Major Head and Neck Reconstruction during the COVID-19 Pandemic: The University of Pittsburgh Approach

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April 28, 2020

Abstract

The 2019 novel coronavirus (COVID-19) pandemic has created significant challenges to the delivery of care for patients with advanced head and neck cancer requiring multimodality therapy. Performing major head and neck ablative surgery and reconstruction is a particular concern given the extended duration and aerosolizing nature of these cases. In this manuscript, we describe our surgical approach to provide timely reconstructive care and minimize infectious risk to both the providers, patients, and families.

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There are no financial conflicts or disclosures to report on behalf of the authors.

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and aerosolizing nature of these cases. In this manuscript, we describe our surgical approach to provide timely reconstructive care and minimize infectious risk to both the providers, patients, and families.

Introduction

Originating in the city of Wuhan, China, the COVID-19 pandemic has swept across the globe as a true public health crisis. This highly infectious SARS-CoV-2 virus was first reported in early December 2019 in China with the first confirmed case in the United States occurring on Jan 22,2020[1]. Since that time, the United States has seen an exponential rise in cases. Pandemic status was confirmed by the World Health Organization (WHO) on March 11,2020[2].

Early reports out of China suggested that otolaryngologists were at particularly high risk for nosocomial spread due to the aerosolizing nature of our procedures and our inherent proximity to the mucous membranes of the upper aerodigestive tract[3].

Surgical decision making in otolaryngology and specifically head and neck surgery has thus been drastically altered. The inherent goals of these changes have been to limit infectious risk to patients, providers, trainees, and staff while continuing to provide high quality and timely care.

With regard to surgical care in the United State, most systems have transitioned to postponing procedures deemed to be elective and proceeding only with those thought be time sensitive or emergent. In head and neck oncology, we deal with a wide spectrum of pathologies with varying biology. While some cases can clearly be deferred to a later date, the determination of the true urgency of certain procedures is sometimes controversial.

Within the subset of patients requiring surgery and microvascular reconstruction for squamous cancer, however, there is little disagreement regarding the urgency of these cases. At the University of Pittsburgh, we have proceeded with surgery for squamous cell carcinoma and other advanced, high grade malignancies despite the ongoing pandemic concerns.

In this paper, we describe our institutional approach for mitigating risk while continuing to provide appropriate reconstructive care. Topics discussed include our protocols for the perioperative management of patients undergoing surgery with microvascular reconstruction. These protocols were developed through consensus among our head and neck reconstructive division based on review of the existing, but admittedly limited literature.

Outpatient Care

At our institution, preoperative assessments for free flap reconstruction have been largely transitioned to telemedicine video conferencing. The visit is coordinated by the clinical staff and the patient is able to virtually interact with the provider using a smartphone or tablet with video capabilities. This is all integrated into the "MyUPMC" application that is a free online health portal available to all of our patients.

While convenient in many ways for patients, the limitation with theses visits is the inability to perform a comprehensive physical exam. Vascular assessments, such as palpating lower extremity pulses and Allen's testing, are particular deficiencies. Nevertheless, we have found that the ability to select an appropriate donor site and plan accordingly remains intact. The availability of radiographic vascular assessment (CT Angiogram), particularly for fibula free tissue transfer, permits this. The quality of the video visits permits general assessment of tumor size and the anticipated defect, facial nerve functionality, and upper/lower extremity anatomy and function. Discussion with the surgical oncologist, who has performed an in person assessment, further allows appropriate planning. In cases in which a physical exam is essential for planning, that is performed in the preoperative holding area. We are careful to counsel patients that, based on this exam, the reconstructive plan may change.

Postoperative visits have been conducted in person due to the need for wound care, tracheostomy care, and flap assessment. We have attempted to reduce the frequency of postoperative visits when feasible.

Postoperative assessments have been performed with personal protective equipment (PPE) to include a standard surgical mask and eye protection. Any aerosolizing procedure is performed with an N95 mask.

Preoperative Testing

The issue of preoperative SARS-CoV-2 testing remains a controversial topic. Given the aerosolizing nature of major head and neck surgery, risk of transmission to health care providers from asymptomatic patients is a major concern. Additionally, there is legitimate concern that operating on a patient in the preclinical incubation period may lead to worse outcomes with postoperative respiratory compromise[4].

At the University of Pittsburgh, preoperative testing has recently become available to all of our patients undergoing major head and neck surgery. We are now making this an essential component of the preoperative evaluation. Patients that test positive will be postponed and those that test negative will proceed with surgery. However, given that our institutional PCR based testing has a quoted false negative rate of nearly 25%, procedures on negative patients will still be performed with full PPE and N95 masks. It should be noted that some institutions are requiring two negative preoperative tests prior to proceeding with surgery. We have not yet adopted this strategy. Postoperatively, standard surgical masks are worn by the care team during non-aerosolizing care.

Case and Flap Selection

There has been much written in the last several weeks regarding the appropriate timing and prioritization of oncologic procedures. Our head and neck oncology team has developed a tiered structure to classify cases based on urgency (Table 1). At the present moment, only tier 3 cases are moving forward with scheduling. Largely, this includes squamous cell carcinoma and other high grade malignancies. Free flap reconstructions for nononcologic indications (osteoradionecrosis, post-traumatic, wounds) have been postponed.

With respect to flap selection and planning, it should be noted that at our institution we have a weekly reconstructive surgery conference. This was in place prior to the current pandemic. Similar to a multidisciplinary tumor board, this hour long conference includes members of the otolaryngology team, plastic surgery team, and nursing staff. During this conference, the weeks cases are presented in a systematic fashion and the reconstructive plan is discussed in detail. From this conference, a planning document is sent out to all providers involved in these cases (nursing staff, anesthesia, general surgery, oral surgery, otolaryngology, plastic surgery) summarizing key elements.

This conference has transitioned to a virtual, video conference using the Zoom (Zoom Video Communications, Inc) platform. Our multidisciplinary tumor board has also transitioned to this format and satisfaction has been high. In a survey performed of our tumor board, 78% of providers felt that the new video format should be continued indefinitely.

Decision algorithms for our patients have changed. Given that these are highly aerosolizing mucosal cases, a major focus has been on simplifying reconstruction and reducing surgical duration when possible. This includes staging reconstruction when acceptable and substituting locoregional flap reconstruction when feasible. We are limiting cases of microvascular reconstruction to those in which is it felt by consensus to be absolutely necessary. Often, these decisions are complex and controversial.

Simplifying reconstructive techniques may have functional consequences and may increase the incidence of local wound complications (dehiscence, fistula, etc). As such, these decisions much balance concerns regarding surgical expediency, creation of a safe wound, and functional restoration. In an effort to standardize this thought process, we have prioritized our reconstructive cases in a tiered fashion similar to our oncology team (Table 2).

Even within the subset of cases that are thought to require free flap reconstruction, the decision regarding performing composite soft tissue with bone reconstruction versus soft tissue reconstruction alone should be

carefully considered. For most defects, the addition of bone reconstruction adds operative time and complexity and in the current pandemic, may not be indicated. A good example is the soft tissue reconstruction of lateral mandibular defects which has been shown in some studies to have comparable functional outcomes[5,6]. When soft tissue reconstruction alone can be done without a large functional consequence, this should be considered.

Our use of virtual surgical planning (VSP) for complex oromandibular reconstructions has not changed but this is likely biased by our institution's experience with this pandemic which has been characterized by a generally low incidence of viral infection. In the setting of large surgical delays, one might consider forgoing VSP planning due to a concern regarding tumor progression and potential intraoperative plan changes. We have found at our institution (unpublished data) that the duration from diagnosis to surgical date is predictive of deviations from VSP planning. Given that our tier 3 oncologic cases have general been able to proceed without delay, our utilization of VSP technology has not changed. Additionally, evidence that VSP generally reduces surgical duration further supports this process[7].

Intraoperative Care

Our intraoperative procedures have been adjusted to adapt to the COVID-19 pandemic. Changes have been made with the primary goals to decrease exposure risk for the operating room team and to conserve PPE. Given the potentially high viral titers on aerodigestive tract mucosal surfaces, all head and neck free flap cases involving mucosal surfaces are performed with N95 masks for all operating room staff. We have reduced the size of the operative team to conserve PPE. These major cases are performed with 4 surgeons (2 attending surgeons, 2 assistants). Thus, the reconstructive component of the procedure is performed entirely by the attending and fellow/senior resident. Also, attending surgeons have agreed upon having no overlapping or concurrent surgical procedures to ensure operative efficiency.

We have worked to optimize case flow to decrease the total amount of PPE used during a case. All flap harvest is done concurrently with flap ablation in a two team approach so that there is no delay in flap transfer to the defect site after the ablation is completed. Preoperative communication with the oncologic team regarding the anticipated defect has allowed us to commit early to our defect for planning purposes.

The surgical team has decreased the amount of times scrubbing in and out during a case to conserve PPE, with the goal of remaining scrubbed in until their portion of the case is completed. Importantly, this also decreases the amount of times that team members are donning and doffing PPE, with PPE removal specifically being high risk for self-contamination[3].

Strategies used during tracheostomy to decrease aerosolization are similar to those published after the SARS outbreak and include using full muscle relaxant to prevent coughing, holding ventilation prior to airway entry, and only resuming ventilation once the tracheostomy tube has been placed with cuff inflated[8]. The number of individuals present during the performance of the tracheostomy is limited to the two otolaryngology surgeons. We are also trying to utilize tracheostomy judiciously and avoid it in cases in which the indication is marginal. A recently published airway scoring system provides a useful framework for determining need for tracheostomy in these complex cases[9].

Our team has noticed subjectively some challenges with prolonged use of the N95 respirators. There is some evidence that prolonged use alters pulmonary gas exchange and promotes hypercarbia[10]. This can present as a headache or lightheadedness. De novo headache symptoms have been found to be present in 81% of N95 users in one recent study[11]. Several of our providers have noted these symptoms during the course of these cases. This obviously has the potential to impact surgical efficiency, performance, and alter decision making capacity. We recommend strategic team breaks during these prolonged cases for recovery.

Intraoperatively all free flaps have both an arterial and venous implantable Doppler sonography probe placed for monitoring due to changes in our postoperative monitoring plan detailed below.

Postoperative Care

The head and neck surgery team has been restructured to decrease the risk of exposure to the entire team from a single patient or a single team member with COVID-19. After anecdotes of department wide quarantines due to possible COVID-19 exposure, we subdivided our head and neck service into two independent teams. This was initiated at a time when our institutional policy for suspected or confirmed COVID-19 exposure was self-quarantine.

The goal was that if one team had to quarantine the other would be able to continue providing patient care. Each team has at least one ablative and one reconstructive attending, one head and neck fellow, one senior resident, and one intern. We have minimized interactions between teams including separate rounding times and elimination of shared workspaces. As mentioned previously, conferences are now virtual which also eliminates physical interaction between teams. The frequency of team rounding has moved from twice daily to once a day.

One of the biggest changes made in response to COVID-19 from a free flap perspective is the postoperative flap monitoring protocol for intraoral flaps by decreasing the frequency of flap checks. The goals were to limit the use of PPE needed for flap checks and to limit surgical team and nursing staff exposure risk. Our previous flap monitoring protocol had been nursing flap checks every 1 hour for 24 hours (postoperative day (POD) 1), every 2 hours for 48 hours (POD 2-3), every 4 hours for 72 hours (POD 4-6), then every 8 hours until discharge. Resident flap checks were performed 6 hours immediately postoperatively, then every 12 hours for the first 72 hours, then once daily. Flap checks previously included both implantable or external handheld Doppler sonography checks as applicable and clinical examination of the skin paddle.

In our new flap monitoring protocol, nursing checks are performed at the prior timing interval but only include checking the arterial and venous implantable Doppler signals and an external skin paddle if applicable. Importantly, the intraoral skin paddle is only checked every 6 hours or if there is a change in Doppler signal, and requires use of proper PPE for the exam. Resident intraoral skin paddle assessment is now performed once at 6 hours postoperatively and then once daily on morning rounds.

These changes decrease the frequency of skin paddle examinations and force a greater reliance on implantable Doppler sonography. Given this increased reliance, we are now implanting both and arterial and venous probe on all cases as mentioned above. Prior to this change, our division protocol called for continuous implantable venous monitoring for all flaps and clinical assessment of arterial perfusion in flaps with a skin paddle amenable to exam.

Ultimately, our new protocol reduces the dependence on the postoperative physical exam. Given that use of implantable doppler technology as an indicator of flap perfusion is imperfect, it is reasonable to assume that such a change in exam frequency could potentially lead to a slightly higher flap failure rate during this time. As a division, this is a risk we have accepted with the hope of reducing potential viral exposures to our team. The effect of resident postoperative flap monitoring frequency on flap survival rates, however, is unclear and controversial. One recent multi-institutional study showed no difference in flap survival rates with reduced resident monitoring frequency[12].

Education

Most of the current changes prioritize the safety of the patient, provider, and trainee over any educational objectives. Clinical volume is down and attending surgeons are performing most aspects of the case to reduce duration. As a consequence, hands on intraoperative surgical education is undoubtedly going to be negatively affected during this time. The overall effect on resident and fellow competency caused by this reduction in volume remains to be seen.

Similarly, educational course are being cancelled and/or postponed. For example, our planned flap dissection cadaver course has been delayed due to concerns regarding 1) violation of social distancing recommendations and 2) potential viral transmission from fresh frozen cadaveric specimens.

To balance some of the negative consequences, some aspects of medical education are being enhanced. Residents are able to engage in research endeavors, studying, and pursue alternative didactic opportunities. Several multi-institutional virtual resident lecture series have sprung up and provided trainees with new options for education.

Conclusion

Our current global health crisis will continue to present new challenges for providing high quality, efficient head and neck reconstructive care. In providing care to cancer patients whose treatment often cannot be postponed, we need to adapt our approach and thinking to optimize patient outcomes and ensure provider safety.

Our current experience with the COVID-19 pandemic has stimulated a fair amount of change in our clinical, research, and administrative practice. It is forcing us to re-examine the urgency of our interventions and why we do the things we do. At our institution, we have adopted a tiered and multidisciplinary approach to our reconstructive decision making.

We hope that some of the change and introspection that has resulted may lead to lasting quality improvement in our processes.

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