposition. For patients undergoing major surgery for oral cancer, de Melo et al. identified bilateral neck dissection and an Acute Physiology and Chronic Health Evaluation II (APACHE II) score greater than 10 as risk factors for postoperative complications. Patel et al. identified risk factors for perioperative complications in patients undergoing head and neck free flap reconstruction to include age, body mass index (BMI), American Society of Anesthesiology (ASA) score, Kaplan Feinstein comorbidity index (KFI) score, preoperative hemoglobin, and tracheostomy [22]. Age, recent weight loss, alcohol dependence, ASA grade, KFI, preoperative hemoglobin, mucosal surgery, anesthesia duration, and crystalloid replacement volume (> 6 mL/kg/hour) were risk factors for prolonged hospital LOS. ASA grade, comorbidity level index, and age have been correlated with perioperative complications in patients undergoing head and neck reconstruction [22–24]. Abt et al. used a modified frailty index to predict ICU level complications in patients undergoing head and neck reconstruction and demonstrated that the score is predictive of critical care support in head and neck reconstruction, especially for free flaps [25].

Tracheostomy has also been identified as a significant determinant of cost and hospital length of stay as well as a predictor for major complications after head and neck surgery [20,22,26,27]. Patients may undergo elective and temporary tracheostomy during major aerodigestive tract reconstruction in anticipation for postoperative edema, however, tracheostomy has been associated with postoperative lower respiratory tract infections, delayed oral intake, airway scarring, tube obstruction, and respiratory arrest [26,28,29]. Many centers are therefore pushing towards avoiding elective tracheostomy. Marsh et al. performed a survey in 2008 of oral and maxillofacial units performing head and neck free flap reconstruction in the United Kingdom and discovered that 39% of institutions would 'almost always' perform elective tracheostomy and 30% of institutions would 'usually' perform tracheostomy [30]. Singh et al. compared tracheostomy to delayed extubation after maxillofacial free flap reconstruction and found no difference in mean ICU LOS but longer mean hospital LOS in tracheostomy patients [26]. Coyle et al. also compared tracheostomy to overnight intubation and found that overnight intubation resulted in a shorter mean ICU LOS and overall hospital LOS [29]. Klug et al., however, reported that a strategy to avoid tracheostomy in patients undergoing free flap reconstruction of irradiated oral cavity and oropharyngeal defects fails in 25.7% of patients; these patients required secondary tracheostomy [14]. Head and neck reconstruction patients undergoing prophylactic tracheostomy are either decannulated during the same hospitalization or during outpatient follow-up. Halfpenny and McGurk described that the median time to decannulation was 10 days in patients undergoing radical head and neck cancer resection [27]. Tracheostomy decannulation may be the end-point of the hospitalization; extending the hospital admission to achieve this goal likely contributes the increased LOS in tracheostomy patients [20,22].

Pulmonary, hemodynamic, cardiac, or other major organ system failures are common medical indications for postoperative ICU admission. Postoperative invasive cardiovascular monitoring is commonly performed; Marsh et al's 2008 survey demonstrated that 87% of units monitor arterial blood pressure 'usually' or 'almost always.' Central venous pressures were measured 'usually' or 'almost always' in 78% of units [30]. Head and neck reconstruction patients are thought to be at risk for perioperative pulmonary complications due to receiving large volumes of intravenous fluids in the setting of intraoperative hypotension to avoid using vasopressors during microvascular reconstruction [31,32]. These patients also have a high incidence of smoking, increased age, concomitant tracheostomy, and comorbid chronic obstructive pulmonary disease (COPD) which contribute to impaired pulmonary status [32–34]. Excessive crystalloid administration may lead to metabolic disturbances and has been shown to increase hospital LOS [22,35,36]. Goal-directed fluid administration is therefore recommended; intraoperative administration of more than 7 L of crystalloid during surgery has been associated with major medical complications as well as free flap complications [37,38]. Patel et al. do not recommend replacing more than 6 mL/kg/hour due to increased perioperative complications [22]. Clark et al. demonstrated that administration of more than 130 mL/kg in 24 h was associated with an increased risk of postoperative medical complications after head and neck free flap reconstruction [34]. Goal-directed management strategies for fluid management using stroke volume variation analysis, blood-pressure analysis, and arterial waveform analysis have been also been described and are associated with reduced reduce intraoperative fluid load and decreased ICU and hospital LOS [36,39]. Blood products also affect outcomes; administration more than 3 units of blood in head and neck free flap patients has been associated with decreased overall survival and increased risk of wound infection [40].

ICU staffing

Intensive care units are typically categorized as "open" or "closed" in regard to intensivist staffing. In the open ICU staffing model, critical care physicians are not required to actively manage every admitted patient. Open units have been described as "low intensity." The closed staffing model designates a critical care physician or team of providers for the management or co-management of all admitted patients [41]. Closed ICUs have been described as "high intensity" units. A systematic review of all critically ill children and adults demonstrated that high-intensity (closed) units were associated with lower hospital mortality, lower ICU mortality, reduced hospital LOS, and reduced ICU LOS [42]. Bhama et al. investigated the impact of a closed versus open ICU setting on head and neck free flap patient outcomes and arrived the same conclusion [41]. These findings may be attributed to the routine postoperative ICU admission of free flap reconstruction patients for the sole purpose of flap monitoring, wound care, or airway management. However, mandatory intensivist consultation for co-management may result in distancing the primary surgical team from the acute postoperative management. Ensuring that diligent wound care, free flap monitoring, and tracheostomy care are provided may be difficult if the head and neck surgical team plays a less active role in acute postoperative management [41]. Bhama et al. believe that management of these issues by an intensivist likely has less of an impact on ICU LOS when compared to more medically complex comorbidities or complications. In their study, an internal medicine physician was consulted for more medically complex patients in the open ICU setting.

Regardless of the staffing model, head and neck free flap patients require a multidisciplinary team of specialists and ancillary staff. ICU