


Development and Assessment of an Otolaryngology-Specific Surgical Priority Scoring System

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Abstract

Objective. To develop and assess an otolaryngology-specific surgical priority scoring system that incorporates varying levels of mucosal involvement.

Study Design. Retrospective cohort.

Setting. Academic medical center.

Methods. A novel mucosal score was developed based on best available evidence. This mucosal score was incorporated into the Medically Necessary, Time-Sensitive (MeNTS) score to generate a MeNTS-Mucosal (MeNTS-M) score. A retrospective cohort of patients was identified to assess the surgical priority scoring systems. Inclusion criteria included all scheduled surgical procedures between March 23, 2020, and April 17, 2020. Decisions about whether to proceed or cancel were made based on best clinical judgment by surgeons, without use of any surgical priority scores. The predictive value of the surgical priority scoring systems was assessed in this retrospective cohort.

Results. The median MeNTS score was significantly lower in adult patients whose surgery proceeded compared to those for whom the surgery was cancelled (48 vs 56; $P = .004$). Mucosal and MeNTS-M scores were not statistically different based on whether surgery proceeded. Among adult patients, the highest area under the curve (AUC) was for the MeNTS scoring system (0.794); both the mucosal and MeNTS-M systems had lower AUC values (which were significantly lower than the AUC for the MeNTS scoring system).

Conclusion. This study represents development and assessment of the first otolaryngology-specific surgical priority score and incorporates varying levels of mucosal disruption. The combined MeNTS-M scoring system could be a valuable tool in appropriately triaging otolaryngology–head and neck surgery procedures.

Keywords

otolaryngology, surgical risk score, COVID-19, novel coronavirus, MeNTS

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The coronavirus disease 2019 (COVID-19) pandemic has had profound impacts on health care and its delivery. The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes COVID-19, is transmitted through respiratory droplets during coughing, sneezing, speech, and aerosol-generating procedures. Extensive precautions must be implemented to mitigate its infectious spread. In addition to implementing mandated distancing and personal protective equipment (PPE) protocols, hospital systems have been preserving limited resources, including PPE, personnel, COVID-19 testing materials, ventilators, and intensive care unit (ICU) beds by limiting nonurgent surgical procedures.^{1–3} The cessation of these lower-acuity procedures was an appropriate emergency measure to conserve resources and protect health care workers. However, it is not feasible to permanently halt nonurgent surgical procedures for the duration of the pandemic, as these procedures are often medically necessary to alleviate patient pain, improve quality of life, and prevent negative outcomes in surgically treatable conditions.⁴ Moreover, this clinical activity

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is crucial to the financial solvency of many health care institutions. It is imperative to incorporate a flexible and widely applicable method of triaging elective operations to optimize hospital resource management and patient outcomes.⁴

The Elective Surgery Acuity Scale (ESAS) and the Medically Necessary, Time-Sensitive (MeNTS) surgical priority score have been developed to balance the need for certain surgical procedures during a pandemic in which certain resources must be conserved.^{2,4} ESAS provides surgical recommendations based on the acuity of the procedure, the health of the patient, and the anticipated location of the operation (ambulatory or in hospital).⁵ The MeNTS scoring system numerically quantifies patient, disease, and procedure risk factors, with higher scores indicating poorer patient outcomes, increased risk of COVID-19 transmission between health care workers and the patient, and an increased resource burden on the health care system.⁴ Using these scoring systems as devices to stratify a patient's risk for elective procedures incorporates the specific concerns of operating on patients in the era of the COVID-19 pandemic as well as the inherent public health considerations.

Otolaryngologic surgeries are considered among the highest risk for COVID-19 transmission since many of these procedures involve disrupting mucosal surfaces, thereby aerosolizing potentially virulent particles.⁶ However, there is a significant case diversity within otolaryngology–head and neck surgery, with cases ranging from no mucosal involvement to transnasal procedures with violation of the nasopharyngeal mucosa. The first aim of the study is to consider this procedural range by creating a mucosal score and a modified version of the MeNTS score (denoted MeNTS-M, which incorporates information about mucosal disruption) to inform decision making about elective otolaryngology–head and neck surgery procedures. The second aim of the study is to assess the predictive value of the various scoring systems (ESAS, MeNTS, mucosal score, and MeNTS-M) in a cohort of patients in whom decisions about whether to proceed with surgery were made without knowledge of these scores in advance. To our knowledge, this is the first study to develop and assess an otolaryngology-specific surgical priority scoring system.

Methods

Expedited institutional review board approval was obtained for this study from the Springfield Committee for Research Involving Human Subjects of Southern Illinois University School of Medicine (SIU SOM).

Surgical Priority Score Development

The MeNTS surgical priority scoring system was reviewed in detail by all authors.⁴ Modifications were proposed and reviewed by all authors in an independent fashion until agreement among all authors was achieved. Given that the MeNTS score does not account for varying levels of risk with extent of mucosal disruption, a novel mucosal score was developed based on best available evidence. A score range of 0 to 25 was

used for this mucosal score based on clinical judgment of the authors.

Assessment of Surgical Priority Score

A retrospective cohort of patients was identified to assess the surgical priority scoring systems. Inclusion criteria included all surgical procedures between March 23, 2020, and April 17, 2020, at SIU SOM by Department of Otolaryngology–Head and Neck Surgery faculty. All surgical procedures that were scheduled, including both those that were cancelled and those that proceeded as scheduled, were included. Decisions about whether to proceed or cancel were made based on best clinical judgment by surgeons; when appropriate and/or necessary, multidisciplinary discussion and consultation with departmental and hospital leaders were undertaken to determine whether to proceed with surgery. The surgical priority scores were not used for clinical decision making among this cohort of patients. The dates of inclusion were chosen to reflect the time period after the American College of Surgeons (ACS) recommended curtailing elective surgical procedures.² Exclusion criteria were procedures performed outside of the operating room setting and those without direct faculty supervision. Demographics, type of surgery, and surgical priority scores were determined for each patient who met inclusion and exclusion criteria.

Continuous variables were described using median and interquartile range (IQR); comparisons between groups were made using Wilcoxon rank-sum and Kruskal-Wallis tests. Categorical variables were compared between groups using χ^2 tests and, when appropriate, Fisher exact tests. Receiver operating characteristic (ROC) curves were generated and area under the curve (AUC) was calculated to assess the predictive value of the surgical priority scores. ROC curves were compared with pairwise comparisons.⁷ $P < .05$ was set as the cutoff for statistical significance. StataSE 14 64-bit (StataCorp) was used for statistical analyses.

Results

Surgical Priority Score Development/Modification

Modifications were made to the MeNTS surgical priority score to allow for nonoverlapping score options for categories with continuous variables (ie, age, operating room time, anticipated blood loss, postop ICU need, intubation probability) (**Table 1**). A mucosal score was developed based on best available evidence regarding coronavirus concentration, colonization, and risk of transmission during surgery⁸⁻¹⁴ (**Table 2**). The highest mucosal score (25) was assigned to transnasal and nasopharyngeal procedures given the data suggesting the high risk associated with nasopharyngeal and sinonasal procedures. The lowest score (0) was assigned to procedures without involvement of mucosa or airway secretions. Intermediate scores were assigned for intermediate levels of risk: middle ear or mastoid surgery (score 5), salivary gland surgery (10), transoral or transnasal nasal procedures without violation of mucosa (15), and transoral or open procedures with violation of mucosa (20). Procedures that involved more than 1 site (eg, adenoidectomy with ear tube placement) were assigned the

Table 1. MeNTS Surgical Priority Score.

Characteristic	Score				
	1	2	3	4	5
Patient factors					
Age, y	<20	20-40	41-50	51-65	>65
Lung disease (asthma, COPD, CF)	None		Minimal (rare inhaler)		>Minimal
Obstructive sleep apnea	Not present		Mild/moderate (on CPAP)		On CPAP
CV disease (HTN, CHF, CAD)	None	Minimal (no medications)	Mild (≤ 1 medication)	Moderate (2 medications)	Severe (≥ 3 medications)
Diabetes	None		Mild (no medications)	Moderate (PO medications only)	>Moderate (insulin)
Immunocompromised ^a	No		Moderate		Severe
ILI symptoms (fever, cough, sore throat, body aches, diarrhea)	None (asymptomatic)				Yes
Exposure to known COVID-19-positive person in past 14 days	No	Probably not	Possibly		Yes
Disease factors					
Nonoperative treatment option effectiveness	None available	Available, <40% as effective as surgery	Available, 40%-60% as effective as surgery	Available, 60%-95% as effective as surgery	Equally effective
Nonoperative treatment option resource/exposure risk	Significantly worse/not applicable	Somewhat worse	Equivalent	Somewhat better	Significantly better
Impact of 2-week delay on disease outcome	Significantly worse	Worse	Moderately worse	Slightly worse	No worse
Impact of 2-week delay on surgical difficulty/risk	Significantly worse	Worse	Moderately worse	Slightly worse	No worse
Impact of 6-week delay on disease outcome	Significantly worse	Worse	Moderately worse	Slightly worse	No worse
Impact of 6-week delay on surgical difficulty/risk	Significantly worse	Worse	Moderately worse	Slightly worse	No worse
Procedure factors					
OR time, min	≤ 30	31-60	61-120	121-180	>180
Estimated length of stay	Outpatient	≤ 23 h	24-48 h	48-72 h	≥ 4 d
Postoperative ICU need, %	Very unlikely	<5	6-10	11-25	>25
Anticipated blood loss, cc	<100	100-250	251-500	501-750	>750
Surgical team size	1 person	2 people	3 people	4 people	>4 people
Intubation probability, %	<1	1-5	6-10	11-25	>25
Surgical site					ENT

Abbreviations: CAD, coronary artery disease; CF, cystic fibrosis; CHF, congestive heart failure; CPAP, continuous positive airway pressure; COPD, chronic obstructive pulmonary disease; COVID-19, coronavirus disease 2019; CV, cardiovascular; ENT, ear, nose, and throat procedure; HTN, hypertension; ICU, intensive care unit; ILI, influenza-like illness; MeNTS, Medically Necessary, Time-Sensitive; OR, operating room; PO, per os.

^aImmunocompromised is defined as hematologic malignancy, stem cell transplant, solid organ transplant, active/recent cytotoxic chemotherapy, anti-tumor necrosis factor α or other immunosuppressants, >20 mg prednisone equivalent/d, congenital immunodeficiency, hypogammaglobulinemia on intravenous immunoglobulin (IVIg), and HIV with CD4 <200.

Table 2. Mucosal Score.

Score	Procedure	Example
0	No involvement of mucosa or airway secretions	Excision of scalp cancer
5	Middle ear or mastoid surgery	Mastoidectomy, ossicular chain reconstruction
10	Salivary gland surgery	Parotidectomy
15	Transoral or transnasal procedure (with possible aerosolization) without violation of mucosa	Rigid bronchoscopy
20	Transoral or open procedure with violation of mucosa	Tracheotomy, glossectomy, tonsillectomy
25	Transnasal or nasopharyngeal procedure with violation of mucosa, including all sinonasal and skull base procedures	Nasopharyngeal biopsy, adenoidectomy, endoscopic skull base resection

Table 3. Unique Components of the P-MeNTS Surgical Priority Score.

Characteristic	Score				
	1	2	3	4	5
Patient factors					
Age, y	16-18		6-15	1-5	<1
Prematurity	Term: birth at 37 weeks GA or greater				Premature: birth at <37 weeks GA
Procedure factors					
Anticipated blood loss	<15% of blood volume				≥15% of blood volume

Abbreviations: ENT, ear, nose, and throat procedure; GA: gestational age; P-MeNTS: Pediatric Medically Necessary, Time-Sensitive.

higher corresponding mucosal score. The MeNTS and mucosal scores were combined into a single composite score designated the MeNTS-M score. The score ranges for the MeNTS score, mucosal score, and MeNTS-M score were 21 to 105, 0 to 25, and 21 to 130, respectively.

The MeNTS surgical priority score was further modified for pediatric patients (age <18 years) by changing the scoring criteria for age and anticipated blood loss; the pediatric modification of the MeNTS surgical priority score was designated as P-MeNTS (**Table 3**). Scores for age were based on published pediatric COVID-19 mortality data.¹⁵ The anticipated blood loss category of MeNTS was modified for pediatric patients using the ACS Advanced Trauma Life Support classification of hemorrhage using 15% of blood volume as the cutoff value.¹⁶ Prematurity was added to the score based on the anticipated increased operative and COVID-19 mortality risk with prematurity. The mucosal score systems were the same for both pediatric and adult patients. The P-MeNTS and mucosal scores were combined into a single composite score designated as the P-MeNTS-M score. The score ranges for the P-MeNTS score, mucosal score, and P-MeNTS-M score were 22 to 110, 0 to 25, and 22 to 135, respectively.

Patient Cohort

There were 56 adult patients who met criteria for inclusion in the retrospective cohort. Of the 56 adult patients, surgery was cancelled for 46 patients (82%) and proceeded for 10 patients (18%). Demographic characteristics and surgical priority

scores are shown in **Table 4**. Of the 10 adult patients who underwent surgery, 8 had cancer or suspected cancer and 2 had airway stenosis. Patients who underwent surgery had significantly higher ESAS tiers ($P < .001$). The median MeNTS score was significantly lower in adult patients whose surgery proceeded compared to those for whom the surgery was cancelled (48 vs 56; $P = .004$). Mucosal and MeNTS-M scores were not statistically different based on whether surgery proceeded. The distribution of MeNTS, mucosal, and MeNTS-M scores is shown in **Figure 1**.

There were 49 pediatric patients who met criteria for inclusion in the retrospective cohort. Of the 49 pediatric patients, surgery was cancelled for 43 patients (88%) and proceeded for 6 patients (12%). Demographic characteristics and surgical priority scores are shown in **Table 5**. Of the 6 pediatric patients who underwent surgery, 5 underwent airway procedures and 1 underwent removal of mandibular distraction hardware. Younger ($P = .006$) and premature patients ($P = .018$) were more likely to proceed with surgery. Patients who underwent surgery had significantly higher ESAS tiers ($P < .001$). The P-MeNTS, mucosal, and P-MeNTS-M scores were not statistically different based on whether surgery proceeded. The distribution of P-MeNTS, mucosal, and P-MeNTS-M scores is shown in **Figure 2**.

The median MeNTS, mucosal, and MeNTS-M scores are shown by ESAS tiers in **Table 6**. ROC curves and AUC were generated to assess predictive value of the surgical priority scores (**Table 7**). Among adult patients, the highest AUC was

Table 4. Demographics and Surgical Priority Scores of All Adult Patients Scheduled for Surgery.

Characteristic	All adult patients scheduled for surgery (n = 56)	Surgery cancelled (n = 46)	Surgery proceeded (n = 10)	P value
Age, median (IQR), y	60 (50-68)	59 (45-68)	63 (55-78)	.210
Sex, female, No. (%)	26 (46)	24 (52)	2 (20)	.087
ESAS tiers, No. (%)				<.001
1a	13 (23)	13 (28)	0	
1b	11 (20)	11 (24)	0	
2a	11 (20)	10 (22)	1 (10)	
2b	6 (11)	6 (13)	0	
3a	9 (16)	3 (6.5)	6 (60)	
3b	6 (11)	3 (6.5)	3 (30)	
MeNTS score, median (IQR)	55 (52-60)	56 (53-60)	48 (41-54)	.004
Mucosal score, median (IQR)	20 (10-20)	20 (5-25)	20 (15-20)	.929
MeNTS-M score, median (IQR)	71.5 (60.5-80.5)	74 (60-82)	65.5 (61-72)	.171

Abbreviations: ESAS, Elective Surgery Acuity Scale; IQR, interquartile range; MeNTS, Medically Necessary, Time-Sensitive; MeNTS-M, Medically Necessary, Time-Sensitive–Mucosal.

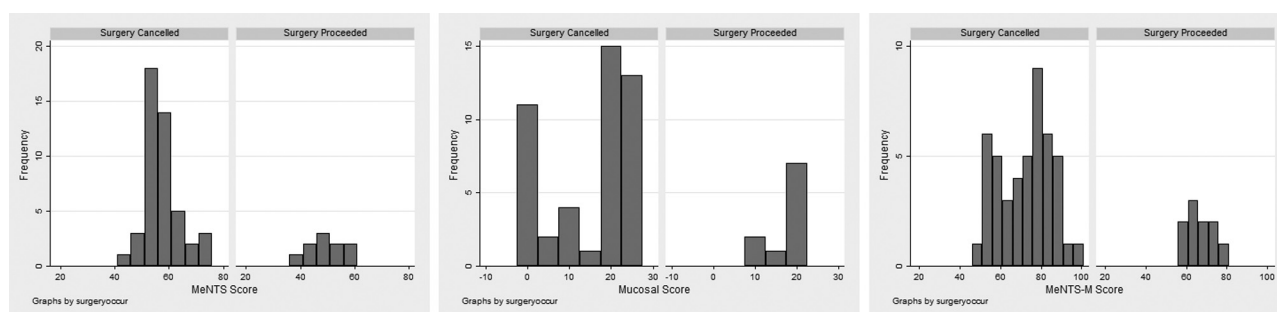


Figure 1. Medically Necessary, Time-Sensitive (MeNTS) score, mucosal score, and MeNTS-Mucosal (MeNTS-M) score among adult patients, by whether surgery proceeded.

for the MeNTS scoring system (0.794); both the mucosal and MeNTS-M systems had lower AUC values (which were statistically significantly lower than the AUC for the MeNTS scoring system).

Discussion

The COVID-19 pandemic has significantly affected all facets of otolaryngology–head and neck surgery. Operating room utilization was severely curtailed at times during the pandemic in the interest of health care worker and patient safety in addition to resource conservation. This caused a temporary cessation of elective surgeries in some geographical areas. However, when some elective procedures can be performed, it is imperative to find a method to be able to prioritize them while considering multiple factors (patient outcomes and need for surgery, risk of COVID-19 transmission, and resource utilization).

The ESAS and MeNTS scoring systems have been described as widely applicable and standardized guides to triaging elective operations based on patient factors, disease process, and potential for COVID-19 transmission. Surgeries performed by otolaryngologist–head and neck surgeons can

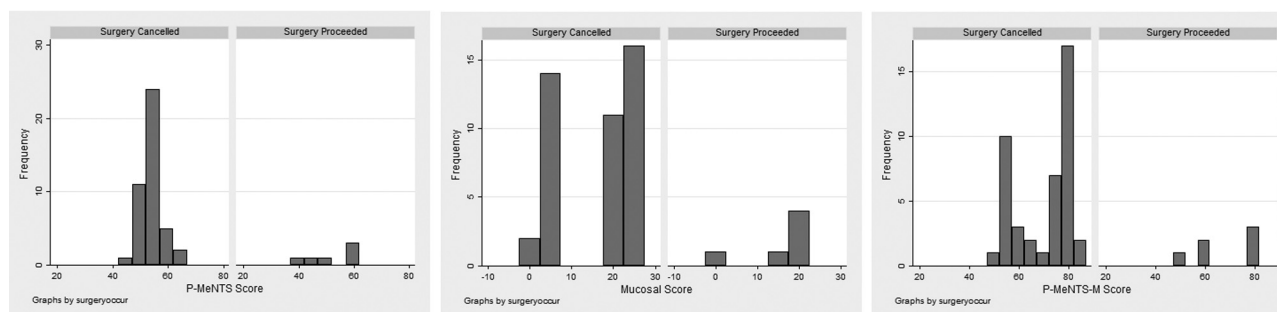
have varying levels of mucosal disruption and, therefore, varying levels of risk of transmission and need for PPE. Therefore, the current study was performed to create an otolaryngology-specific surgical priority scoring system that incorporates varying levels of mucosal involvement. To our knowledge, this is the first otolaryngology-specific surgical priority scoring system. Although it has the benefit of incorporating varying levels of mucosal involvement to quantify risk and resource utilization, a key limitation and potential barrier to implementation is the lack of applicability to non-otolaryngologic surgeries.

Once the MeNTS-M scoring system was developed, we performed retrospective scoring of all surgeries scheduled at our institution during the time period the ACS recommended limiting elective procedures. While these scoring systems were not used to prospectively guide decision making, retrospective application and scoring provided valuable information regarding the predictive value of each system. From our analysis, both ESAS and the MeNTS scoring systems significantly predicted the likelihood of cancellation of adult surgical procedures based on the risk considerations incorporated in the system criteria. The MeNTS-M combined system

Table 5. Demographics and Surgical Priority Scores of All Pediatric Patients Scheduled for Surgery.

Characteristic	All pediatric patients scheduled for surgery (n = 49)	Surgery cancelled (n = 43)	Surgery proceeded (n = 6)	P value
Age, median (IQR), y	3.3 (1.5-7.6)	3.9 (1.7-7.9)	0.9 (0.2-2.0)	.006
Premature, No. (%)	11 (22)	7 (16)	4 (67)	.018
Sex, female, No. (%)	26 (53)	23 (53)	3 (50)	1.000
ESAS tiers, No. (%)				<.001
1a	38 (78)	38 (88)	0	
1b	0	0	0	
2a	5 (10)	2 (9)	1 (17)	
2b	0	0	0	
3a	6 (12)	1 (2)	5 (83)	
3b	0	0	0	
P-MeNTS score, median (IQR)	54 (51-56)	54 (51-56)	55 (46-59)	.963
Mucosal score, median (IQR)	20 (5-25)	20 (5-25)	20 (15-20)	.407
P-MeNTS-M score, median (IQR)	74 (58-80)	74 (56-80)	70 (59-79)	.963

Abbreviations: ESAS, Elective Surgery Acuity Scale; IQR, interquartile range; P-MeNTS, Pediatric Medically Necessary, Time-Sensitive; P-MeNTS-M, Pediatric Medically Necessary, Time-Sensitive–Mucosal.

**Figure 2.** Pediatric Medically Necessary, Time-Sensitive (P-MeNTS) score, mucosal score, and Pediatric Medically Necessary, Time-Sensitive–Mucosal (P-MeNTS-M) score among pediatric patients, by whether surgery proceeded.**Table 6.** Correlation of Surgical Priority Scores With ESAS Tiers.^a

ESAS tiers	Adult patients		
	MeNTS	Mucosal	MeNTS-M
1 (1a and 1b)	56 (52.5-60)	20 (15-25)	77.5 (66-83)
2 (2a and 2b)	55 (53-60)	10 (0-20)	61 (54-72)
3 (3a and 3b)	54 (47-61)	20 (15-20)	72 (62-81)
	<i>P</i> = .670	<i>P</i> = .008	<i>P</i> = .029
1a, 2a, 3a	53 (49-55)	20 (5-20)	64 (58-73)
1b, 2b, 3b	60 (57-65)	20 (10-25)	81 (71-88)
	<i>P</i> < .001	<i>P</i> = .255	<i>P</i> < .001
	Pediatric patients ^b		
	P-MeNTS	Mucosal	P-MeNTS-M
1 (1a and 1b)	53 (51-55)	20 (5-25)	73.5 (56-80)
2 (2a and 2b)	60 (51-64)	20 (0-20)	75 (65-80)
3 (3a and 3b)	58.5 (46-59)	20 (20-20)	78.5 (61-79)
	<i>P</i> = .198	<i>P</i> = .626	<i>P</i> = .644

Abbreviations: ESAS, Elective Surgery Acuity Scale; IQR, interquartile range; MeNTS, Medically Necessary, Time-Sensitive; MeNTS-M, Medically Necessary, Time-Sensitive–Mucosal; P-MeNTS, Pediatric Medically Necessary, Time-Sensitive; P-MeNTS-M, Pediatric Medically Necessary, Time-Sensitive–Mucosal.

^aAll values shown are median (IQR).

^bNo pediatric patients were in tier 1b, 2b, or 3b.

Table 7. Comparison of Predictive Value of Surgical Priority Scoring Systems.

Surgical priority scoring system	AUC	P value
Adult patients		
MeNTS	0.794	Reference
Mucosal	0.509	.015
MeNTS-M	0.639	.050
Pediatric patients		
P-MeNTS	0.494	Reference
Mucosal	0.601	.560
P-MeNTS-M	0.506	.917

Abbreviations: AUC, area under the curve; MeNTS, Medically Necessary, Time-Sensitive; MeNTS-M, Medically Necessary, Time-Sensitive–Mucosal; P-MeNTS, Pediatric Medically Necessary, Time-Sensitive; P-MeNTS-M, Pediatric Medically Necessary, Time-Sensitive–Mucosal.

functioned better than the mucosal score alone. The mucosal score alone did not significantly predict the likelihood of cancellation of surgical procedures in an adult or pediatric population. The ESAS system (but not any of the other scores) was able to significantly predict surgery cancellation in the pediatric population.

Our study supports the use of the ESAS and MeNTS systems as effective predictors of surgical risk compared to expert physician opinion. The utility of these scoring guidelines is their ease of use and broad applicability, making them strong clinical tools to gauge the risk of an elective surgery in light of the additional COVID-19 considerations. While neither the mucosal score alone nor the combined MeNTS-M score significantly predicted procedure cancellations, the mucosal addendum represents a poignant revision to the original MeNTS scoring system for otolaryngologic surgeries. An added benefit is that it represents a wide score range, which allows for hospitals and surgeons to use differing score cut-offs, depending on local factors (eg, level of COVID-19 test positivity and resource availability).

It may seem that the development and approval of vaccines for SARS-CoV-2^{17,18} could make surgical priority scores irrelevant as our society moves closer to ending the COVID-19 pandemic. However, even with the recent development and approval of vaccines for SARS-CoV-2, vaccines alone will be unlikely to curtail the current pandemic, especially before a large proportion of the population is immunized.¹⁹ In addition, even after vaccine uptake allows for herd immunity, it is possible that isolated outbreaks could occur. For that reason, the appropriate utilization of health care resources and prioritization of surgical procedures remain relevant strategies, even as vaccination for SARS-CoV-2 becomes prevalent.

It is important to remember that the MeNTS-M and P-MeNTS-M systems may not have better predictive value compared to the MeNTS system or ESAS, although this can be assessed with future studies. Furthermore, the current study did not assess the impact of surgery postponement or cancellation on patient outcomes. Future studies could assess which of

the systems minimizes adverse patient outcomes due to delayed or cancelled surgeries.

Our findings are based on an empirically developed mucosal score based on best available data. It would be difficult to reproduce the findings of this study as the cases reviewed predate the broad formal use of either ESAS or MeNTS at our institution, and current protocols include the use of one or both of these scoring methods. The MeNTS-M scoring system does not anticipate the resource availability necessary to manage postoperative complications, readmissions, or other departures from routine postoperative care. In addition, there can be an inflated sense of objectivity associated with a single-value risk score; there is significant subjectivity in determining values for individual identified factors, and assignment of scores may vary from physician to physician. Additional studies will be useful in establishing the generalizability of our findings. Future studies could focus on multi-institutional external validation and the use of principal component analysis to determine which factors capture the greatest variance.

There is benefit in having an otolaryngology-specific surgical scoring system to incorporate the risk of mucosal violation among the variety of otolaryngology–head and neck surgery procedures. This study aimed to compare the existing predictive surgical scoring systems (ESAS and MeNTS) and to propose a mucosal addendum to the MeNTS system. We found ESAS and MeNTS to be effective and significant tools in predicting elective surgery cancellation in adult patients. The combined MeNTS-M scoring system could be a valuable tool in appropriately triaging otolaryngology–head and neck surgery procedures.

Author Contributions

Arun Sharma, substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, drafting the manuscript, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Sophia Matos**, interpretation of data, drafting the manuscript, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Sandra L. Ettema**, acquisition of data, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Stacie R. Gregory**, acquisition of data, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Pardis Javadi**, acquisition of data, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Matthew D. Johnson**, acquisition of data, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Brendan C. Stack Jr.**, substantial contributions to conception and design, interpretation of data, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work; **Dana L. Crosby**,

substantial contributions to conception and design, acquisition of data, interpretation of data, revising manuscript critically for important intellectual content, final approval of the version to be published, and agreement to be accountable for all aspects of the work.

Disclosures

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