

Research Article

Emergent Aerosols Generating Procedures in Oral & Maxillofacial Surgery in COVID-19 Pandemic

Zubair Ahmad¹, Nabeela Riaz², Anam Abid³, Hafiz Shakir⁴, Armaghan Mirza⁵, Ehsan ul Haq⁶

¹Post Graduate Resident, Department of Oral & Maxillofacial Surgery, Mayo Hospital, Lahore; ²Professor & Head of Department of Oral & Maxillofacial Surgery, KEMU/ Mayo Hospital, Lahore; ³Post Graduate Resident, Department of Oral & Maxillofacial Surgery, Mayo Hospital, Lahore; ⁴Senior Consultant, Department of Oral & Maxillofacial Surgery, Mayo Hospital, Lahore; ⁵Associate Professor, Department of Oral & Maxillofacial Surgery, KEMU/ Mayo Hospital, Lahore; ⁶Assistant Professor, Department of Oral & Maxillofacial Surgery, KEMU/ Mayo Hospital, Lahore

Abstract

Introduction: COVID-19 has a great impact on the practice of maxillofacial surgery. To fulfill our professional obligations, we continued the services of department by carrying out emergency procedures most of which include aerosol generating procedures which need special consideration and are in high risk category in this current pandemic. In this study we interrogated the literature and evaluated the procedures, their modification and the protocols followed by our team.

Objective: To study and analyze the emergency aerosol generating procedures performed, modifications done according to current situation, duration of procedures and recommended precautionary measures followed.

Methods: We performed a retrospective observational study in the Department of Oral & Maxillofacial Surgery, Mayo Hospital, Lahore. The patients who presented in emergency and underwent emergency aerosol generating procedures in the duration of two months and 10 days from 1st April'20-10th June'20 were included in the study. Diagnosis, type of emergency procedures performed, duration of procedure, type of anesthesia, precautionary measures followed according to the recommended guidelines and any modification made in the procedures in the current pandemic was assessed and logged on structured proformas.

Results: A total of 542 patients were included in the study. Out of 358 cases of trauma closed reduction was performed in 160 cases, open reduction and internal fixation in 49 cases, 19 incision and drainage, 5 debridements, 76 wound irrigation, 7 tracheostomies, 10 resections along with or without neck dissections, 151 laceration repairs, 3 flap divisions, 32 extractions and 2 resection of the lesions along with tracheostomy.

Conclusion: During this pandemic, there is a great chance of airborne transmission of virus during aerosol generating procedures. Best possible treatment and care should be provided to the patient along with ensuring protection of patient and the hospital staff by modifying the procedural techniques and following the recommended safety protocols.

Corresponding Author | Dr Anam Abid, Post Graduate Resident, Department of Oral & Maxillofacial Surgery, Mayo Hospital, Lahore. **Email:** anam_abid@outlook.com

Keywords | aerosol generating procedures; COVID-19; pandemic; oral and maxillofacial surgery

Introduction

In the city of Wuhan situated in Hubei province of China, there was an outbreak of Covid-19 in the last days of December, 2019. After its deadly spread in China the disease rapidly involved over 209 countries across the globe including Pakistan.¹ The World Health Organization declared the Covid-19 breakout as a global health emergency and a pandemic in early 2020 attesting the severity of the situation.^{1,2} The virus was confirmed to reach Pakistan in February 2020, when a patient was diagnosed as confirmed case of Covid-19.³ Up till now there are 7,145,176 confirmed cases worldwide, with 407,388 deaths and 3,485,299 recovered cases.⁴ USA, Brazil and Russia are among the top 3 with most number of cases, followed by Spain, UK, India and Italy.⁴ Pakistan stands on 16th number with total of 103,671 reported cases with a death rate of 2,067 and 34,355 recovered cases.^{4,6}

SARS-CoV 2 belongs to the family of RNA virus which are single stranded and are also known as Coronaviridae. It is a strain of coronavirus which is new and was not found in humans before. The incubation period is not known but it is generally up to 2 weeks as the appearance of symptoms varies from 2 to 14 days after exposure.⁸ There are two previously reported outbreaks of Coronavirus which include severe acute respiratory syndrome (SARS) reported in 2003 in South China and the other is Middle East respiratory syndrome (MERS) first reported in Saudi Arabia in 2012.⁸

Transmission of this virus is believed to be by droplets and surface contact thus its spread is easy and challenging to prevent during the medical procedures that are to be performed in clinical settings.⁹ The procedures which produce aerosols are very common in the surgery of head and neck, therefore a great chance of airborne transmission of virus during such procedures exists.¹⁰ Airborne particles which range from 0.5 to 10 microns in size are known as aerosols. Aerosols are produced because of use of instruments in the upper aero-digestive region.⁹ There is a high load of virus in COVID-19 in saliva with around $1 \cdot 2 \times 10^8$ infective copies per mL.¹⁰ Viral load is present the most in nasopharynx followed by oropharynx and lower respiratory tract.^{9,10} Procedures which generate aerosols in oral and maxillofacial surgery include

tracheostomy, care of tracheostomy, oral and nasal intubation, suctioning of airway, drainage of abscess, irrigation of wounds, all intra-oral procedures including trauma surgery, biopsies, use of high speed hand piece devices, electrocautery, ultrasonic and piezoelectric instruments.¹¹ Most patients infected with SARS-CoV 2 are asymptomatic so all patients presenting should be treated as infective unless proven infection free.¹² Patients with unclear Covid-19 status need special attention while performing any aerosol generating procedure in emergency as there is an increased risk of airborne transmission and specific measures are indicated in order to ensure protection of the surgeon and all operating room staff. Specific measures include use of mouthwashes before the procedures as they reduce the bacterial as well as viral load in the saliva. povidone-iodine (PVP-I) 7% gargle/mouthwash at defined dilution is proved to have some virucidal properties.¹³ N95 masks are approved by FDA and National Institute of Occupational Safety and Health for safety from airborne transmission.¹⁴ Closed reduction methods for facial trauma should be preferred when possible, intra-oral radiographs which can produce a cough or gagging should be avoided and duration of procedure should be kept minimum in order to limit the time of exposure.¹⁵ But during the aerosols generating procedures carried out on SARS-CoV 2 suspected or positive patients, extreme precaution is recommended which includes face, body and eye protection, powered air purifying respirators, operating rooms with negative pressure to minimize the risk of contaminated aerosol spread and use of high volume suction devices.¹²

The department of Oral and Maxillofacial Surgery in Mayo Hospital, Lahore, is carrying out all the emergency head and neck procedures including trauma surgeries, emergency tracheostomies, cancer surgeries, odontogenic abscess drainage, management of facial space infections and necrotizing fasciitis, post-operative and traumatic wound care and irrigation. All these come under the category of high risk aerosol generating procedures. In our study, we aim to survey all the procedures performed in Covid-19 pandemic in our department along with the recommended precautions followed as we have to fulfill our professional obligations in this current scenario with modifying procedures and ensuring the protective

measures in attempt to provide the best possible treatment to the patients and protect the surgeons, staff and the patients from viral transmission.

Methods

It was an analytical cross-sectional study. This study was carried out in the department of oral & maxillofacial surgery department. Duration of study was 2 months and 10 days from 1st April' 20 to 10th June'20. A total of 542 patients were selected by purposive sampling, that were presented in emergency or indoor and operated being categorized as emergent. Diagnosis, type of emergency procedures performed, duration of procedure, type of anesthesia, precautionary measures followed according to the recommended guidelines and any modification made in the procedures in the current pandemic was assessed and logged on structured proformas. A computer aided descriptive data analysis was performed using the SPSS software 25.0.

Results

The mean age was 31.54 with age ranging from 5 years to 74 years.

There were 423 male and 119 female patients that were operated during this time span.

Out of total 542 cases, there were 8 cases of squamous cell carcinoma, 358 cases of trauma, 5 cases of other pathologies, 47 cases including odontogenic infection and facial space infections, 5 cases of necrotizing fasciitis, 86 post-operative cases, 5 firearm and ballistic injuries, and 28 cases of non-healing ulcers. (Figure 1)

Closed reduction was performed in 160 cases, open reduction and internal fixation in 49 cases, 19 incision and drainage, 5 debridements, 76 wound irrigation & dressings, 7 tracheostomies, 10 resections along with or without neck dissections, 151 laceration repairs, 3 flap divisions, 32 extractions and 2 resection of the lesions along with tracheostomy. (Figure 2)

About 65 cases were operated under general anesthesia and 477 cases under local anesthesia. (Figure 3)

Duration(Minutes)

The minimum duration of operation was 10 minutes and the maximum duration was 280 minutes with a mean operating time of 37.89 minutes.

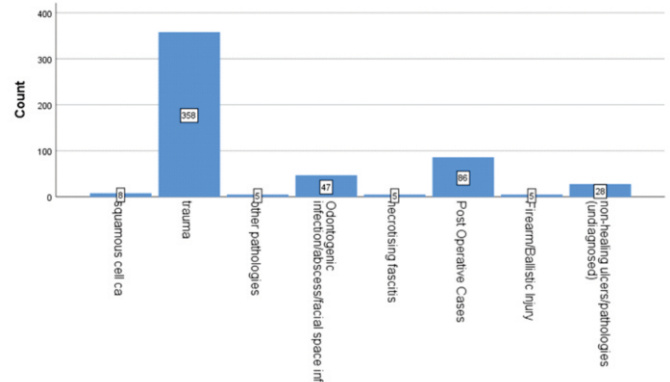


Figure 1: Distribution of Cases

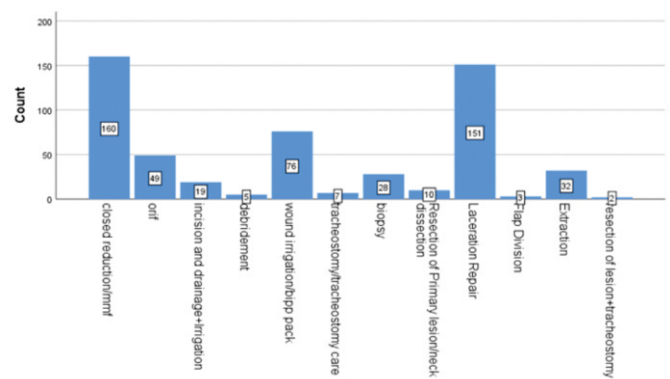


Figure 2: Treatment Plans with Frequency Distributions

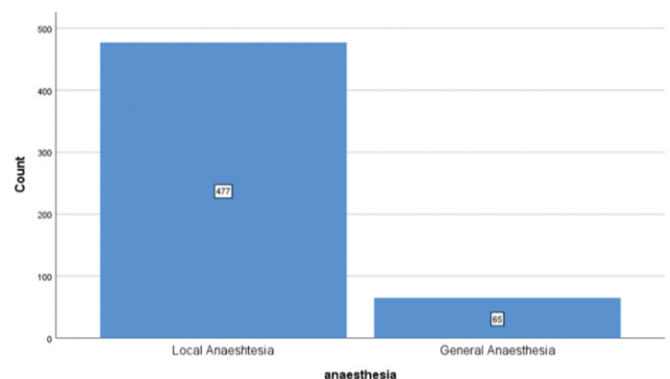


Figure 3: Types of Anaesthesia administered



Figure 1 (a,b,c)

Rhabdomyosarcoma of Nasopharynx Causing Airway Compromise. Tracheostomy was Performed followed by Excision of the Lesion

Discussion

COVID-19 is a 6th world's public health emergency of international concern as declared by World Health Organization (WHO).² It is caused by SARS-CoV 2 virus and has brought an unrivalled challenge for the medical personnel.⁹ Covid-19 has a spread by droplet transmission just as that of most respiratory infections.¹³ When the infection is transmitted via large aerosols directly from an infected person over a short distance, it is referred to as 'droplet transmission'.⁹ It is believed that it also has transmission via surface contact as the virus remains on inanimate surfaces from a duration of 2 hours for up to 9 days depending on the type of surface, humid conditions, temperature and the load of virus.¹³

Upper respiratory tract including the nose, mouth,

oropharynx, nasopharynx and the trachea, bronchus are the regions in which there is high load of virus.¹ The carriers of SARS-CoV 2 which are not symptomatic have the same load of virus as that of symptomatic patients. The viral load is greatest in the secretions of oral and nasal cavity so the procedures in these regions are high risk for transmission of the disease.^{9,10,16} Oral and maxillofacial surgeons should be aware of all the challenges while working in this pandemic in order to reduce the transmission of virus to the surgeon, hospital staff or even to the patient.¹¹ All procedures which cause virus particle aerosolization are categorized as 'high risk' by AOCMF, BAOMS and CDC.^{13,14,17,18} Procedures which generate aerosols in oral and maxillofacial surgery include tracheostomy, care of tracheostomy, oral and nasal intubation, suctioning of airway, drainage of abscess, irrigation of wounds, all surgical procedure which include oral, nasal and endotracheal mucosa including trauma surgery, biopsies, use of high speed hand piece devices, electro-cautery, ultrasonic and piezoelectric instruments.^{12,14,19}

Guidelines were presented by CDC, NHS foundation and WHO for infection control and performing aerosol generating procedures. Furthermore, there were guidelines given specifically for oral and maxillofacial surgeons for performing all the emergent procedures by AOCMF and BAOMS.^{14,18,20-25} We educated our staff regarding infection control and prevention against COVID-19 according to the guidelines by CDC and WHO and ensured that every health care personnel in our department worked with PPE. We divided our procedures in to emergent and elective. Emergency procedures included trauma surgeries, traumatic lacerations, gunshot and ballistic injuries, oncological cases, airway difficulties, odontogenic abscesses, facial space infections and necrotizing fasciitis. While the cases which were categorized as elective were TMJ ankyloses, benign pathologies, old traumatic deformities, cosmetic procedures, orthognathic surgeries and frontal sinus and frontal bone with aesthetic concerns only. Oncologic cases which were not candidates for surgery first or surgery was not possible were referred for radiation therapy. Some of our doctors were appointed in telemedicine department who answered the queries related to psychogenic and neurogenic pains, temporomandibular joint pain dysfunction syndrome, tooth aches etc. and medicated the patients

where necessary. Only the cases classified as emergent were dealt in our department. We divided the duties of our doctors to limit the exposure and used man power as necessary.

All the procedures were done following the guidelines by AOCMF, BAOMS and the standard protocol set by our department. Pre-operatively, the patients were evaluated by the anesthesia and the pulmonology department. Chest x-rays were done along with other baseline investigation in all patients and covid-19 status was checked via RT-PCR in those patients which were suspected and as advised by pulmonology department. We operated 542 cases in a duration of 2 months and 10 days under local and general anesthesia. Operating rooms were well-ventilated. The duration of procedures was minimum 10 and maximum 280 minutes. Intubation in the cases done under general anesthesia was performed by our anesthesia team. In most of the cases intubation was nasal, mask/bag ventilation was avoided and suctioning was done when necessary. The operating room team entered the theatre 20 minutes after the intubation as the virus remains in the air for minimum 14 minutes and maximum 21 minutes after an aerosol generating procedure.¹⁴ The surgical team operated with recommended PPE including FFP3/N95 masks (PAPR respirator is also recommended but we used what was available to us), eye protection, body protecting gowns and gloves. Tracheostomy was done when needed but the patients was pre-oxygenated, paralyzed, and well ventilated before tracheal incision in order to reduce aerosols as there is a high risk of aerosolisation and viral transmission during this procedure due to high air flow in trachea. Modification was done in trauma cases where closed reduction was done in cases where the fracture was easily reduced and occlusion was achievable. In cases when ORIF was needed, incisions were mostly made with the help of scalpel and for hemostasis, bipolar cautery was used. According to a study by Ishihama et al, it was observed that aerosolized blood is present in filters of air vents when electrocautery was used for head and neck surgery.⁹ Osteotomes were used for osteotomy and drilling was done with slow speed handpiece with minimum irrigation. For midfacial fractures, two-point fixation was preferred over three-point fixation in most cases. Rapidly growing and aggressive tumors, lesions causing airway

obstruction or with a risk of airway obstruction and cases in which delay of surgery can cause worst outcomes were operated and neck dissections were done where necessary. Excision of the lesion was done in a patient with rhabdomyosarcoma of the nasopharynx as the lesion was causing airway obstruction (figure 1). A spindle cell lesion on the floor of the mouth was excised as it was increasing rapidly in size and was causing tongue elevation resulting in swallowing difficulties and airway compromise. An intra-oral round blue cell tumor involving the mandible was excised. Total 8 cases of squamous cell carcinoma were operated in which excision along with neck dissections were done. Other procedures that were done included debridement and eye exenteration due to mucormycosis, incision and drainage and wound irrigation for facial space infections, facial abscesses, debridement for cases of necrotizing fasciitis, traumatic lacerations stitching, management of cases with gunshot and ballistic injuries and biopsies of lesions with clinically malignant behavior.

We catered the patients in this pandemic to the best of our capabilities. Most of the head and neck procedures which were categorized as emergent are aerosol generating and in high risk category. But we continued our services by following proper guidelines in this challenging scenario.

Conclusion

During this pandemic, there is a great chance of airborne transmission of virus during aerosol generating procedures. Best possible treatment and care should be provided to the patient along with ensuring protection of patient and the hospital staff by modifying the procedural techniques and following the recommended safety protocols. We should remain updated with the ongoing researches and newly proposed guidelines in order to continue our services and minimize the spread.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest

Funding Source: None

References

1. Waris A, Khan AU, Ali M, Ali A, Baset A. COVID-19 outbreak: current scenario of Pakistan. *New Micro-*

- bes and *New Infections*. 2020;100681.
2. Organization WH. Coronavirus disease 2019 (COVID-19): situation report, 72. 2020.
 3. Waqas M, Farooq M, Ahmad R, Ahmad A. Analysis and Prediction of COVID-19 Pandemic in Pakistan using Time-dependent SIR Model. *arXiv preprint arXiv:200502353*. 2020.
 4. Worldometer. COVID-19 CORONAVIRUS PANDEMIC Worldometer.com2020 [Available from: <https://www.worldometers.info/coronavirus/>].
 5. Yousaf M, Zahir S, Riaz M, Hussain SM, Shah K. Statistical analysis of forecasting COVID-19 for upcoming month in Pakistan. *Chaos, Solitons & Fractals*. 2020;109926.
 6. Pakistan GoH. COVID-19 Confirmed Cases 2020 [Available from: <http://covid.gov.pk/>].
 7. Development UN. COVID-19 Pandemic Response 2020 [Available from: <https://www.pk.undp.org/content/pakistan/en/home/coronavirus.html>].
 8. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *Journal of autoimmunity*. 2020;102433.
 9. Thamboo A, Lea J, Sommer DD, Sowerby L, Abdalkhani A, Diamond C, et al. Clinical evidence based review and recommendations of aerosol generating medical procedures in otolaryngology–head and neck surgery during the COVID-19 pandemic. *Journal of Otolaryngology-Head & Neck Surgery*. 2020;49:1-14.
 10. Kerawala C, Riva F. Aerosol-generating procedures in head and neck surgery—can we improve practice after COVID-19? *British Journal of Oral and Maxillofacial Surgery*. 2020.
 11. Zimmermann M, Nkenke E. Approaches to the management of patients in oral and maxillofacial surgery during COVID-19 pandemic. *Journal of Cranio-Maxillofacial Surgery*. 2020.
 12. Howard BE. High-risk aerosol-generating procedures in COVID-19: respiratory protective equipment considerations. *Otolaryngology–Head and Neck Surgery*. 2020;0194599820927335.
 13. Bali RK, Chaudhry K. *Maxillofacial surgery and COVID-19, The Pandemic!!* : Springer; 2020.
 14. Michael Grant M, PhD, FACS, Alexander Schramm DDS MD Ulm, Brad Strong MD Sacramento, Daniel Buchbinder DDS MD Ed Ellis DDS San Antonio, Eppo Wolvius DDS MD Rotterdam, Gregorio Sánchez Aniceto DDS MD AO CMF International Task Force Recommendations on Best Practices for Maxillofacial Procedures during COVID-19 Pandemic. 2020.
 15. Coulthard P. Dentistry and coronavirus (COVID-19)-moral decision-making. *British Dental Journal*. 2020; 228(7):503-5.
 16. Levi E. Aerosol Generating Procedures in the COVID era 2020 [Available from: <https://ericlevi.com/2020/03/28/aerosol-generating-procedures-in-the-covid-era/>].
 17. Grant J, Shafi A, Halsnad M. Aerosol prevention in osteosynthesis for maxillofacial trauma—a technical note. *The British Journal of Oral & Maxillofacial Surgery*. 2020.
 18. Magennis P. Guidance for the care of OMFS and Oral Surgery patients where COVID is prevalent *British Association of Oral Surgeons*2020 [Available from: https://www.baoms.org.uk/_userfiles/pages/files/professionals/covid_19/baos_baoms_covid19_position_s_paper_final.pdf].
 19. Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. *PloS one*. 2012;7(4).
 20. HCP HP. Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Healthcare Settings.
 21. Control CfD, Prevention. Healthcare infection prevention and control FAQs for COVID-19. 2020.
 22. Control CfD, Prevention. Public health guidance for community-level preparedness and response to severe acute respiratory syndrome (SARS). Atlanta: Centers for Disease Control and Prevention. 2005.
 23. Service NH. Appendix 46. NHS Foundation Trust 2020.
 24. Smith PW, Rusnak PG. Infection prevention and control in the long-term-care facility. *Infection Control & Hospital Epidemiology*. 1997;18(12):831-49.
 25. OMFS and ENT surgeons issue new COVID-19 PPE guidance. *British Dental Journal*. 2020;228(8):571-.