

# **PLASTIC SURGERY AND THE COVID-19 PANDEMIC: A REVIEW OF CLINICAL GUIDELINES**

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## Abstract

**Background:** A novel coronavirus disease (COVID-19) was first reported in December 2019 in China and was soon declared a pandemic by World Health Organization. Many elective and non-essential surgeries were postponed worldwide in an effort to minimize spread of disease as well as to conserve resources. Our goal with this article is to review current practice guidelines in setting of the COVID-19 pandemic, based on available data and literature.

**Methods:** Websites pertaining to surgical and medical societies, and government agencies were reviewed, along with recently published literature to identify recommendations related to COVID-19 and plastic surgery procedures.

**Results:** Clinical practice modifications are recommended during the pandemic, in outpatient and perioperative settings. Use of personal protective equipment is critical for aerosol generating procedures such as surgery in the head and neck area. Care for trauma and malignancy should continue during the pandemic, however definitive reconstruction could be delayed for select cases. Specific recommendations were made for surgical treatment of cancer, trauma and semi-urgent reconstructive procedures based on available data and literature.

**Conclusion:** The risk and benefit of each reconstructive procedure should be carefully analyzed in relation to necessary patient care, minimized COVID-19 spread, protection of health care personnel and utilization of resources. Recommendations in this manuscript should be taken in the context of each institute's resources and prevalence of COVID-19 in the region. It should be emphasized that the guidelines provided are a snapshot of current practices and are subject to change as the pandemic continues to evolve.

**Keywords:** COVID-19; Pandemic; plastic surgery; triage; reconstruction; Head and Neck; maxillofacial; Breast reconstruction; skin cancer; Hand Surgery; SARS-CoV-2; Coronavirus

## BACKGROUND

A novel human coronavirus named “severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)” was first reported in Wuhan, China in December 2019, and the outbreak of coronavirus disease 2019 (COVID-19) was declared a pandemic by World Health Organization on March 11<sup>th</sup>, 2020.<sup>1</sup> As of April 24<sup>th</sup> 2020, there are 2,626,321 confirmed cases of COVID-19 worldwide, 181,938 of which resulted in death.<sup>2</sup> In comparison to prior coronavirus outbreaks (2003 SARS pandemic and 2012 MERS outbreak) SARS-CoV-2 so far has shown a lower case-fatality rate.<sup>3,4</sup> However, potential transmission from minimally symptomatic and even asymptomatic patients<sup>3,5</sup> has posed difficulties in regards to case detection and isolation strategies.<sup>3</sup> Means of transmission include respiratory droplets, direct human contact, fecal-oral route, aerosol and fomite (contaminated surface) transmission.<sup>4,6-11</sup> Duration of viral shedding has been reported from 1 to 37 days<sup>12,13</sup> and critically ill patients may possess an enhanced ability of viral shedding.<sup>14</sup>

As the outbreak spreads, intensive research on vaccine development and medical treatment continues worldwide.<sup>15-21</sup> However, to-date, there is no widely available and effective medical treatment or prevention against COVID-19. Health care personnel (HCP) continue to work at the frontlines, at risk of contracting the disease, while providing care to many patients in need. A recent publication from the Chinese Center for Disease Control and Prevention reported that out of 44,672 COVID-19 cases, 3.8% were HCP.<sup>22</sup> This number was reported to be as high as 9% in Italy.<sup>23</sup>

In the midst of the pandemic, non-essential procedures have been postponed or deferred in many countries per government recommendations. Almost all surgical disciplines have modified their operative approach in an attempt to off load the health care system. In the United

States, as of March 2020, plastic surgeons have stopped performing elective procedures, in accordance with guidance from American Society of Plastic Surgeons, American College of Surgeons, American Medical Association, and Centers for Medicare & Medicaid Services.<sup>24-27</sup>

As we continue to carry out necessary reconstructive surgeries, the risk and benefit of each surgical procedure should be carefully analyzed. Our practice should reflect a balance of patient care, protection of HCP, minimized COVID-19 spread, and resource conservation.

Our goal with this article is to summarize practices in plastic surgery during the COVID-19 pandemic and provide recommendations regarding perioperative care and case prioritization based on current evidence. As more data becomes available, it is likely that the strategies outlined in this document will change accordingly.

## **OUTPATIENT VISITS**

During the pandemic it is imperative that patients avoid unnecessary travel to health care facilities where they could expose themselves or others' to further illness. Telemedicine services (audio and video calls) are now being offered for many non-urgent appointments, routine surveillance encounters, and follow-ups. In the United States, these visits are considered the same as in-person visits and are paid at same rate as regular, as per CMS guidelines.<sup>28</sup> Physicians are encouraged to maintain relationship with patients using virtual visits to reassure continuation of care, instead of simply cancelling or postponing appointments.

If an in-person visit is indicated, patients must be queried about COVID-19 symptoms before they come in to the facility. During the visit, patients should be kept in one physical location if feasible and their interaction with multiple HCP should be minimized. Practitioners should carry out an expedient visit, use appropriate PPE, and perform a more focused physical

exam.<sup>29</sup> Clinical scenarios with a higher risk of disease transmission to practitioner include examination of ear, nose, mouth or throat, placement/removal of nasal packing, tracheostomy care or any procedure that involves manipulation of mucosa. Such procedures should be limited to patients who have a clear indication as infectious aerosols can remain in the room for three hours or more.<sup>10</sup> Patients who are asymptomatic and untested should be approached as COVID-19 positive.

## **SURGICAL PROCEDURES**

A judicious approach in clinical practice would be to postpone all elective surgery, carrying out urgent and emergency procedures only, to preserve resources and minimize viral spread. (Table 1)<sup>25,26,30,31</sup> Allowable and appropriate operations are those where a delay would have significant negative impact on outcome of the condition. There are valuable resources from surgical and medical societies, and government agencies to help guide the decision making process in patient and procedure selection. We should also realize that regional prevalence of COVID-19 and individual institutional factors such as the availability of resources or patient's need for postoperative care (i.e Intensive care unit (ICU) care) will impact decision making.

As the pandemic continues to evolve and hopefully declines, the scope of practice can be broadened according to emerging guidelines. Transitioning to normal function should be undertaken in a tiered approach. Recommendations in Table 1 can be employed in reverse order, i.e gradually resuming treatment of skin cancers, breast reconstructions and eventually phasing in all elective surgeries and cosmetic procedures. The transition is subject to change depending on the number of cases in that particular region, resources of individual institutions, as well as capacity of the health care system in general.

Below, we present recommendations for perioperative care as well as management of specific medical conditions, as it relates to plastic surgery practice.

### *Perioperative Care*

The patient's COVID-19 status should be determined prior to surgery, if possible.<sup>25,32</sup> Reverse transcriptase polymerase chain reaction (RT-PCR) is the preferred laboratory-test to-date<sup>33,34</sup>, with diagnostic accuracy in the range of 56%-83%.<sup>35,36</sup> As availability and reliability of PCR tests increase, preoperative assessment of COVID-19 status will presumably become standard of practice. Patients who are positive should be operated in designated operating rooms with a team dedicated to their care.<sup>14,37-39</sup> The positive pressure airflow environment of the operating room may enhance the risk of viral transmission, therefore conversion to negative-pressure airflow room should be considered.<sup>14</sup> Since the viral pathogen survives on environmental surfaces for extended periods of time, usual cleaning practices may be inadequate and need adjustment.<sup>10,40-42</sup> Multi-faceted perioperative infection control will ensure that the patients are appropriately cared while the HCP is protected.<sup>38,43,44</sup> (Table 2)

Another important step in delivering health care is identification of aerosol-generating procedures (AGPs), where more stringent precautions are advised due to a higher risk of disease transmission to health care personnel. Such procedures typically involve airway manipulation (i.e intubation), breach of mucosa, gastrointestinal tract surgery and thoracic surgery<sup>14,29,45,46</sup> The coronaviruses have been shown to be also present in the blood stream and body fluids<sup>6,7,14,25,37,44</sup> thus bone-sawing procedures and electro-cautery use is also related with increased potential exposure.<sup>44,47</sup> A list of high risk AGPs that plastic surgeons may encounter are summarized in Table 3.<sup>25,29,48</sup>

One of the most commonly debated topics in setting of COVID-19 pandemic is choice of personal protective equipment (PPE). Despite conflicting practices worldwide, use of respirator masks that efficiently filtrate airborne particles (i.e N95 respirator), eye protection and isolation gowns are usually recommended.<sup>14,25,38,49</sup> Most institutions have developed individual protocols adapted from guidelines of World Health Organization.<sup>50</sup> Utilization of appropriate PPE during head and neck surgery is particularly important due to high risk of viral transmission. When performing high-risk aerosol generating procedures, health care personnel should wear a N95 mask with goggles/face shield, or powered air purifying respirators (PAPR), gown and double gloves to achieve adequate protection.<sup>29</sup> Practitioners are advised to take precautions regardless of COVID-19 status, as asymptomatic cases are not uncommon and testing may be limited.

#### *Cancer care*

Though cancer surgery is not considered elective, surgical interventions need prioritization. With diminished resources oncologists must consider what treatments are most likely to be successful, symptom relieving, or lifesaving. For select patients, delays in surgical treatment may be acceptable as they undergo neoadjuvant treatment.<sup>51</sup> A multidisciplinary tumor board conference is most helpful to determine if the patient is a candidate for surgery versus alternative treatments or observation and should be documented in patient's chart. Evidence shows that cancer patients have a higher risk of contracting COVID-19 and developing severe events related to disease necessitating ICU admission, along with higher mortality rate.<sup>52,53</sup>



## Breast Cancer and Reconstruction

Depending on stage and receptor status of the tumor, endocrine therapy or neoadjuvant chemotherapy may precede surgery.<sup>54</sup> Post-mastectomy reconstruction options will be limited, thus patients are encouraged to undergo breast conserving surgery when possible. A definitive mastectomy and/or reconstruction could be performed in a delayed fashion.<sup>54,55</sup> Surgeons should consider only addressing the cancer side, and avoid contralateral operations that might prolong surgery. Delayed and revisional breast reconstruction surgeries are elective and thus should be postponed.<sup>55</sup>

Decisions about immediate breast reconstruction are less straightforward since the patient is being brought to the operating room by the breast surgeon. In general, plastic surgeons should err on the side of caution and delay reconstruction.<sup>55</sup> Immediate reconstruction has higher risk of complications compared to mastectomy only, and utilizes additional resources such as PPE, operative time, multiple office visits. Tissue expander or direct to implant reconstruction can be offered on a case-by-case basis after careful evaluation of patient's individual risk factors and a change in future reconstructive options (i.e anticipated radiation therapy).<sup>55</sup> Autologous reconstruction (excluding cases that need wound coverage) should be deferred due to excessive use of resources.<sup>54-56</sup>

## Skin Cancer

Surgical treatment of non-melanoma skin cancers with slow growth rate such as basal cell carcinoma (BCC) and low risk squamous cell carcinoma (SCC) are not regarded as urgent and may be postponed. Surgery can be considered for patients with high risk SCC (>4 cm, deep invasion, perineural invasion, or poor differentiation)<sup>57</sup>, malignancies close to critical anatomical

areas such as skull base, eyes and lip and rapidly progressing tumors in transplant patients. Non-surgical treatment options for advanced BCC and SCC such as cryotherapy, radical-intent radiotherapy, neoadjuvant use of cemiplimab or vismodegib may be considered as an alternative treatment approach, especially in high risk patients (i.e age>70, presence of comorbidities, immunosuppression).<sup>58-61</sup> Merkel cell carcinoma excisions with/without sentinel lymph node biopsy (SLNB) should not be deferred during the pandemic as delay may cause progression and even distant metastasis.<sup>62</sup>

Diagnostic excisional biopsies for suspected melanoma are carried out with intent to remove the clinical lesion. For the biopsy proven malignant melanoma (any thickness) with clear histologic margins or in situ melanoma present at peripheral transection, wide local excision (WLE) can be delayed for up to 3 months. SLNB that is indicated for melanomas thicker than 0.8mm may be delayed for up to 3 months unless a WLE in the OR is planned, in which case SLNB may be performed simultaneously. Therapeutic lymph node dissections can be postponed and nodes kept under surveillance using US, CT, PET and MRI. If clinically palpable lymph nodes are present, neoadjuvant systemic therapy can be offered. In cases of metastatic nodes invading vital structures and those failing systemic therapy, therapeutic lymphadenectomy should be considered<sup>63</sup>.

## Head and Neck Cancer

Majority of the head and neck cutaneous and salivary gland malignancies are slow growing and treatment can be delayed for a few weeks or months with limited impact on oncologic outcome.<sup>58</sup> However, oral mucosa cancers, human papilloma virus (HPV) negative oropharyngeal SCC and advanced laryngeal cancer are considered aggressive malignancies and

therefore may need urgent surgical intervention to prolong survival, preserve organ function and/or avoid further harm from underlying disease.<sup>26</sup> As a general rule, complex free flap reconstructions should be avoided. Primary closure, skin grafts, local/regional flaps are preferred to minimize morbidity and mortality that could result from extended operations and prolonged recovery period. Alternative treatment options such as chemotherapy and radiotherapy can be utilized in select cases.<sup>64-66</sup>

### *Trauma and Emergency Care*

As a result of diminished industrial work and restricted travel, there is reduced volume of acute injuries presenting to Emergency Rooms. Surgery should be performed if delaying the procedure may cause significant harm to the patient, is likely to prolong the hospital stay, or if there is no non-surgical treatment option. Plastic surgeons are frequently consulted for maxillofacial fractures and hand injury, approach to which is discussed in detail below. Other emergency room encounters needing immediate care include 3<sup>rd</sup> degree burns, necrotizing soft tissue infections, compartment syndromes and limb threatening injury.<sup>67</sup> Select cases of lower extremity trauma with soft tissue loss may be temporized with vacuum assisted wound therapy until definitive reconstruction. However, majority of open fractures require immediate debridement and adequate soft tissue coverage, especially Gustilo-Anderson Type III fractures which involve extensive soft tissue damage. Vascular repair should not be delayed in Type IIIC fractures.<sup>68-70</sup>

## Maxillofacial trauma

Facial lacerations or other minor injuries should be repaired in the Emergency Room under local anesthesia. Most facial fractures do not require urgent treatment and definitive reconstruction could be postponed. Operative repair of orbital floor fractures can be delayed if there is no sign of orbital apex/fissure syndrome and no entrapment of extraocular muscles that can lead to necrosis.<sup>71</sup> Similarly, nasal, mid-face, and zygomaticomaxillary complex fractures can be treated conservatively if there is no significant functional impairment.<sup>71</sup> Plan for same day discharge should be made for all such cases unless airway compromise is a significant risk. Patients with complex maxillofacial trauma (i.e panfacial fractures, significant soft tissue injury, those with airway obstruction or vision changes) may require urgent surgical management and admission. While the management plan should be at the discretion of the surgeon as to whether open reduction and internal fixation (ORIF) is warranted, less invasive procedures such as maxillomandibular fixation using hybrid arch bars should be considered.

## Hand Surgery

American Academy of Orthopaedic Surgeons recommends that every locality should be making their own decisions based on the prevalence of COVID-19 and the availability of resources and personnel.<sup>68</sup> Semi-urgent cases such as lacerations with tendon or nerve involvement, acute fractures of the hand and wrists, comminuted fractures of the joints should still be performed considering the poor functional outcome if not treated or with a delay in treatment.<sup>72,73</sup> If possible, these procedures should be done in the outpatient setting to minimize utilization of resources. As the virus becomes more prevalent and resources become of more paramount importance, the option for surgery becomes much more limited. Under these

conditions, injuries in which immediate surgical intervention would prevent significant impairment of function should be considered, including compartment syndromes, open fracture and irreducible joint dislocations, septic joints, abscesses and amputation/subamputation with devascularization of upper extremity segments. Among replantations, thumb amputation, multiple amputated fingers, pediatric amputations and proximal amputations of the dominant/non-dominant hand should still be considered absolute indications.<sup>74</sup> Replantation of individual digits distal to the insertion of the flexor digitorum superficialis and ring avulsion injuries are relative indications and pros and cons of surgery should be discussed with the patient.

Patients for whom surgery is deemed “non-essential” are those with chronic problems whose surgery can certainly be delayed without significant harm to the patient or eventual outcome. Although an argument can be made for the need for surgery in some individuals due to pain or functional impairment, the determining principle is that delaying treatment will not significantly alter the eventual outcome. Such conditions are: tendonitis of the hand, wrist, elbow, trigger finger, De Quervain’s tendonitis, medial and lateral elbow epicondylitis, nerve compression syndromes and degenerative joint disease. All these patients can be assessed and followed-up with virtual visits and prescribed NSAIDS or oral steroid and placed in splints. Injections of steroid into the tendon sheaths and joints in the hand and wrist can be considered for patients who failed the first line of treatment.<sup>69</sup>

## CONCLUSION

Plastic surgery practice during the pandemic is curtailed to urgent and emergent care, in an effort to reduce risk of disease transmission and to prevent shortage of valuable resources. As the outbreak gradually resolves, the scope of practice will broaden accordingly. The recommendations that are summarized in this article are a snapshot of current practices which are subject to change, however they also provide a valuable resource on how to practice under unusual circumstances that we may encounter in the future. Finally, all suggestions should be taken in the context of each institute's resources and prevalence of disease in the region.

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Table 1. Tier based management in plastic surgery practice <sup>25,26,30,31</sup>

<b>Tiers</b>	<b>Definition</b>	<b>Examples</b>	<b>Action</b>
<b>Tier 1</b>	<b>Low acuity surgery/procedure</b>	-Carpal tunnel release -Fat grafting -Revisional reconstructive breast surgery -Cosmetic procedures	Postpone surgery/procedure
<b>Tier 2</b>	<b>Intermediate acuity surgery/procedure</b>  Not performing surgical treatment has the potential for increasing morbidity or mortality	-Post-mastectomy breast reconstruction -Treatment of non-melanoma skin cancer -Open reduction internal fixation of maxillo-facial fractures	Consider postponing surgery/procedure
<b>Tier 3</b>	<b>High acuity surgery/procedure</b>  Lack of treatment could result in patient harm	-Thumb replantation -Debridement of necrotizing fasciitis -Reconstruction of defects involving skull base -3rd degree burns -High risk SCC in transplant patients -Fasciatomy for compartment syndrome	Do not postpone

Table 2. Summary of perioperative recommendations <sup>38,43,44</sup>	
Enhanced environmental cleaning including bedside equipment	<ul style="list-style-type: none"> <li>-If possible, use a combination of deep cleaning with surface disinfectants and Ultraviolet C disinfection</li> <li>-Designated dirty and clean areas</li> </ul>
Patient decolonization	<ul style="list-style-type: none"> <li>-Preprocedure chlorhexidine wipes or preoperative home bathing instructions</li> <li>-Nasal povidone iodine within one hour of incision</li> <li>-Chlorhexidine mouth rinse</li> </ul>
Improved hand hygiene	<ul style="list-style-type: none"> <li>-Easy access to alcohol based hand gel for all HCP</li> <li>-Frequent hand washing</li> </ul>
Increased care during vascular catheter placement	<ul style="list-style-type: none"> <li>-Appropriate disinfection of skin</li> <li>-Closed lumen IV system</li> </ul>
Improved intubation practices	<ul style="list-style-type: none"> <li>-Double gloving for anesthesia staff</li> <li>-Appropriate and prompt disposal of dirty equipment</li> </ul>
Operating room management	<ul style="list-style-type: none"> <li>-A dedicated OR for COVID-19 cases, ideally negative pressurized</li> <li>-Dedicated PPE donning/doffing area</li> <li>-Minimize equipment/items in the OR</li> <li>-Minimize use of multiple simultaneous ORs</li> <li>-Terminal cleaning between cases</li> </ul>
Personnel management	<ul style="list-style-type: none"> <li>-Longer shifts, aiming for fewer staff changes</li> <li>-Minimize in-out traffic to the OR</li> <li>-Limited people in the OR, including trainees</li> <li>-Dedicated team members to manage COVID-19 cases each day</li> </ul>
Surgical equipment	<ul style="list-style-type: none"> <li>-Liberal use of smoke evacuators</li> <li>-Low power electrocautery or ultrasonic scalpel</li> <li>-Increased attention to prevent PPE damage</li> </ul>
PPE	<ul style="list-style-type: none"> <li>- Protective goggles, visor, mask and gown (including N95 vs PAPR, or other as per institute guidelines)</li> </ul>
Post-anesthesia care unit	<ul style="list-style-type: none"> <li>-Avoid a common unit</li> <li>-Patient recovery in OR, if feasible</li> <li>-Isolation room for COVID-19 positive cases</li> </ul>
Admission	<ul style="list-style-type: none"> <li>-Maximize outpatient surgery</li> <li>-Consider nerve blocks to facilitate same-day discharge</li> </ul>
<i>HCP: health care personnel, OR: operating room</i>	

Table 3. Aerosol generating procedures (AGP) that plastic surgeons may encounter <sup>25,29,48</sup>

<ul style="list-style-type: none"><li>-Maxillo-facial trauma care<ul style="list-style-type: none"><li>Laceration repair involving mucosa</li><li>ORIF via intra-oral/nasal approach</li><li>Closed reduction of nasal fractures</li><li>Drainage of nasal septal hematoma</li><li>Arch bar application</li></ul></li><li>-Head and neck cancer surgery<ul style="list-style-type: none"><li>Cancers involving oral and nasal mucosa, including larynx</li><li>Ear surgery, including mastoidectomy</li></ul></li><li>-Dental extractions</li><li>-Tracheostomy</li><li>-Bone-sawing procedures, amputations</li><li>-Electrocautery of blood, and any body fluids</li><li>-Suctioning of blood, and any body fluids</li><li>-Intubation/extubation, bag-valve ventilation</li><li>-Cardiopulmonary resuscitation</li></ul>
<p><i>ORIF: Open reduction internal fixation</i></p>

ACCEPTED