Original Article

A survey of physicians' appreciation and knowledge about airway safety measures in the wake of COVID-19 pandemic

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Abstract

Background and Aims: The implementation of safety measures during airway management is a major concern to prevent COVID-19 transmission during pandemic. Various guidelines and advisories are in vogue to ensure safe practices. However, their success depends on the caregivers' knowledge and understanding. This survey was conducted to assess the knowledge and safety concerns amongst physicians towards airway management in the background of COVID-19 pandemic.

Material and Methods: A survey instrument of thirty questions covering three timelines of airway management viz. 'before', 'during' and 'after' airway intervention was created. The questionnaire was electronically mailed to the eligible physicians over a period of one month via a web-based platform and the responses were analyzed. The responses were depicted numerically as percentage. A multiple discriminant analysis was used to test the accuracy of responses after adjusting for common variables.

Results: Out of 407 responses, 300 were eligible for analysis. The respondents with correct answers to questions with single correct response were 46%, 69% and 57.3%, along the three timelines and the respondents with more than 75% correct responses in questions with multiple correct responses were 49%, 58% and 31% along the same timelines. About 75% of the participants became aware of transmission through aerosols aftermath pandemic. About two-third of the participants had knowledge about the safety guidelines and recommendations. Majority of the respondents were aware of the safety measures 'during airway intervention'.

Conclusion: Our study found satisfactory knowledge and appreciable concern among the practicing physicians regarding airway safety measures in the wake of COVID-19 pandemic. However, more physicians were aware about the measures required to be adopted 'during' airway intervention. The survey highlights the need for a more focused training of the caregivers about safety measures 'before' and 'after' airway intervention.

Keywords: Airway safety measures, COVID-19 pandemic, SARS CoV2

Introduction

COVID-19 pandemic has altered many conventional dynamics of patient care. Airway management technique is one such area as it results in increased risk of virus spread due to multiple reasons. The notable ones among them are the spread through aerosols, spread due to inadequate social distancing, and spread owing to the persistence of virus in the adjacent surfaces ('fomites'). Hence a cautionary approach is obligatory on the part of physicians to minimize the risk of virus transmission.[1-3]

The anesthetists, intensivists, emergency medicine physicians and pulmonologists are the frontline caregivers involved in the day-to-day airway management and care. Various guidelines and advisories are advocated by

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professional and regulatory bodies towards safe practice during airway management in the wake of COVID-19 pandemic.[1,4] However, the success of these guidelines and advisories depend on the physicians' perception of the safety issues and their comprehension about the remedial measures.[3-5]

Therefore, this survey was conducted to test the knowledge about safety measures and elicit the concerns of airway management among practicing anesthetists, intensivists, emergency care physicians and pulmonologists in relation to the published guidelines and advisories in the aftermath of the COVID-19 pandemic.

Material and Methods

This cross-sectional survey was based on a self-reported questionnaire received from physicians involved in airway management of patients. All practicing anesthetists, intensivists, emergency care physicians and pulmonologists with post graduate qualifications in their respective specialty and membership in any of the following societies were eligible for enrollment – Indian Society of Critical Care Medicine, Indian Society of Anesthesiologists, Society of Emergency Medicine India and Indian Chest Society. Those below 25 years or above 75 years of age, those who were either non-practicing or retired professionals, and those who responded the questionnaire from an email different from the one used by the investigators for correspondence, were excluded. The survey was conducted between 1st April 2020 and 3rd May 2020, with the first questionnaire being sent on 1st April and the last response received on 3rd May.

The questionnaire was constructed in two steps. In the first step, two sets of 20 questions each were separately framed by two investigators taking into consideration the safety guidelines and advisories of airway management published after the emergence of COVID-19 pandemic [Table 1]. In the second step, the two drafts were compiled into a single questionnaire of 30 questions by the third investigator on a web-based platform on Google Forms [Annexure 1]. The electronic mode of circulation was chosen for communication ease while ensuring social distancing. The questionnaire was pre tested in ten randomly selected physicians with expertise in airway management for relevance, clarity and appropriateness before putting into use.

The email IDs and telephone numbers of the prospective respondents were retrieved from the directory of Indian Society of Anesthesiologists (ISA), Indian Society of Critical Care Medicine (ISCCM), Society of Emergency Medicine India (SEMI) and Indian Chest Society (ICS) when available with confirmation of their post graduate qualifications. In addition, emails were sent to the offices of these societies soliciting their support in securing the email IDs of more members.

The email along with link to the survey questionnaire was mailed to all the eligible participants between 1st April, 2020 and 1st May, 2020. In case of no response, a reminder email was sent. Not more than three reminders were sent to any prospective participant within the stipulated period of one month. The study was also publicized on social media (WhatsApp, Twitter) for wider coverage and the respondents were encouraged to disseminate this information to their peers. The participation was purely voluntary with no incentives and informed consent for publication.

The questionnaire opened with a small description of the background and purpose of conducting the survey followed by a brief credential of the investigators. A total of 30 questions ranging across three timelines—before airway intervention, during airway intervention and after airway intervention—and were chronologically arranged in 4 parts [Figure 1]. All questions were close ended with multiple choice responses with the possibility of either single or multiple correct answers. The correct responses were the ones which were incorporated in any of the guidelines and advisories [Table 1].

The first part of the questionnaire had 9 questions pertaining to the demographic data of the respondents including their specialty, nature of practice, duration of practice, work experience in any COVID facility etc. The second part had 7 questions to assess the physician's concern while handling a suspected COVID patient. The third part had 8 questions to understand the physicians' concerns during intubation and ventilation. The fourth part had 6 questions enquiring the post intubation safety concerns and the benefits, if any this survey accrued to them.

The browser rejected incomplete submissions. Once submitted, the choices could not be altered. All completed data was stored electronically for processing and analysis. The qualitative variables were described by frequency distribution, while quantitative variables were described by the mean and standard deviation. The questions with single correct response was evaluated in percentage and the questions with multiple correct responses were divided into three quartiles of less than 50% correct response, between 50-75%correct response and more than 75% correct response. The responses

Table 1: Showing the published guidelines and position statements on safety measures on airway management aftermath COVID-19 pandemic

Name of the Professional/ Regulatory body	Title	Nature and date of publication	Site of publications	Key features used for formulating the survey questionnaire
American Society of Anesthesiologists	Information for Health Care Professionals	Guidelines (March 2020)	https://www.asahq.org/about-asa/governance-and-committees/asa-committees/committee-on-occupational-health/coronavirus	Before airway intervention AIIR, PPE, Planning (avoid rescue intervention) During airway intervention Most experienced professional double gloves, RSI, double gloves, HEPA filter
Indian Society of Anesthesiologists	ISA National Advisory and Position Statement regarding COVID-19	Advisory and position statement (April 2020)	Indian Journal of Anesthesia	Before airway intervention PPE, avoid high flow O_2 During airway intervention Experienced anesthesiologists, exchange filters, two layers of wet gauze over patient's nose and mouth, RSI, immediately inflate cuff, Video-laryngoscope, prophylactic administration of anti-emetic, supraglottic airway devices in 'cannot ventilate' situations After airway intervention Closed airway suction system, lung protective strategies: low TV (4-8 ml/kg PBW), High PEEP, Lower inspiratory pressures (PP <30 cmH_2O), pH goal 7.30-7.45
Centre for Disease Control and Prevention	Information for Healthcare Professionals about Coronavirus (COVID-19)	Interim Infection Prevention and Control Recommendations (April 2020)	https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html	Before airway intervention AIIR, Hand hygiene with 60-95% alcohol or soap and water for at least 20 seconds, PPE During airway intervention Limit personnel during procedure After airway intervention Disinfect procedure room, surfaces
World Health Organization	Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected	Interim guidance (March 2020)	https://www.who.int/publications-detail	Before airway intervention PPE, hand hygiene, assessment if additional precautions needed (e.g., droplet, contact, or airborne), HFNO, NIV with close monitoring During airway intervention Intubation by experienced provider using airborne precautions After airway intervention MV: low TV (4-8 mL/kg PBW), higher PEEP, low inspiratory pressures (PP <30 cmH_2O), prone ventilation in severe ARDS
Chinese Society of Anesthesiology Task Force on Airway Management	Expert Recommendations for Tracheal Intubation in Critically ill Patients with Noval Coronavirus Disease 2019	Expert recommendations (February 2020)	Chinese Medical Sciences Journal	Before airway intervention Airborne droplet PPE During airway intervention Experienced anaesthesiologist, familiar airway device, use of wet gauzes preoxygenation for 5 minutes, video- laryngoscopy, modified RSI, second-generation laryngeal mask After airway intervention ETT confirmation: direct vision, $ETCO_2$, thoracic movement, closed airway suction, HEPA filter

Contd...

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Name of the Professional/ Regulatory body	Title	Nature and date of publication	Site of publications	Key features used for formulating the survey questionnaire
CHEST	COVID-19 Precautions during airway management	Advisory (March 2020)	Official site https://www.chestnet.org/Guidelines-and-Resources/COVID-19/Updates-and-Resources	Before airway intervention Negative pressure room, anterooms for PPE, designated intubation cart, N95 or higher respirator, minimizing personnel, debrief and share lessons During airway intervention Experienced provider, preoxygenation for 5 min, RSI, dedicated Video-laryngoscope, lidocaine as cough suppressant during intubation After airway intervention Exposure monitoring for all HCWs exposed to COVID-19 patient
Anaesthesia 2020*	Consensus guidelines for managing the airway in patients with COVID-19:	Guidelines (March 2020)	Anaesthesia	Before airway intervention Negative pressure room >12 AE/h, COVID-19 intubation trolley, limit staff (intubator, assistant, drug administrator, runner), PPE with double gloves, communicate plan, cognitive aids During airway intervention Best skilled airway manager, preoxygenation for 5 min, two person-two hand technique, video-laryngoscope, supraglottic airway device, HME filters, RSI, clamp tube After airway intervention Confirm with capnogram
International Anesthesia Research Society.	Recommendations for Endotracheal Intubation of COVID-19 Patients	Editorial (March 2020)	Anesthesia- analgesia	Before airway intervention PPE (head covers not standardized), plan ahead During airway intervention Most experienced anesthetist, preoxygenation for 5 min, RSI, avoid awake fibreoptic intubation, high efficiency hydrophobic filter After airway intervention Robust communication system: front-line health care providers to provide rapid feedback to policy makers and vice versa

**AIIR=Airborne Infection Isolation Room, PPE=Personal Protective Equipment, RSI=Rapid Sequence Induction, HME=Heat and Moisture Exchange, HEPA=High Efficiency Particulate Air, MV=Mechanical ventilation, TV=Tidal Volume , PBW=Predicted Body Weight, PP=Plateau Pressure, PEEP=Peak End-Expiratory Pressure, HFNO=High Frequency Nasal Oxygen, NIV=Non-Invasive Ventilation, ARDS=Acute Respiratory Distress Syndrome*

to both types of questions were depicted numerically as percentage. Pearson's Chi-square test was used to compare all categorical data. A multiple discriminant analysis was run to find how accurately a participant with formal or informal training can be expected to answer the questions correctly after adjusting for age, specialty and duration experience. All data were analyzed via Statistical Package for the Social Sciences (SPSS, version 24.0, Chicago, IL) software and significance was evaluated as $P < 0.05$ wherever relevant.

Results

Out of 407 participants, 300 were found eligible for evaluation [Figure 1]. The mean age of the participants was 38 ± 9.54 years (mean ± SD) within a range of 25-75 years and male preponderance (2:1). The majority of the respondents were anesthesiologists (65.7%) followed by intensivists (18.3%). Most of them were practicing in a single institution (89.3%). Their average duration of experience was 9.8 ± 8.9 years (mean ± SD) within a range of 3-44 years. 22.7% of the respondents were working in a dedicated COVID hospital. 23% of the respondents received safety training during airway management in COVID patients and 60.3% were self-trained. Majority of them were practicing in India (98%) [Table 2].

The 'before airway intervention' timeline consisted of 3 single correct response questions and 3 multiple correct response questions [Figure 2]. The percentage of participants with correct response to single correct response questions were 63%, 35% and 40%, respectively, and the percentage of respondents with more than 75% correct responses to

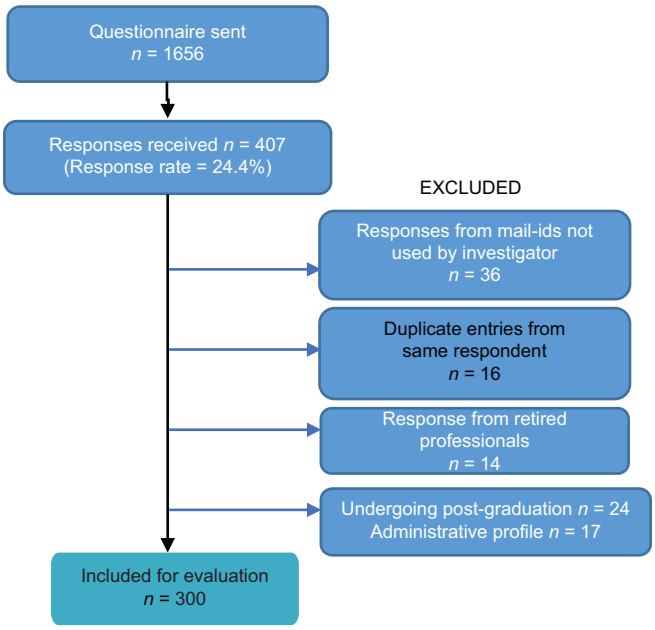

Figure 1: Flowchart depicting recruitment of eligible respondents and final evaluation of survey

Table 2: Demographic profile of respondents

Demographic variables	Values
Age (years) Mean±SD (Range)	38±9.54 (25-75)
Gender *n* (%)	
Male	186 (62%)
Female	114 (38%)
Speciality *n* (%)	
Anaesthesiology	197 (65.7%)
Critical Care	55 (18.3%)
Respiratory Physician	6 (2%)
Emergency Physicians	42 (14%)
Type of hospital practice *n* (%)	
Single hospital	268 (89.3%)
Multiple hospitals	27 (9.0%)
Transport & ambulances	5 (1.7%)
Experience (years) Mean±SD (Range)	9.86±8.91 (0-44)
Working in designated COVID-19 hospital *n* (%)	
Yes	68 (22.7%)
No	232 (77.3%)
Have you received any formal training? *n* (%)	
No, but have gained knowledge	181 (60.3%)
No, no prior knowledge than this	50 (16.7%)
Yes	69 (23.0%)
Geographical location	
India	242 (80.7%)
Outside India	6 (2%)
Unknown	52 (17.3%)

multiple correct response questions were 55%, 32% and 60%, respectively [Figures 3 and 4].

The 'during airway intervention' timeline contained 4 single correct response questions and 2 multiple correct response questions [Figure 1]. The percentage of participants with correct response to single correct response questions were 52%, 35%, 76% and 66% respectively and the percentage of respondents with more than 75% correct responses to multiple correct response questions were 71% and 45% respectively [Figures 5 and 6].

The 'after airway intervention' timeline had 2 single correct response questions and one multiple correct response question [Figure 1]. The percentage of participants with correct response to the single correct response question was 69% for both the questions, while 31% participants provided more than 75% correct responses to the multiple correct response type questions [Figures 7 and 8].

It was found that 75% of the participants were unaware about the risk of COVID-19 spread through aerosol generation before the pandemic, but 90% became aware of the same after the pandemic. About 11% were not adopting any measures to minimize the aerosol borne transmission of the virus. About 81% of the participants considered prior training as helpful in improving their knowledge and skills. Two third of the respondents were thoroughly abreast with the published safety guidelines and recommendations, while 30% were partially aware but not fully well-versed. About 62% of the physicians found our survey to be useful in expanding their knowledge about safety measures during airway management in relation to COVID-19 pandemic while 35% found it to be moderately useful [Figure 9].

Multiple discriminant analysis was run to find how accurately one can predict if a participant formally trained or informally trained or not at all trained in airways management can provide answer to the questions. The canonical variables were compared to some of the selected questions where the function was represented according to the regression equations depending on the choices of answer. 63% of original grouped cases are correctly classified in this model. Cases in blue color (not trained, but gained information from other sources) were well separated, reflecting fewer errors in classification and 97.8% correct classification [Figure 10].

Discussion

Our study found a considerable gain in the knowledge of SARS CoV2 transmission via aerosol among physicians involved in airway management aftermath COVID-19 pandemic. There are enough reasons for the same. Although coronaviruses have infected human beings since the late 1960s, their lethal potential was only recognized after the outbreak of severe acute respirator syndrome (SARS) in 2002 and Middle East respiratory syndrome (MERS) in 2012. The major difference between SARS CoV of 2002 and SARS CoV2 of 2019 (COVID-19) is that in the former the virus load reached high levels much later during the

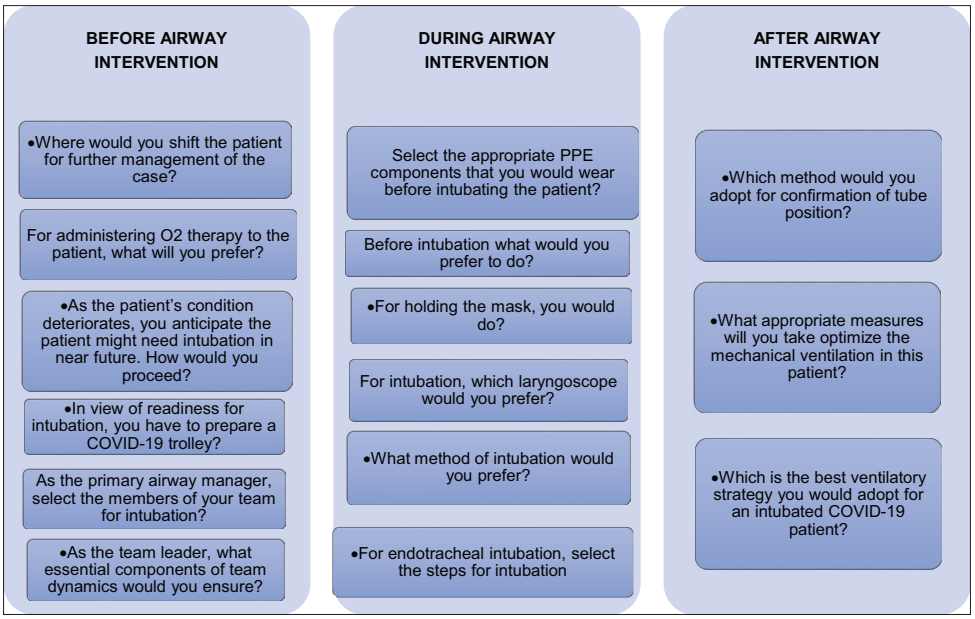

Figure 2: Figure showing chronology of the questions across the three timelines

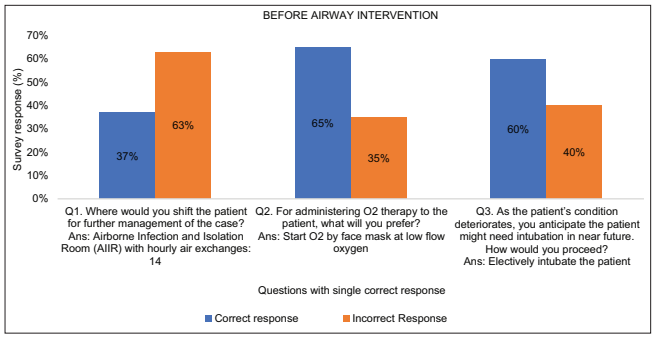

Figure 3: Figure depicting percentage of respondents selecting the correct response to questions with single correct answers pertaining to before airway intervention

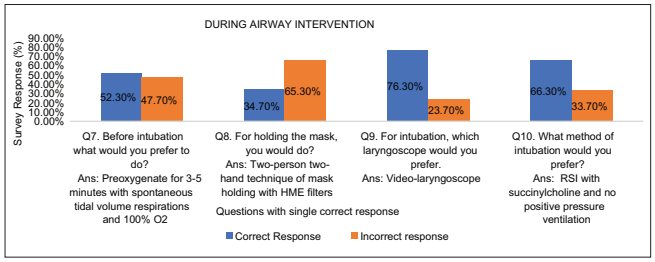

Figure 5: Bar diagram depicting percentage of respondents selecting the correct response to questions with single correct answers pertaining to "During airway intervention"

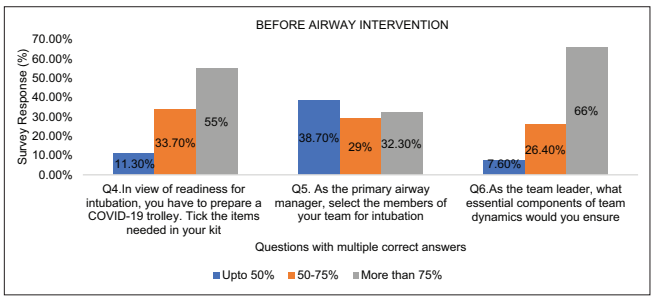

Figure 4: Figure depicting percentage of respondents selecting correct responses (<50%, 50-75%, >75%) to questions with multiple correct choices pertaining to "Before airway intervention". Q4 (Ans). Face masks, airways, HME filters, supraglottic airway devices, endotracheal tubes with subglottic suction ports, stylet, closed suction catheters, mackintosh laryngoscope, video-laryngoscopes, wet and dry gauzes, tube clamps, Q5 (Ans). Most expert airway manager with donned PPE, expert assistant for protocol/ devices with donned PPE, second expert team member with donned PPE, another airway manager with donned PPE outside the area, PPE donning and doffing observer (buddy) outside the area, runner outside the room for collecting essential stuff, Q6 (Ans). Prepare a strategy, closed loop communication, visual aids for reference, clear delineation of roles, clear communication of airway plan, closed monitoring for all team members for potential contamination, team debriefing

illness and was concentrated much less in the nasal cavity and nasopharynx.[6,7] MERS although had a higher case fatality exceeding 30% but was less transmissible than SARS CoV. Hence, the spread of the virus during airway manipulations occurred in much lesser magnitude after SARS CoV and MERS than SARS CoV2. The lesser spread fostered lesser data and limited sharing of experiences. No guidelines or advisories were published following earlier outbreaks for guiding safety measures during airway management by the professional or regulatory bodies. This was in contrast after SARS CoV2. Long before COVID-19 was declared as a pandemic by WHO, Singapore General Hospital framed guidelines for airborne and contact precautions, including environmental safety measures, staffing pattern, disinfection practices, sterilization safeguards and personal protective equipment (PPE) utilization.[8] Similar guidelines were also in vogue in Korea, Hong Kong and Germany.[9] This led to more sensitization of physicians all over the world and many who were earlier unaware about the risk of virus transmission during airway management became aware of the same during the current pandemic.

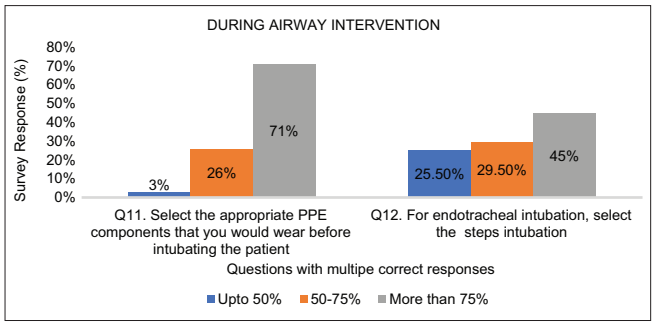

Figure 6: Figure depicting percentage of respondents selecting correct responses (<50%, 50-75%, >75%) to questions with multiple correct choices pertaining to "During airway intervention". Q11 (Ans).: Donning and doffing buddy, separate donning and doffing area, hospital scrubs, head cover, hand hygiene- hand wash with soap, hand hygiene- hand rub with alcohol, shoe covers, one layer of impervious gown, N95 mask/ high quality respirator, eye goggles, face shield, two pairs of gloves, Q12(Ans): Intubate under vision, attach to the breathing circuit without tube confirmation, inflate endotracheal cuff with air, clamp the tube safely with tube clamp/arterial clamp before intubation, keep wet gauze over mouth and nose during mask ventilation

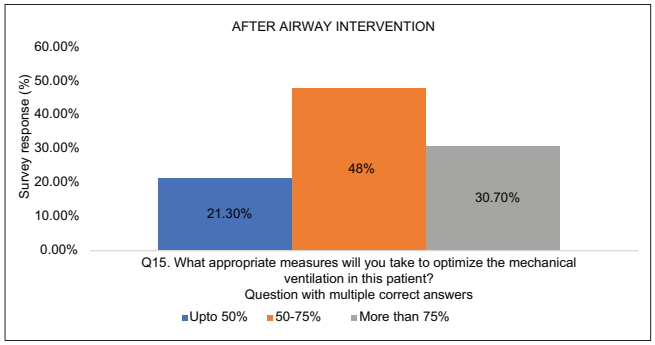

Figure 8: Figure depicting percentage of respondents selecting correct responses (<50%, 50-75%, >75%) to questions with multiple correct choices pertaining to "After airway intervention". Q15 (Ans): HME filter at the expiratory limb of breathing circuit closed suction technique, early proning if needed

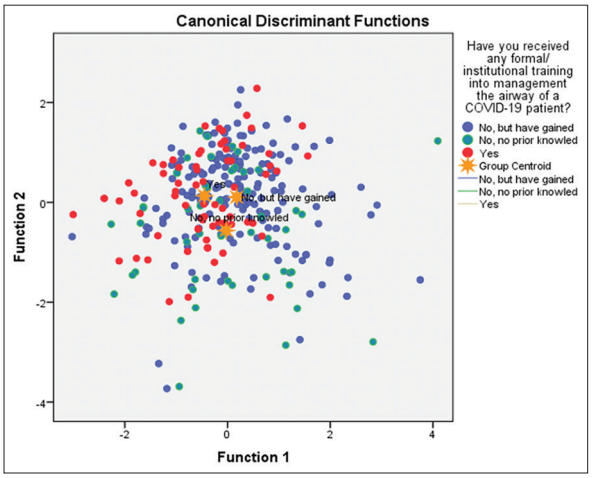

Figure 10: Canonical plot demonstrating the strength of association between prior training received and the proportion of correct responses to questionnaire after adjusting for the duration of practice and age

Our study extracted more correct responses for the questions pertaining to the events occurring 'during airway intervention' than those 'before' or 'after' airway intervention. This suggests

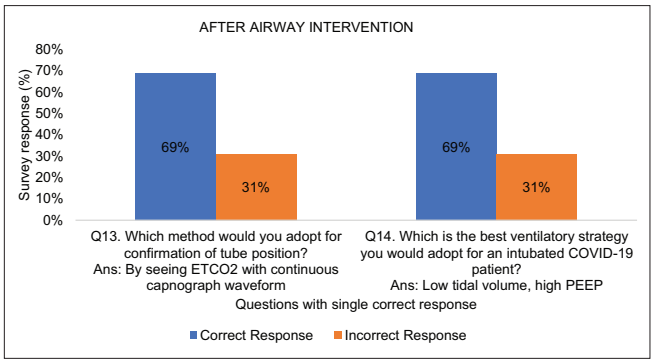

Figure 7: Figure depicting percentage of respondents selecting the correct response to questions with single correct answers pertaining to "After airway intervention"

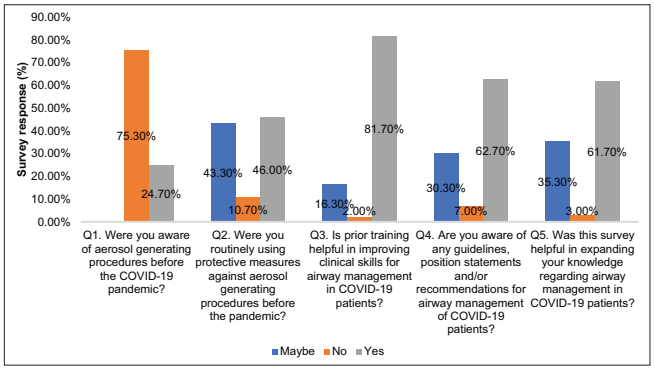

Figure 9: Figure depicting concerns of respondents regarding the safety measures for airway management

that the physicians are more observant and particular during the performance of endotracheal intubation and airway management procedures and hence more careful about the safety measures during such acts. It was reported during SARS CoV outbreak that healthcare workers performing or being exposed to a tracheal intubation had a higher risk of SARS CoV transmission compared to unexposed healthcare workers.[10] Hence, it is obvious that SARS CoV2 which has far greater infectivity than SARS CoV can pose an even higher risk of disease transmission during acts of airway intervention. So, the greater awareness among physicians about safety measures 'during airway intervention' as reflected from the increased correct responses can ensure the lesser likelihood of virus spread during airway intervention. But it is important to recognize the high rate of 'fomite' born transmission that can take place either 'after' or 'before' airway intervention.[10,11] More training programs should focus on these areas to ensure implementation of the guidelines to reduce the risk of such spread.

In one study, where generalized estimating equation (GEE) logistic regression models and classification and regression trees (CART) were used for the identification of risk factors for SARS transmission, it was found that the presence more number of personnel and for greater time period inside the

room harboring SARS CoV patient increased the risk of SARS-CoV transmission among healthcare workers.[11] This may be explained on account of failure to maintain sufficient social distancing in the wake of limited availability of PPE in 2002. This is another area where more caution is required as per our survey results. Simulation and debriefs are smart and novel ways for system testing. Besides limiting the PPE usage in resource crunch settings, it can measure the time required for donning in special situations viz. ambulances, ICU etc. The mock PPEs are particularly useful for repetitive exercises like adaption to sign language, task collaboration between 'clean' and 'non-clean' workers and infection control during handover and transport.[12]

The likelihood of extra cautious during endotracheal intubation that is depicted in our survey from the high correct response rates to such questions have been also observed in the earlier studies.[13,14] This approach is reassuring because it allows early recognition of failures and facilitates post exposure prophylaxis in cases of PPE failure.[15]

In the timelines of 'before' and 'after airway intervention' the lesser number of correct responses to the survey questionnaire suggests lesser vigilance of the physicians towards the safety measures. This may be possible on account of shared responsibility of the physicians with other workers which can lead to diminution in their vigilance.[16] Furthermore, many maneuvers like tracheobronchial toileting, drug nebulization etc. are performed by the nursing personnel, anesthesia assistant etc., and not by the physicians or intensivists. Therefore, considerable scope for increased virus transmission exists during these acts if the concerned workers are less vigilant. Hence, good nursing education coupled with good training of the paramedical personnel is necessary for preventing virus transmission to the healthcare workers during these steps.[16,17]

The participants in our survey were wary about the ventilation maneuvers and some of the answers to the survey questions were incongruent. This occurred due to repetitive changes in the position of the expert bodies about the ventilatory strategies for COVID patients. While the initial recommendations called for either oxygen therapy or early invasive ventilation with near total abolition of non-invasive ventilation (NIV) and high flow nasal cannula (HFNC), the later directives urged for HFNC in selective patients. This occurred after the recognition of L and H as 2 distinct variants of COVID-associated pneumonia where spontaneous ventilation was preferred in the former and early invasive ventilation in the later. Even when invasive ventilation was required, the applied PEEP was normal to low in the former and high in the later.[18-20] These frequent shifts in our ventilatory strategies within a narrow time frame created some knowledge gap amongst physicians. The variable responses to the questions about ventilatory strategies in our survey highlight this fact.

In our study, more physicians felt the need for comprehensive training programs. This not only points to some inadequacies in our current training methods but also proposes to use a focused approach during training of professionals. In reality there may be much variation in physicians' practice of donning and doffing of PPE, in the performance of bronchoscopy and overall aptitude. A specialty-based focused training of professionals can correct the specific deficiencies in a better way. A focused training can also identify such barriers which show inter-individual variation viz. inability to converse after wearing PPE, easy of response to sign language etc. Since the learning curves depend on the specialty and exposure, simulation based training can be utilized as corollary to real time scenarios. Our survey found that the physicians were happier after receiving training in a COVID hospital. This may be due to the psychological effect of experiencing training in real time. Most of the findings of our study are likely to yield correct responses as per the multiple discriminant analysis in our canonical graphs.

Finally, our survey found that many participants gained knowledge about the safety measures against virus transmission during airway management after participating in our survey. Therefore, besides gathering information, our survey was useful in propagating awareness the airway safety measures. This happened because many of our participants were not affiliated to teaching institutions and were practicing in small hospitals. There were also logistic constraints across many parts of our country owing to inadequate PPE supply, lack of N95 masks etc. during the initial phase of the pandemic. Therefore, despite propagation of awareness, its implementation on ground level was wanting.

Our survey had some limitations. One, it was conducted in a diverse group of practitioners with large variation in their experience, knowledge and skills. This can influence or results. Second, the sample was small as only twenty five percent of the emails were responded. This may be because of the hectic duty shifts of the physicians during the pandemic. Third, our survey was pre tested among the physicians of 2 out of 4 specialties before use, and hence may have escaped the more stringent scrutiny. Despite these shortcomings, we were able to secure reliable data and perform consistent analysis.

To conclude, our survey found satisfactory knowledge and requisite concern among the practicing physicians towards the

risk of virus transmission during airway management in the wake of COVID pandemic. However, since our observation is based on a small and heterogeneous cohort of physicians from multiple specialties it cannot be generalized for entire population. More studies are required to understand the subtle differences in practice patterns and create measurement tools for ensuring safety of the patient and health care workers in such environment.

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Conflicts of interest

There are no conflicts of interest.

References

1. Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists. Anaesthesia 2020;75:785-99.
2. Orser BA. Recommendations for endotracheal intubation of COVID-19 Patients. Anesth Analg 2020;130:1109-10.
3. Greenland JR, Michelow MD, Wang L, London MJ. COVID-19 infection: Implications for perioperative and critical care physicians. Anesthesiology 2020;132:1346-61.
4. Banik RK, Ulrich AK. Evidence of short-range aerosol transmission of SARS-CoV-2 and call for universal airborne precautions for anesthesiologists during the COVID-19 pandemic. Anesth Analg 2020:10.1213/ANE.0000000000004933. doi: 10.1213/ANE.0000000000004933. Online ahead of print.
5. Heffernan DS, Evans HL, Huston JM, Claridge JA, Blake DP, May AK, *et al*. Surgical Infection Society Guidance for operative and peri-operative care of adult patients infected by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Surg Infect (Larchmt) 2020;21:301-8.
6. Liu J, Zheng X, Tong Q, Li W, Wang B, Sutter K, *et al*. Overlapping and discrete aspects of the pathology and pathogenesis of the emerging human pathogenic coronaviruses SARS-CoV, MERS-CoV, and 2019-nCoV. J Med Virol 2020;92:491-4.
7. Guarner J. Three Emerging Coronaviruses in Two Decades. Am J Clin Pathol 2020;153:420-1.
8. Au Yong PS, Chen X. Reducing droplet spread during airway manipulation: Lessons from the COVID-19 pandemic in Singapore. Br J Anaesth 2020:S0007-0912(20)30219-1. doi: 10.1016/j.bja.2020.04.007. Online ahead of print.
9. Cheung JC, Ho LT, Cheng JV, Cham EYK, Lam KN. Staff safety during emergency airway management for COVID-19 in Hong Kong. Lancet Respir Med 2020;8:e19.
10. 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:e35797.
11. Raboud J, Shigayeva A, McGeer A, Bontovics E, Chapman M, Gravel D, *et al*. Risk factors for SARS transmission from patients requiring intubation: A multicentre investigation in Toronto, Canada. PLoS One 2010;5:e10717.
12. Dieckmann P, Torgeirsen K, Qvindesland SA, Thomas L, Bushell V, Langli Ersdal H. The use of simulation to prepare and improve responses to infectious disease outbreaks like COVID-19: Practical tips and resources from Norway, Denmark, and the UK. Adv Simul (Lond) 2020;5:3.
13. Weinger M, Englund C. Ergonomic and human factors affecting anesthetic vigilance and monitoring performance in the operating room environment. Anesthesiology 1990;73:995-1021.
14. Gaba DM, Howard SK, Small SD. Situation awareness in anesthesiology. Hum Factors 1995;37:20-31.
15. Choi JW, Kim DK, Cho CK, Park SJ, Son YH. Trends in medical disputes involving anesthesia during July 2009-June 2018: An analysis of the Korean Society of Anesthesiologists database. Korean J Anesthesiol 2019;72:156-63.
16. Houghton C, Meskell P, Delaney H, Smalle M, Glenton C, Booth A, *et al*. Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: A rapid qualitative evidence synthesis. Cochrane Database Syst Rev 2020;4:CD013582.
17. Karimi-Shahanjarini A, Shakibazadeh E, Rashidian A, Hajimiri K, Glenton C, Noyes J, *et al*. Barriers and facilitators to the implementation of doctor-nurse substitution strategies in primary care: A qualitative evidence synthesis. Cochrane Database Syst Rev 2019;4:CD010412.
18. Phua J, Weng L, Ling L, Egi M, Lim CM, Divatia JV, *et al*. Intensive care management of coronavirus disease 2019 (COVID-19): Challenges and recommendations. Lancet Respir Med 2020;8:506-17.
19. Gattinoni L, Coppola S, Cressoni M, Busana M, Rossi S, Chiumello D. Covid-19 does not lead to a "typical" acute respiratory distress syndrome. Am J Respir Crit Care Med 2020;201:1299-300.
20. Gattinoni L, Chiumello D, Caironi P, Busana M, Romitti F, Brazzi L, *et al*. COVID-19 pneumonia: Different respiratory treatment for different phenotypes? Intensive Care Med 2020;46:1099-102.