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Otolaryngology consultations for COVID-19 patients: A retrospective cohort study of indications, interventions, and considerations

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ABSTRACT

Objective: To identify differences in inpatient otolaryngology consultations and interventions for patients based on COVID-19.

Methods: Records were reviewed for all patients for whom otolaryngology was consulted at a high-volume tertiary care hospital from April 30, 2020 to October 1, 2020. Demographic information, length of stay, COVID-19 status, indication for consultation, and otolaryngology interventions were recorded. Statistical analysis was performed using R software.

Results: Bleeding composed a significantly higher proportion of otolaryngology consults in COVID-19 positive patients (28% vs. 8.4%, p<0.0001). Management of bleeding was the most common procedure performed in positive patients (n=37, 35%), and they had a higher median number of interventions performed when compared to bleeding patients who tested negative (1, IQR 1-2 vs. 1, IQR 0-1, p=0.04). COVID-19 positive patients with bleeding were more likely to expire than those with other indications for otolaryngology consultation (50% vs. 7%, p<0.001).

Conclusion: Bleeding and associated interventions comprised the predominant discrepancy between COVID-19 positive and negative patients in our cohort. We encourage routine use of simple and cost-effective methods to decrease risk of bleeding.

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1. Introduction

The Coronavirus SARS-CoV-2 (COVID-19) pandemic devastated communities and healthcare systems around the globe, with over 449 million cumulative confirmed cases worldwide and a death toll upwards of 5.9 million [1]. Healthcare professionals modified routines and procedures to protect
themselves, with a cross-sectional multi-institutional survey of 55 otolaryngology departments across North America revealing near-universal (n = 53 of 55, 96.3%) cancellations of elective cases at the height of the pandemic [2]. With these fluctuations in cases and responses, otolaryngology attendings and residents have continued to operate and take call across the country, with inevitable exposure to patients confirmed or under investigation for COVID-19 [2,3]. Although otolaryngologic symptoms of COVID-19 such as olfactory dysfunction, sneezing, and nasal congestion have been well-characterized to date [4], there remains a paucity of literature documenting inpatient trends of otolaryngology consults since the onset of the pandemic, with the few published studies demonstrating variable changes in consult patterns [5,6]. Only one case series and one small cohort study have addressed the issue of oropharyngeal bleeding requiring management by otolaryngology services [7,8]. In response to high rates of thrombotic events observed among patients with COVID-19, therapeutic dosing of anticoagulants was widely adopted as standard treatment, despite the inherently increased risks of bleeding [9–11]. As such, the overall bleeding rate in hospitalized COVID-19 patients is estimated at 2-5%, with a proportion accounted for by upper airway bleeding [8]. Recent findings have questioned the utility of therapeutic anticoagulation in improving overall survival in patients with severe cases of COVID-19, shifting the focus instead to the potential morbidity of this practice [12].

The observed high numbers of interventions for oropharyngeal bleeding in patients with severe COVID-19 infection, in light of new data challenging the benefit of therapeutic anticoagulation [12], prompted this single-institution study of inpatient otolaryngology consult rates based on COVID-19 status. In particular, we sought to determine whether patients with COVID-19 were more likely to require otolaryngology consultation for bleeding than patients without COVID-19, and if they would require a greater frequency of interventions to control their bleeding.

2. Methods

2.1. Ethical Considerations

This study was approved by the Committee for the Protection of Human Subjects of the University of Texas Health Science Center at Houston (IRB: HSC-MS-20-0970). Study participants provided written informed consent.

2.2. Study Design

This was a single-institution retrospective cohort study encompassing all patients with otolaryngology consults at a high-volume, tertiary care hospital, from April 30, 2020 to October 1st, 2020. Data on demographics, COVID-19 status, consult indication, length of stay, and interventions were collected.

2.3. Study Population

All patients for whom otolaryngology was consulted from April 30, 2020 to October 1, 2020 were included. We excluded patients with planned inpatient stays following scheduled operations. COVID-19 status was defined by test results dated within 14 days before or after consultation. Patients were also considered positive if they were being actively treated for COVID-19 related pneumonia or respiratory failure, even if their positive date was more than 14 days before consultation. Receipt of therapeutic anticoagulation was based on protocols established by the intensive care unit or hematology services and was variable. Typically, this involved heparin infusions or daily enoxaparin administration.

2.4. Stratification

Consultations were divided into 12 categories. Trauma included patients evaluated for facial trauma, temporal bone and laryngeal fractures, and traumatic injury to local structures (e.g. facial nerve, parotid duct, etc). Infections included peritonsillar abscess, cellulitis of the head-and-neck, Pott’s puffy tumor, epiglottitis, parotitis, and salivary gland abscesses. Bleeding included epistaxis and oropharyngeal hemorrhage. Otologic evaluations included otitis, mastoiditis, hearing loss, vertigo, and infections of the eardrum. Post-operative consultations included post-tonsillectomy hemorrhage, loosening of hardware (e.g. mandibulomaxillary fixation devices), and concerns for surgical site infection. Rhinologic evaluations included sinusitis, cerebrospinal fluid leaks, and pituitary masses. Tracheostomy management included consultations for placement, accidental decannulation, exchange, and bleeding from tracheostomy. Head-and-neck masses included consultations to investigate suspicions for malignancy, known head-and-neck malignancy, and benign endocrine masses. Airway evaluation included consultations that required an assessment of the upper airway secondary to concerns for airway compromise or active stridor that were not secondary to foreign body obstruction. The dysphonia category included consultations involving an assessment of the upper airway in patients with altered phonation. Foreign body consults involved an airway evaluation if there was suspicion or known foreign object causing obstruction. Consults for dysphagia were undertaken for patients with concern for aspiration or inability to tolerate oral intake.

Bedside laryngoscopy was performed using a flexible fiberoptic laryngoscope to evaluate consults including dysphonia, dysphagia, foreign body evaluation. Dressing and packing of infectious or post-surgical wounds was undertaken using iodineoform quarter or half-inch packing strips and Kerlix (Medline, Illinois, USA) gauze bandage rolls. Management of bleeding in the oropharynx entailed saline or tranexamic acid-soaked Kerlix (Medline, Illinois, USA) gauze bandage rolls. Nasopharyngeal bleeding management involved the application of gelatin absorbable Surgifoam (Ethicon, New Jersey, USA) sponges wrapped in Surgicel (Ethicon, New Jersey, USA) and soaked in oxymetazoline which were placed in the nasal cavities to obtain hemostasis. At our institution, facial laceration closure was rotated between the otolaryngology, plastic surgery, and oral and maxillofacial surgery services. Tracheostomy management includes tracheostomy changes and replacement with flexible laryngoscopy to evaluate for tube/cuff displacement, patency, or post-tracheostomy pos-
tioning. Routine tracheostomy care was performed by respiratory therapists and was not tabulated. Incision and drainage occurred most frequently for management of peritonsillar abscesses. Drainage of other cutaneous abscesses of the head and neck as well as simple hematoma evacuation were similarly performed bedside. Fine needle aspiration and biopsy was undertaken for masses and nodules requiring pathologic diagnosis. Rigid nasal endoscopy entailed the use of a 0-degree scope for an intact nose and a 30-degree scope for a post-surgical evaluation or evaluation of cerebrospinal fluid leak. Closed reduction of facial fractures included those of the mandible and nasal bones and were typically performed in the emergency department. There was no uniform protocol or instrumentation for foreign body removal in the airway. Other bedside interventions included wick placement for otitis externa, lingual frenectomy, and wound vacuum placement.

Procedures requiring intervention in the operating room were diverse and included tracheostomy, direct laryngoscopy, hematoma evacuation, complex abscess incision and drainage, complex laceration repair, endoscopic sinus surgery, and transsphenoidal hypophysectomy among others.

2.5. Statistical Analysis

Statistical analysis was performed using R [13–15]. Chi-square was used to test the null hypothesis that demographic factors, consult indications, and interventions performed were independent of the three COVID-19 statuses (positive, negative, and untested), df=2. Variables in which the null hypothesis was rejected (p<0.05) were examined further with chi-square using each COVID-19 status as a binary independent variable (e.g. positive vs. all others) to identify significant associations, df=1. Fisher’s exact test was used for variables with observation counts less than five. Tables display the p-value calculated for the initial analysis among all three groups; p-values for further binary analysis within individual groups are included in the text. P-values for all comparisons were adjusted using the Benjamini-Hochberg (BH) method to control the false discovery rate (FDR) [16]. Tables and in-text p-values reflect the lowest acceptable FDR at which the null hypothesis could be rejected, and associations considered significant. We rejected all null hypotheses in which the FDR was equal to or less than 0.05.

Shapiro-Wilk test was used to test normality of numerical variables. Medians were used to evaluate statistical significance of non-normal numerical variables. Kruskal-Wallis ANOVA was used to test the null hypothesis that there was no difference in medians among the three groups. Numerical values exhibiting significant differences among the three groups were then examined using pairwise tests for medians (positive vs. negative, positive vs. untested, and negative vs. untested), with p-values adjusted using the BH method.

3. Results

Of 1,089 otolaryngology consults completed during the period of interest, 693 (64%) were negative, 57 (5%) were positive, and 339 (31%) were untested for COVID-19. Six hundred and sixty-one (61%) were male, and the median age was 41 years (23 – 61 years) (Table 1). Shapiro-Wilk test revealed that none of the measured variables exhibited normal distributions. Analysis of demographic factors revealed an association with race (p=0.001; Table 1), however, investigation into insurance status yielded no association with positive COVID-19 status. Breakdown of consultation proportions by COVID-19 status is demonstrated in Fig. 1.

Bleeding composed a significantly higher proportion of consults in positive patients than all others (28% vs. 8.4%, p<0.0001; Table 2; Fig. 1). As such, bleeding management was the most common procedure performed for patients testing positive (n=37, 35%; Table 3). COVID-19 positive patients with bleeding had a higher median number of inter-

Table 1. Patient Demographics and Insurance Status. P-values represent associations among all three COVID-19 statuses, (chi-square for categorical, df=2; Kruskal-Wallis for numerical). P-values for significant associations using COVID-19 statuses as binary variables (df=1) are included in the text.

| Total (n= 1089) | COVID-19 positive (n=57, 5%) | COVID-19 negative (n=693, 64%) | Untested (n=339, 31%) | P-value |
|-----------------|-----------------------------|-------------------------------|-----------------------|---------|
| Male            | 662                         | 37 (5.6%)                     | 417 (63%)             | 208 (31%)| 0.9 |
| Median Age, yrs (IQR) | 41 (23, 61)                 | 44 (21, 61)                   | 38 (24, 60)           |         | 0.9 |
| Non-Hispanic White | 405                      | 7 (2%)                        | 269 (66%)             | 129 (32%)| <0.001 |
| Hispanic        | 314                         | 32 (10%)                      | 176 (56%)             | 106 (34%)| <0.0001 |
| Non-Hispanic Black | 302                 | 17 (5.6%)                     | 199 (66%)             | 86 (28%) | 0.6 |
| Asian           | 41                          | 0 (0%)                        | 32 (78%)              | 9 (22%)  | 0.15 |
| Inpatient       | 732                         | 51 (7.0%)                     | 574 (78%)             | 107 (15%)|         |
| Emergency Department | 357                  | 6 (1.7%)                      | 119 (33%)             | 232 (65%)| <0.0001 |
| Med LOS, (IQR)  | 2 (1, 10)                   | 13 (2, 43)                    | 5 (2, 13)             | 1 (0, 1) | <0.0001 |
| Intervened      | 708                         | 38 (5%)                       | 454 (64%)             | 216 (31%)| 0.6 |
| Private Insurance | 357                    | 18 (32%)                      | 221 (32%)             | 118 (35%)| 0.7 |
| Medicaid        | 241                         | 17 (30%)                      | 167 (24%)             | 57 (17%) | 0.02 |
| Medicare        | 225                         | 8 (14%)                       | 153 (22%)             | 64 (19%) | 0.3 |
| Self-pay        | 207                         | 12 (21%)                      | 113 (16%)             | 82 (24%) | 0.02 |
| Other           | 59                          | 2 (4%)                        | 39 (6%)               | 18 (5%)  | 0.9 |

IQR = interquartile range, LOS = length of stay.
otolaryngology consults stratified by indication in A) all consults, B) consults on COVID-19 positive patients, C) consults on COVID-19 negative patients, and D) consults on patients untested for COVID-19.

Table 2. Indications for Consultation. P-values represent associations between all three COVID-19 statuses, (chi-square for categorical, df=2). P-values for significant associations using COVID-19 statuses as binary variables (df=1) are included in the text.

| Indication                  | Total (n=1089) | COVID-19 positive (n=57, 5%) | COVID-19 negative (n=695, 64%) | Untested (n=339, 31%) | P-value |
|-----------------------------|----------------|-----------------------------|--------------------------------|------------------------|---------|
| Facial Trauma               | 363            | 17 (4.7%)                   | 217 (36%)                      | 129 (36%)              | 0.13    |
| Infection                   | 174            | 6 (3.4%)                    | 112 (64%)                      | 56 (32%)               | 0.6     |
| Bleeding                    | 103            | 16 (15%)                    | 41 (40%)                       | 46 (45%)               | <0.0001 |
| Airway Evaluation           | 95             | 3 (3%)                      | 72 (76%)                       | 20 (21%)               | 0.07    |
| Head and Neck Mass          | 80             | 3 (3.8%)                    | 60 (75%)                       | 17 (21%)               | 0.14    |
| Rhinologic                  | 51             | 2 (3.9%)                    | 40 (78%)                       | 9 (17.6%)              | 0.10    |
| Otologic                    | 50             | 4 (8%)                      | 32 (64%)                       | 14 (28%)               | 0.6     |
| Post-operative              | 51             | 1 (2%)                      | 35 (69%)                       | 15 (29%)               | 0.04    |
| Tracheostomy Management     | 48             | 2 (4.2%)                    | 33 (69%)                       | 13 (27%)               | 0.9     |
| Dysphonia                   | 27             | 0 (0%)                      | 25 (93%)                       | 2 (7.4%)               | 0.01    |
| Foreign Body                | 20             | 1 (5%)                      | 6 (30%)                        | 13 (65%)               | 0.01    |
| Dysphagia                   | 14             | 2 (14%)                     | 11 (78%)                       | 1 (7.1%)               | 0.08    |
| Other                       | 13             | 0 (0%)                      | 9 (69%)                        | 4 (31%)                |         |

COVID-19 positive patients had longer median lengths of stay than negative and untested patients (13 days, IQR 2-43 vs. 2 days, IQR 1-9, p<0.0001; Table 1, Fig. 3). Of the 57 positive patients, 11 (19%) expired during their hospitalization. Nine (81%) died of respiratory failure due to COVID-19. Of the remaining two, one suffered from a subarachnoid hemorrhage while the other succumbed to a mixed cardiogenic shock; both had also developed hypoxic respiratory failure and received therapies targeting COVID-19. Of the 16 COVID-19 positive patients for whom otolaryngology was consulted for bleeding, 8 died (50%). This was a significantly higher rate than positive patients for whom otolaryngology performed than bleeding patients who were untested or tested negative (1, IQR 1-2 vs. 1, IQR 0-1, p<0.0001; Table 2; Fig. 2). After excluding consults from the emergency department, this difference held true (1, IQR 1-2 vs. 1, IQR 0-1; p=0.001). Twenty-three (40%) of 57 COVID-19 positive patients for whom otolaryngology was consulted had received therapeutic anticoagulation (TA) up to the day prior to consultation. TA was associated with consultation for bleeding, as otolaryngology was consulted for bleeding in 15 of the 23 COVID-19 positive patients receiving TA but only for one of the 34 COVID-19 positive patients not receiving TA (65% vs. 7%, p<0.0001).
Table 3. Procedures Performed. Mean procedures per patient are provided. However, p-values were calculated using non-parametric Kruskal-Wallis test due to a non-normal distribution.

| Procedure                          | Total (Mean/per patient) | COVID-19 positive (n=57) | COVID-19 negative (n=695) | Untested (n=339) | P – value (Kruskal-Wallis) |
|------------------------------------|--------------------------|--------------------------|----------------------------|------------------|---------------------------|
| Bedside                           | 1,117                    | 100 (1.75)               | 759 (1.09)                 | 258 (0.76)       | 0.02                      |
| Laryngoscopy                      | 262 (0.24)               | 15 (0.26)                | 201 (0.29)                 | 46 (0.14)        | <0.001                    |
| Dressing/Packing                  | 146 (0.13)               | 18 (0.32)                | 103 (0.15)                 | 25 (0.07)        | 0.13                      |
| Bleed Management                  | 109 (0.10)               | 37 (0.65)                | 32 (0.05)                  | 40 (0.12)        | <0.0001                   |
| Laceration Repair                 | 111 (0.10)               | 4 (0.07)                 | 59 (0.08)                  | 48 (0.14)        | 0.03                      |
| Tracheostomy                      | 91 (0.08)                | 11 (0.19)                | 70 (0.10)                  | 10 (0.03)        | 0.03                      |
| Incision and Drainage             | 73 (0.07)                | 1 (0.02)                 | 32 (0.05)                  | 40 (0.12)        | <0.0001                   |
| Fine Needle Aspiration and Biopsy | 31 (0.03)                | 0 (0)                    | 21 (0.03)                  | 10 (0.03)        | 0.5                       |
| Nasal Endoscopy                   | 23 (0.02)                | 2 (0.04)                 | 18 (0.03)                  | 3 (0.01)         | 0.2                       |
| Closed Reduction of Facial Fracture | 13 (0.01)             | 0 (0)                    | 6 (0.01)                   | 7 (0.02)         | 0.2                       |
| Foreign Body Removal              | 9 (0.008)                | 0 (0)                    | 3 (0.004)                  | 6 (0.02)         | 0.10                      |
| Other                             | 19                       | 2                        | 10                         | 7                |                           |
| Operating Room                    | 226                      | 10 (0.18)                | 199 (0.29)                 | 17 (0.05)        | <0.001                    |

was consulted for other reasons (50% vs. 7%, p=0.003). Although a higher median age was noted among COVID-19 positive patients who died, this was not statistically significant (53 vs. 38, p=0.07).

Consult rates, likelihood of intervention, and median number of procedures performed for other indications were similar between patients testing positive and negative (Tables 2; 3 and Fig. 1).

4. Discussion

During early stages of the COVID-19 pandemic, high incidences of pulmonary embolism (PE), deep venous thromboses (DVT), and arterial thrombotic events such as stroke were observed and associated with increased mortality among patients with COVID-19, despite treatment with prophylactic anticoagulation [9,10]. In some cases, patients already receiving therapeutic anticoagulation for other reasons demonstrated decreased rates of thrombotic events compared to those who received only prophylactic doses, raising the question as to whether therapeutic anticoagulation should be utilized to decrease thrombotic tendencies in patients with COVID-19 [9–11]. Subsequent observational studies of therapeutic anticoagulation in COVID-19 patients yielded conflicting results with regards to its effect on mortality, thrombotic events, and risk for bleeding, thus underscoring the need for further investigations to determine differences in outcomes [11]. Despite this uncertainty, guidelines have recommended anticoagulation in COVID-19 patients to mitigate some of the prothrombotic effects of the disease [17].

A recent landmark study found that in critically ill patients, anticoagulation with therapeutic dosing did not confer a survival advantage or improve the number of days free of cardiovascular or respiratory organ support as compared to thromboprophylaxis dosing [12]. This finding contrasts with previous cohort studies that have indicated that anticoagulation in COVID-19 positive patients increases overall survival.
This group also conducted an analogous trial for patients with COVID-19 who did not require intensive care unit-level support for organ dysfunction. In noncritically ill COVID-19 patients, this trial found that initial therapeutic-dose heparin significantly increased survival probability and reduced the need for cardiopulmonary end-organ support [20]. The changes in treatment that will undoubtedly result from these findings in relation to bleeding risk remain to be seen. At our institution, few protocols were specifically altered for COVID-positive patients.

We sought to examine differences at the patient level by comparing indications for consults, stratified by COVID-19 status (Table 2, Fig. 1). Consults for bleeding comprised the predominant indication for consultation among patients with COVID-19 during the studied period, suggesting that patients with COVID-19 were more likely to bleed than other patients. In addition, increased numbers of bleeding management procedures for COVID-19 positive patients suggest that bleeding in the context of COVID-19 is a complicated condition requiring repeat interventions with associated morbidity, cost, and potential for disease transmission (Table 3). Although un surprising given the high prevalence of therapeutic anticoagulation used during the time of study, these findings have important implications for both patient management and provider protection.

The standard intervention for epistaxis at our institution involves placing absorbable hemostatic packing such as Surgi-Foam and Surgicel (Ethicon, New Jersey, USA) in the nasal cavity, and saturating it with topical medications such as oxymetazoline, phenylephrine, tranexamic acid, or in refractory cases, epinephrine. The standard intervention for oropharyngeal bleeding in patients who are mechanically ventilated involves placing saline wet Kerlix gauze bandage rolls (Medline, Illinois, USA) in the oropharynx. Success is defined as observed hemostasis upon completion of the procedure. Rebleeding was exceptionally common in the positive cohort (Table 3), accounting for repeat procedures and substantial morbidity attributed to resuscitations from blood loss.

In response, we offer the following anticipatory guidance in COVID-19 positive patients given the increased risk for upper airway bleeding: 1) Additional care orders to include frequently scheduled nasal saline sprays, oral saline rinses, topical lubrication, and humidification. 2) In critically ill patients with significant episodes of bleeding requiring interventions and transfusions, frequent re-evaluation of therapeutic anticoagulation to determine whether the risk outweighs the benefit.

Of paramount importance is the ongoing prevention of transmission by patients to providers, as otolaryngologists are particularly susceptible due to the high volume of aerosol generating procedures in the head-and-neck. Current recommendations are to use N95 mask protection when in contact with positive patients in addition to standard personal protective equipment (PPE), especially when performing aerosol generating procedures [21]. Nasal and oral packing procedures cause coughing, sneezing, and spitting requiring considerable mucosal exposure and suctioning. Need for repeat interven-
5. Conclusion

Bleeding and associated interventions comprised the predominant discrepancy between COVID-19 positive and negative patients in our cohort. The risk of bleeding in COVID-19 patients should be considered when evaluating the need for therapeutic anticoagulation. We encourage routine use of simple and cost-effective methods to decrease the risk of bleeding in COVID-19 patients.

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