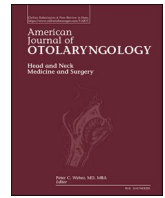Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Lessons learned from safe tracheostomy aftercare taskforce implemented during COVID-19 pandemic

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ARTICLE INFO

ABSTRACT

Purpose: At the height of the COVID-19 pandemic, our institution instituted a Safe Tracheostomy Aftercare Taskforce (STAT) team to care for the influx of patients undergoing tracheostomies. This review was undertaken to understand this team's impact on outcomes of tracheostomy care.
Methods: We compared retrospective data collected from patients undergoing tracheostomies at our institution from February to June 2019, prior to creation of the STAT team, to prospectively collected data from tracheostomies performed from February to June 2020, while the STAT team was in place and performed statistical analysis on outcomes of care such as decannulation prior to discharge, timely tube change, and post-discharge follow-up.
Results: We found that the STAT team significantly increased rate of decannulation prior to discharge ($P < 0.0005$), performance of timely trach tube change when indicated ($P < 0.05$), and rates of follow-up for tracheostomy patients after discharge from the hospital ($P < 0.0005$).
Conclusion: The positive impact of the STAT team on outcomes of patient care such as decannulation prior to discharge, timely tube change, and post-discharge follow-up makes a strong case for its continuation even in non-pandemic times.

1. Introduction

Tracheostomies are one of the most common procedures performed for patients on prolonged ventilator support; 34% of patients on mechanical ventilation for more than 48 h receive a tracheostomy, which amounts to over 100,000 patients in the United States annually [1]. Despite the prevalence of the procedure, attention to tracheostomy aftercare is often lacking. The COVID-19 pandemic created a crisis in tracheostomy care, as unprecedented numbers of patients developed respiratory failure requiring tracheostomy. Between February through June of 2020, at the height of the pandemic, tracheostomy rates nearly doubled at our institution, Columbia University Irving Medical Center (CUIMC), and we were inundated with more surgical airway inpatients than ever before.

The risk of post-tracheostomy complications in the COVID-19 patients was further complicated by lack of understanding of the COVID-19 virus and the potential for adverse events due to increased secretions,

with increased risk of mucous plugging requiring frequent suctioning and airway clearance [2,3]. In addition, there were the known post-tracheostomy complications of decannulation and false passage of the tube into soft tissue tracts adjacent to the airway which exist with all fresh tracheostomies.

To address the overwhelming burden of tracheostomy patients and increased risk of postoperative complications in this environment, we developed the Safe Tracheostomy Aftercare Taskforce (STAT) Team. The STAT Team was comprised of military personnel, physician assistants, and resident providers under direct supervision of an attending. The goal of this team was to provide standardized post-operative care for COVID-19 patients undergoing tracheostomies by establishing COVID-tracheostomy care guidelines, implementing a formal rounding structure, and providing inpatients care teams with targeted education interventions.

The STAT team initiated care on post-operative day (POD) 1, and the team would evaluate the patient and establish contact with the patient

care providers. The team would ensure that all appropriate care equipment was at the bedside, they would continue to follow the patient daily until the first trach change, and they would educate the team on standardized tracheostomy care guidelines. On POD4, provider comfort with these recommendations was revisited to close any educational gaps, and on POD7, the team would perform inner cannula changes, remove sutures and exchange tracheostomy ties.

The STAT team also responded to tracheostomy-related issues such as cuff leaks, stoma bleeds, and wound care issues, and prioritized an expedited tracheostomy weaning pathway, including management of managing tube size adjustments, facilitating use of speaking valves, and design and implementation of a capping protocol which, when completed, resulted in decannulation. They also coordinated post-discharge follow-up via video visit for each patient within two months following discharge. This review was undertaken to quantify and understand the STAT team's benefits on the outcomes of tracheostomy care.

2. Methods

Retrospective data were collected from tracheostomy patients at our institution from February to June 2019, prior to creation of the STAT team, and were compared to prospectively collected data from February to June 2020, while the STAT team was in place (IRB approval from Columbia University IRB AAAT2649 (M02Y01)). The primary endpoint was decannulation before discharge. Secondary endpoints included time to first tracheostomy change, incidence of appropriate tracheostomy change when indicated, and time to outpatient follow-up. Statistical analysis was run on both cohorts to assess the significance of differences found.

3. Results

170 patients underwent tracheostomy from February through June of 2020 at CUIMC, all of whom were cared for by the STAT team. This included 106 males (62%) and 64 females (38%), averaging 60.9 years old (range 23–91 years). Prior to the creation of the STAT team, 92 patients underwent tracheostomy at CUIMC from February through June 2019, including 59 males (64%) and 33 females (36%), averaging 59.9 years old (range 20–93 years). 144 (85%) and 72 (78%) patients survived to discharge in the STAT team and pre-STAT team cohorts respectively (Table 1).

The average length of hospital stay of patients surviving to discharge was 69.1 days in the STAT team cohort and 67.8 days in the pre-STAT team cohort (Table 1). Mean time from tracheostomy to discharge was shorter for the STAT team cohort, 39.7 days (range 2–205; SD 30.3)

versus 43.7 days (range 1–174; SD 45.5) pre-STAT team, but this was not statistically significant.

Of those that survived to discharge, 86 (60%) of the STAT team patients were decannulated prior to discharge compared to 16 (22%) of the pre-STAT team patients ($p < 0.00001$). Under the STAT team, decannulation rates prior to discharge increased absolutely by 40% and relatively by 178% (Table 1, Fig. 1).

Time to first tracheostomy change was also analyzed. Of those patients who had a tracheostomy change during their stay in the hospital, the average time to first change was 31.6 days (SD 18.8) in the 2020 cohort and 35.8 days (SD 34.3) in the 2019 cohort ($p > 0.05$). Our institution typically uses a Shiley cuffed tube, which the manufacturer recommends to be exchanged after 30 days of consecutive use [4]. Of patients who had a tracheostomy for longer than 30 days, thus requiring tube exchange, 59 (49.2%) STAT team patients were changed in a timely fashion, compared to only 16 (29.1%) patients in the pre-STAT team cohort ($p < 0.05$). The STAT team thus increased the incidence of first tracheostomy change within 30 days absolutely by 20.1% and relatively by 69.1% (Table 2, Fig. 2).

Furthermore, the STAT team followed and remained in contact to advise further trach care for 116 of the 144 (80.6%) surviving discharged patients. Significantly, 36 of the 72 (50%) discharged patients were lost to follow-up pre-STAT team ($p < 0.0005$). STAT team outpatient first follow-up occurred primarily via telehealth (96 patients, 66.7%), although 3 (2.1%) patients were seen first in outpatient clinic and 17 (11.8%) patients were seen in follow-up during hospital readmission for unrelated issues. Additionally, 5 patients who were seen first via telehealth subsequentially followed up in clinic. Pre-STAT team, 27 (38%) discharged patients were seen in hospital before any outpatient follow-up appointment, and only nine (12%) had follow-ups as an outpatients in clinic. The STAT team increased follow-up absolutely by 30.6% and relatively by 61.2% (Table 3, Fig. 3).

Finally, the STAT team time to first post-discharge follow-up was also quicker than pre-STAT team. 21 patients (18.1% of total followed-up patients) STAT team patients were seen within for follow-up within 1 month of discharge, versus 5 patients (13.9%) in the pre-STAT team cohorts. 64 (55.2%) STAT Team patients were seen at 1–2 months post-discharge, versus only 17 (47.2%) of the pre-STAT team cohort. Thus the STAT Team increased follow-up within 2 months of discharge from 61.1% to 73.3%; this increase was not found to be significant ($P = 0.16$) (Table 4, Fig. 4).

4. Discussion

The STAT team improved to care for tracheostomy patients as measured by higher rates of decannulation before discharge, greater incidence of first tracheostomy change, and increased patient follow-up. Arguably, these improvements were due to the care teams' single focus which allowed for meticulous follow through of care despite a chaotic setting (the pandemic), and resulted in accumulation of experience leading to expert management that can be applied across broader settings beyond the pandemic.

Decannulation prior to discharge, when appropriate, can significantly decrease the potential risk of tracheostomy-related complications outside the hospital, such as mucous plugging and accidental decannulation. This was a significant concern in particular during the COVID-19 pandemic because care facilities were already at capacity, overburdened, and had limited resources for complex patient care, including tracheostomy. Decannulation also facilitated placement for patients who were otherwise cleared-for-discharge but would need to spend extra days in the hospital waiting on placement in a facility that would accept tracheostomy patients, remaining susceptible to hospital-acquired infections, delaying bed turnover, and overall increasing burden of care for all involved parties [5]. The STAT team's increased rates of decannulation benefitted both patients and our institution.

For patients with longer need for tracheostomies and longer hospital

Table 1
Patient characteristics.

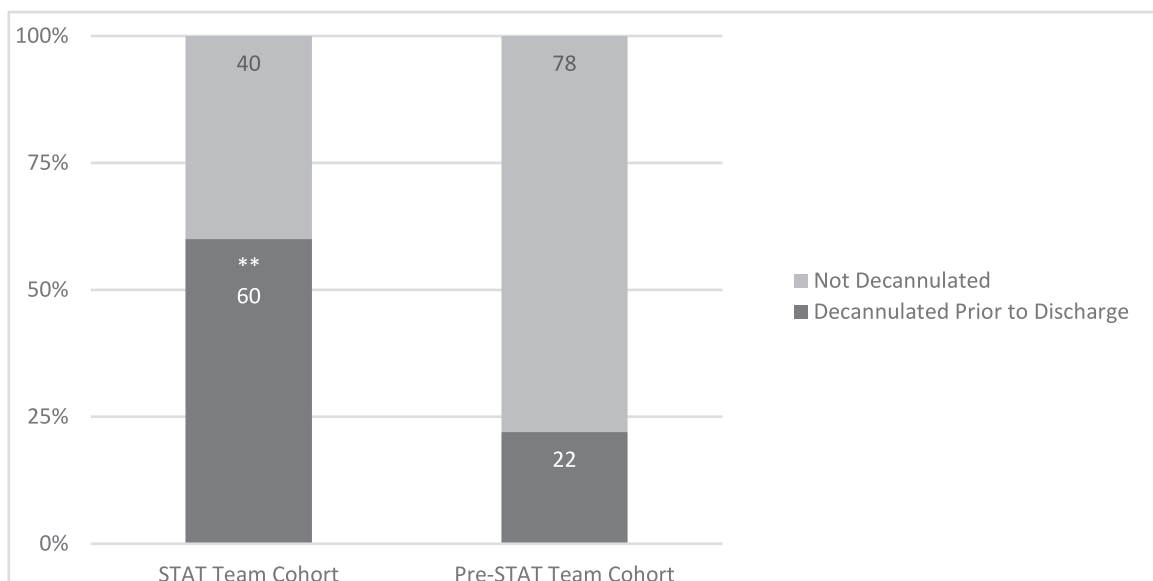|	STAT team (COVID Pts, 2020)	Pre-STAT team (Non-COVID Pts, 2019)
N		
Total	170	92
Surviving (%)	144 (18%)	72 (78%)
Expired	26	20
Gender		
Male (%)	106 (62%)	58 (64%)
Female (%)	64 (38%)	33 (36%)
Age		
Avg years (SD, range)	60.9 (12.3, 23–91)	59.9 (16.8, 20–93)
Length of stay		
Avg days (SD)	69.1 (32.6)	67.8 (52.0)
Trach to discharge		
Avg days (SD)	38.7 (30.3)	43.7 (45.5)
Decannulated prior to discharge		
N (%)	86 (60%)**	16 (22%)**

** $P < 0.0005$.

Fig. 1. Decannulation Rates Prior to Discharge. The STAT Team significantly increased decannulation rates prior to discharge (**$P < 0.0005$).

Table 2
Time to and incidence of appropriate trach change.

	STAT team (COVID Pts, 2020)	Pre-STAT team (Non-COVID Pts, 2019)
Time to first trach change		
Avg days (SD)	31.6 (18.8)	35.8 (34.3)
First trach change within 30 days		
Yes (%)	59 (49.2%)*	16 (21.9%)*
No (%)	61 (50.8%)*	41 (79.1%)*

* $P < 0.05$.

stays, vigilant tracheostomy care is paramount but often overlooked. One such care task is tracheostomy tube exchange within 30 days, as indicated by the manufacturer. When tube exchange is delayed beyond 30 days, patients are at greater risk for developing granulation tissue and contracting airway infections [4], making tracheostomy changes more difficult and dangerous, and in the most severe case in our experience, requiring a trip to the operating room to exchange the tube. The STAT team greatly increased the incidence of timely tube changes within 30 days, improving the safety of long-term tracheostomy care and reducing the likelihood of such avoidable complications.

Table 3
Method and rates of first follow up.

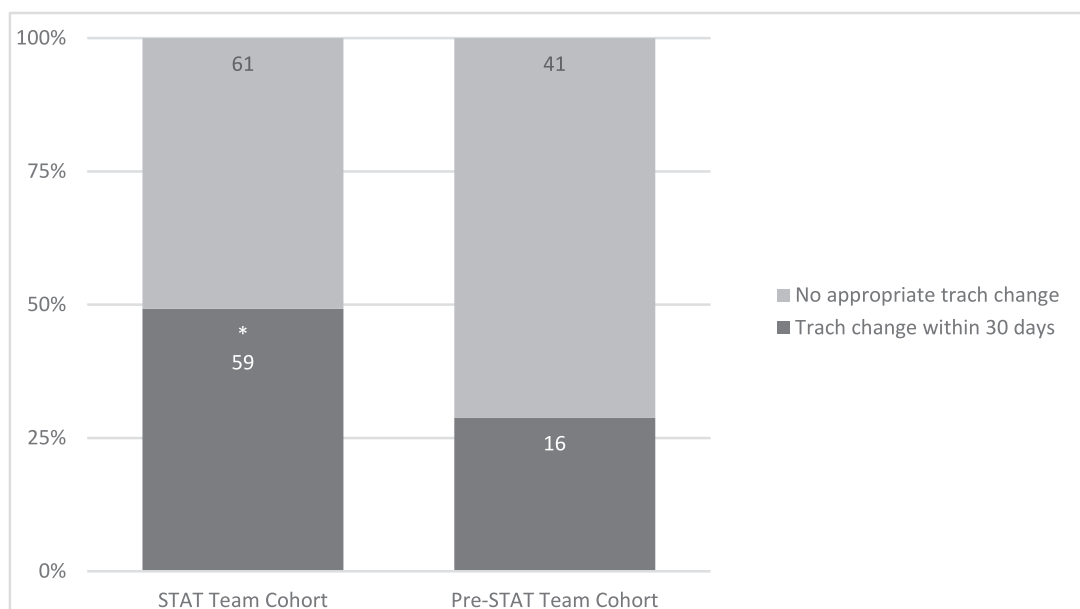| First follow up setting	STAT team (COVID Pts, 2020)	Pre-STAT team (Non-COVID Pts, 2019)
Total (%)	116 (80.6%)**	36 (50%)**
In hospital (%)	17 (11.8%)	27 (37.5%)
Outpatient clinic (%)	3 (2.1%)	9 (12.5%)
Phone call/video visit (%)	96 (66.7%)	N/A
None (%)	28 (19.4%)	36 (50%)

** $P < 0.0005$.

Fig. 2. Incidence of Appropriate Trach Tube Change. The STAT Team significantly increased the incidence of trach tube change within 30 days in indicated patients (*$P < 0.05$).
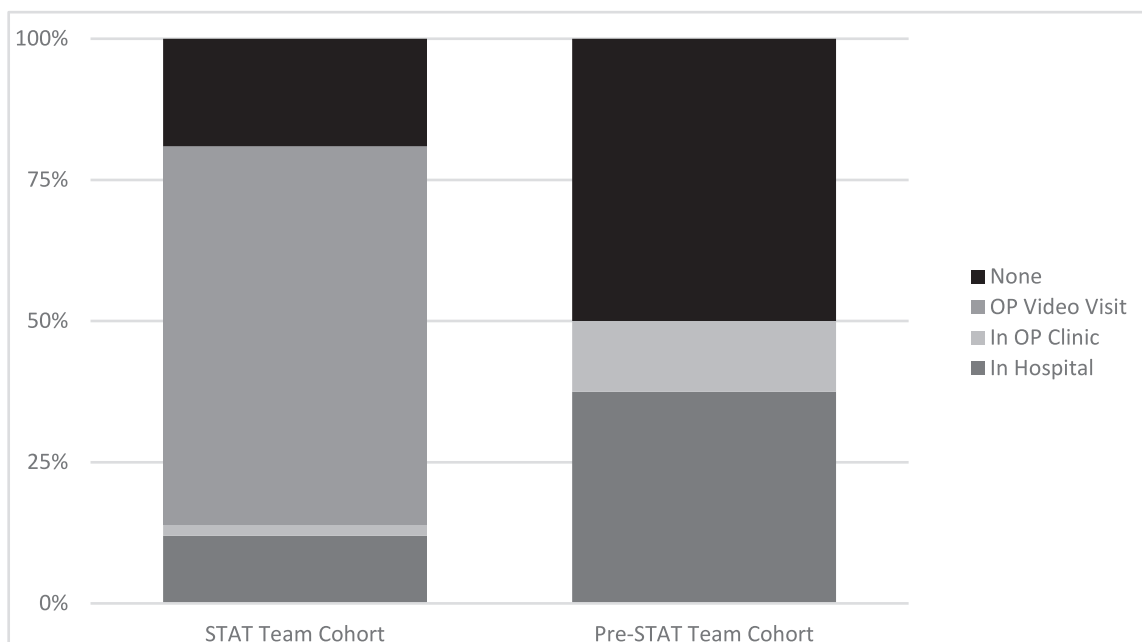
Fig. 3. Tracheostomy Patient Follow-Up. The STAT Team significantly increased rates of follow up for tracheostomy patients (OP: outpatient, $P < 0.0005$).

Table 4
Time to First Follow Up. Percentages were calculated from the total of followed-up patients.

Time to first follow up	STAT team (COVID Pts, 2020)	Pre-STAT team (Non-COVID Pts, 2019)
<1 month (%)	21 (18.1%)	5 (13.9%)
1–2 months (%)	64 (55.2%)	17 (47.2%)
2> months (%)	31 (26.7%)	14 (38.9%)

($P = 0.16$).

Finally, the STAT team significantly increased rates of follow up post tracheostomy. The very nature of "being lost to follow up" makes the phenomenon and subsequent complications difficult to quantify, but several studies that have attempted to do so cite incidences of tracheostomy losses to follow up as high as 75% [6]. These patients are at risk for developing airway complications that require higher orders of care in the long term that could have been avoided with follow up care [7]. The STAT team was able to provide appropriate post-discharge follow-up care to avoid these complication, particularly in the stressed healthcare environment during the COVID-19 pandemic.

It is possible that the increase in patient follow up seen with the STAT team is confounded by the different modes of follow up utilized prior to and during COVID because it can be more difficult for a patient to come in for an in-office appointment versus an at-home telemedicine appointment. However, a useful strategy can still be learned from this confounder: that video visits perhaps have higher rates of adherence and should be incorporated as the standard method of follow up moving forward, especially for more difficult to reach patients, such as those in nursing homes or bedbound at home with limited access to
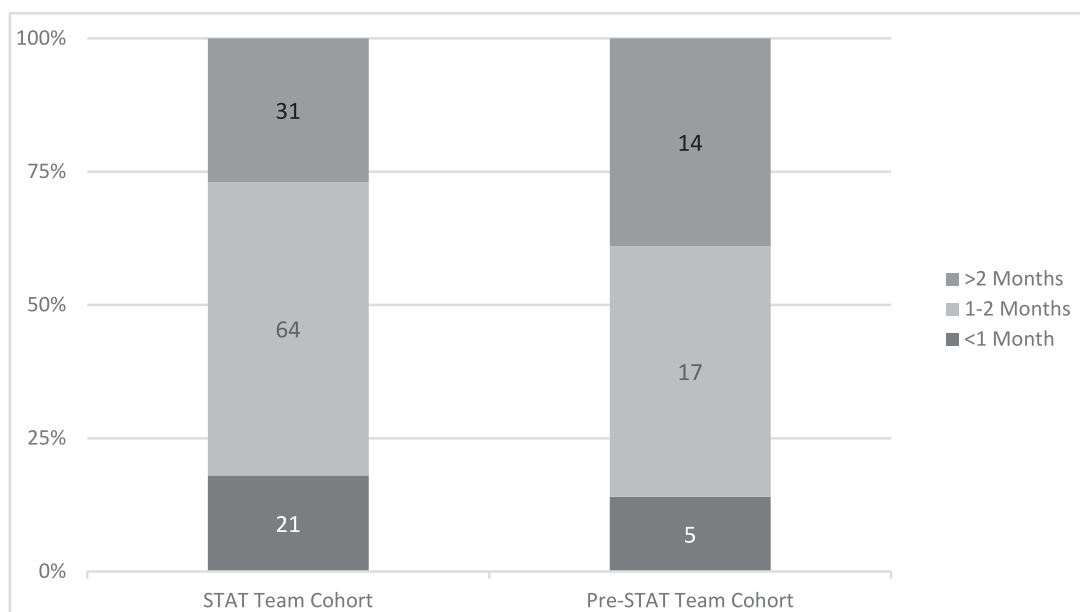

Fig. 4. Time to First Follow-Up. The STAT Team increased rate of first follow-up within 2 months from 61.1% to 73.3%.

transportation.

Other institutions have also demonstrated the success of collaborative care teams specific to a single procedure or diagnosis. Multidisciplinary care teams are in place in hospitals around the country for expert management of pulmonary embolism patients, urgent catheterization of appropriate cardiovascular patients, and expedition identification and rehabilitation of stroke patients [8–10], with significant benefit for the patients. Multidisciplinary care teams also exist for tracheostomy management with a variety of team structures [11]; however we are the only institution we are aware of that created this team as a direct response to the burdens of the COVID-19 pandemic on our hospital system. Given the clear benefits of our STAT team illustrated here, we advocate for continued tracheostomy care measures demonstrated by the STAT team, not only in our hospital system but as a generalized approach to tracheostomy management in other healthcare systems as well.

Tracheostomies require complex monitoring and interventions that can be overlooked in a busy hospital settings by teams charged with a diversity of responsibilities. The success of the STAT team demonstrates how useful a single-focus team can be in bridging gaps in care for patients of such a common, high-acuity procedure. The significant benefits provided by the STAT team despite the limitations and challenges of operating in the middle of the pandemic further suggests that there may be larger benefits to such a tracheostomy care team during non-pandemic times, strengthening the argument for permanent implementation and continuation of such single-focus care teams.

5. Conclusions

The STAT team was significantly beneficial to the care of tracheostomy patients at the height of the COVID-19 pandemic in New York. The team significantly increased rates of decannulation before discharge, thus facilitating advancement towards rehabilitation and independence from car. The STAT team also increased timely tracheostomy tube exchanges, reducing the change for avoidable tracheostomy-related complications. Finally, the team improved follow-up for tracheostomy care and capitalized on the use of telehealth medicine. The advantages of this single-focus type of care team would almost certainly extend beyond times of crisis, and could continue to provide benefits as a permanent fixture of hospital systems that care for tracheostomy patients.

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