Original Research Article

Cross- sectional Questionnaire-Based study to assess the impact of mechanical ventilation training during COVID-19 pandemic

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Abstract

Background and aim: Today the whole world is fighting the COVID-19 pandemic with scarcity of critical care experts and sudden surge in patients have come out to the real challenge for our nation. To solve this problem all clinicians, post graduates, undergraduates including all health care workers and support staff should be made conversant, competent, confident and accustomed with ventilators to manage patients during emergency. Government of India has been precocious in designating anaesthesiologists to train health care workers. All clinical experts have taken up the challenge and gone above and beyond in implementing it. **Material and method:** The prospective questionnaire-based survey study including 210 doctors was conducted in tertiary care hospital. Training included didactic lectures, videos, role plays, skill demonstration along with practice on manikins and preparedness rehearsal. Post training and deployment in COVID -19 area participants were provided with a questionnaire of 15 questions with three possible outcomes. Submission of questionnaire post completion was considered as consent. **Observation:** Statistical analysis was performed using Statistical package for Social Sciences (SPSS) version 22 (SPSS Inc., Chicago, IL, USA). Data pertaining to participants receptance of training and its advantage were collected and analysed descriptively using frequencies and percentages. **Results:** Out of 210 participants 80.95% found the training essential, informative and helpful in-patient management while 19.05% found it informative yet were doubtful regarding enhancement of skills and confidence. Conclusion: This study provided encouraging results and gave new dimensions in making professionals competent in handling COVID -19 crisis.

Keywords: Mechanical ventilation education, ventilator training, covid-19 education, corona virus, simulation.

Introduction

Sudden global outbreak of COVID-19 pandemic and scarcity of experts for managing the disease has risen as a huge challenge in front of medical fraternity for managing the acute surge and severity of disease including the morbidity and mortality associated with it.

There is a clear depletion of knowledge and qualified specialists who can manage patients requiring mechanical ventilatory support during the course of disease. This problem is further accentuated by need to provide adequate quarantine period and early diagnosis and isolation of infected health care workers in order to contain the spread of deadly COVID -19 infection among medical and paramedical population.

To handle this situation of unprecedented strain [1,2] which has been put on anaesthesiologists and respiratory physicians a government of India directed ventilation training programme was organised by department of anaesthesiology and critical care for doctors at tertiary COVID-19 designated hospital which included all the health care workers who were planned to be deployed in the COVID-19 working area.

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Due to fear amongst the doctors regarding this mysterious disease [3] and non-familiarity with the airway management and ventilation protocol associated with the COVID-19 pneumonia it was considered that knowledge and skills regarding self-care, protection and management of corona positive patients should be imparted before posting doctors in frontline COVID -19 area [4]. It is indicated that topics such as respiratory physiology, ventilation modes, use of non-invasive and invasive ventilation, monitoring, complications of mechanical ventilation (MV), and appropriate weaning strategies are the main competencies for any MV operator[5]. Nevertheless, in developing countries, due to a predominance of lack of experience in handling critical patients inside the health-care team, initiation of MV relies on untrained general physicians [6].The objective of the training was to impart importance of personal protective gear due to severity of disease spread, assessing severity of patient's condition, following treatment protocol according to standard guidelines and decision making for providing non-invasive or invasive ventilatory support in deteriorating patients under guidance of experts. Achievement of skills, improvement in level of confidence, removal of fears and development of positive attitude while patient management were aimed by the training.It was very well understood that trained medical graduates and post graduates of different specialities cannot be the replacement of experts but could act as helping hands in monitoring and management of patients in COVID -19 area under their physical or virtual supervision.

Material and methods

This prospective, cross-sectional survey was conducted for the period of 1 year from march 2020 to march 2021 in a tertiary care hospital to obtain an

insight into advantages of ventilatory training in midst of covid-19 surge. 239 doctors were invited to attend the training including faculty, senior residents, junior residents and interns from department of general surgery, microbiology, obstetrics and gynaecology, dermatology, respiratory medicine, ENT, ophthalmology, paediatrics, radiology, orthopaedics and Ayush graduates.All were given cognitive background and hands on training for a period of 30 hours each with 5 hours training for 6 days. Participants were randomly allocated in sixteen different group with15 each maintaining adequate social distancing during conduct of training. Mandatory protocols were followed strictly by wearing of mask and cap with hand washing and sanitisation while attending the training. Department of anaesthesiology with cooperation of department of respiratory medicine and medicine prepared the training protocol which included few basic and relevant topics to provide cognitive back ground regarding personal protection, airway management and basic ventilation knowledge, conducted hands on training for airway intubation and strategies involved in management of non- invasive and invasive ventilation[7]. Didactic lectures, Videos, Demonstrations of skills by the trainers on manikins and models, ICU ventilators for learning settings, Clinical assessment of airway amongst the trainees, Role plays, Preparedness rehearsal regarding drugs, equipment and human resources were used as tools for training[4, 8]. Direct observation of procedural skills(DOPS) method was used to evaluate the practical skills and provide feedback[9].Closed multiple-choice design for the questionnaire was selected to meet the criteria of objectivity and to exclude the possibility of interpretational errors. The questionnaire was provided to them after completion of training with request to answer it and mention their own experiences and comments in provided space. The questionnaire consisted of four sections. The first section was related to general information regarding the disease. The second section pertained to the trainee's confidence in intubation and airway management. The third section was intended to gain information regarding knowledge associated with ventilation. The fourth section indicated the effectivity of training in adding knowledge and confidence in patient management. The questionnaire was distributed manually among trainees though the two ayush doctors who attended the training could not be contacted, out of which 223 reverted submitting the questionnaire. 13 participants were excluded from the study due to incompletely filled questionnaire. therefore, a total of 210 participants were included in this study [FIGURE 1]. Sharing of the personal information in the questionnaire and submitting it after completion by the participants implied their consent.

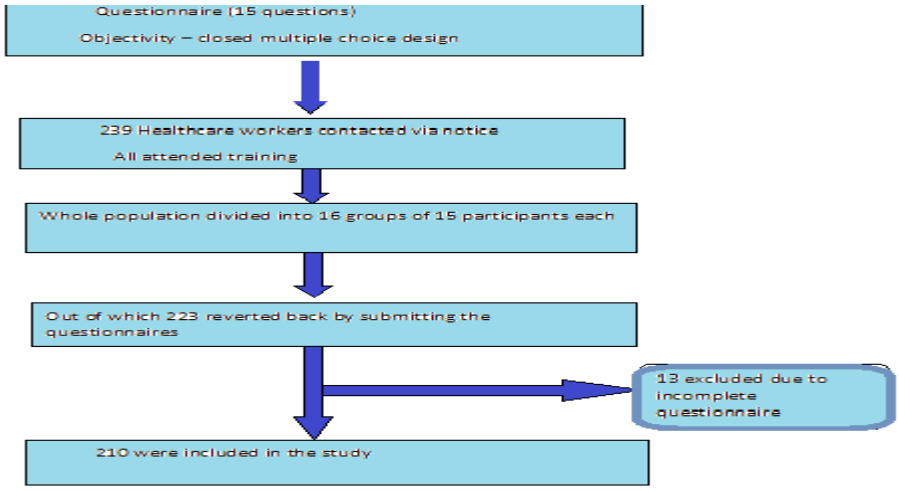

Fig 1: consort diagram

Statistical analysis

Statistical analysis was performed using Statistical package for Social Sciences (SPSS) version 22 (SPSS Inc., Chicago, IL, USA). Data pertaining to participants receptance of training and its advantage were collected and analysed descriptively using frequencies and percentages.

Observations

In this study the percentage of faculty participation was 19.04% of total participants. Out of which 9.52% were from obstetrics and gynaecology and 4.76% each from anatomy and general surgery. Residents from different speciality departments participating in the study comprised of 76.19% out of which 52.38% were junior and 23.81 % were senior residents. Intern participation was found to be 4.77% [TABLE 1]. Two ayush graduates who could not be contacted and 14 others who did not respond to the questionnaire and 13 whose response was incomplete were excluded from the study. Thus 210 participants were considered for calculation of results. Each question had three outcomes and percentage of each outcome for every question was calculated [TABLE 2].

Table 1. Demographic distribution of participants.

S.N.	Designation	Percentage	Details	
1	Faculty	19.04%	Speciality and designation	Percentage
			Obstetrics and gynaecology	9.52%
			Anatomy	4.76%
			General surgery	4.76%
2.	Residents	76.19%	Junior residents	52.38%
			Senior residents	23.81%
3.	Interns	4.77%	-	4.77%

TABLE 2: Percentage wise response to the survey questionnaire

QUESTIONS	PERCENTAGE OUTCOME
PART 1	
1. Did you observe videos of donning and doffing technique carefully and understood the importance of each and every step?	Yes: 100% No:0% Uncertain-0%
2. Do you really understand the importance of co-ordination between inter professional group of health care professionals and paramedical staff in safe management of COVID-19 patients in ICU?	Yes:71.5% Partially yes:9.5% No:0%
PART 2	
3. Could you check prerequisites and perform intubation?	Confident:47.7% Willing to try:28.6% Fearful of idea:4.8%
4. Were you comfortable in using intubation equipment and trolley?	Complete understanding:71.5% Partial understanding:23.8% No understanding:0%
5. Have you ever intubated a patient after hands on training?	Yes:28.6% Under supervision:28.6% no:42.9%
PART 3	
6. Understanding of terms and clinical applications of non- Invasive ventilation (NIV) and intermittent positive pressure ventilation (IPPV):	Confident:66.6% Doubtful: 33.4% Not confident:0%
7. Could you manage the patient on non re-breathable mask (NRM) & continuous positive airway pressure (CPAP) ventilation?	Yes: 38% Not independently: 20% No: 42%
8. Your understanding of importance of asepsis and ventilator associated pneumonia (VAP)	Strict aseptic precautions:95.3% Maintain cleanliness:4.8% No understanding:0%
9. In view of trouble shooting the ventilator	Prepared:42.9% No understanding but try:33.4% Never heard of:
10. In view of handling ventilators and deciding mode of ventilation.	Independently confident:76.2% Under supervision:23.8% Not confident:0%
11. Do you understand weaning protocols?	Understanding with successful attempt:28.6% Willing to try:61.9% Not confident:9.5%
PART 4	
12. Rate your experience in view of confidence in COVID-19 patient management after training.	Newly developed clinical skill:62% Not sure:38% No change:0%
13. The outlook after attending the training and being posted for duty to manage patients in COVID-19 area:	More confident:95.3% Outlook changes:4.8% No difference:0%
14. Usefulness of videos and case scenarios:	Very useful:90.5% Slightly useful:4.8% No use:0%
15. Regarding hands on workshop my opinion is that it is:	Very helpful:76.2% Partially helpful:23.8% Wastage of resources:0%

Results

Maximum and minimum points obtained by trainees on assessment of questionnaire were 90 and 47. According to the response of participants ranking was allotted under 3 sub heads namely: First rank: Training is best in terms of providing cognitive background, development of skills, improvement in level of confidence, removal of fears and positive change in attitude of patient management. Thus, found the training very useful and essential in achieving this clinical skill for patient management. Second rank: Training is good and informative. Trainees are doubtful regarding the factors governing the patient management correlated with training though find the training helpful in treating patients. Third rank*:* Trainees found the training waste of time and resources [TABLE 3].There were 15 training-based questions. Among the trainees 100% understood donning and doffing technique through video and demonstration and applied the knowledge during their deployment in covid-19 area. In clinical application of NIV and IPPV 66.6% were confident, 33.4% were doubtful. In questions related to management of the COVID-19 patients including shifting on ventilator 62% were confident whereas 38% required assistance. Out of all the participants 71.5% had knowledge of using intubation equipment and trolley but 23.8% understood it partially. In the study 28.6% of the participants attempted and intubated the patients successfully though 42.9% were unsuccessful yet 28.6% performed successful intubation under expert's supervision. Out of the participants 76.2% found workshop helpful but rest 23.8% were not completely sure regarding its significance and usefulness. According to the recorded data 95.3% followed strict aseptic precautions during intubation procedure while 4.8% maintained cleanliness. Out of total sample size 28.6% pupils had knowledge of weaning protocols and applied it successfully whereas 61.9% were willing to try and 9.5%

were not confident.

Table 3. Percentage of participants falling under each subhead of ranking

S.N.	Scores	Percentage of participants in each range	Rank
1.	90 –61	80.95 %	First
2.	60---31	19.05 %	Second
3.	30--- 0	0.0%	Third

Discussion

This pandemic has highlighted the need for making basic ventilation training mandatory not only for anaesthesiologists but for all clinical specialties across the medical field. Preparation for the care of patients with COVID-19 demonstrated the need for the development of an effective training module over a limited time[10]. Studies have shown that residents tend to exhibit training-induced cognitive bias, implying they will preferentially choose a technique for which they received formal instruction. Successful airway management requires team collaboration and implementation of the correct plan of action therefore familiarising our residents with the correct airway management protocol also becomes essential and was taken as utmost priority in the training protocol[7,4]. Our study dedicated whole section of the training to proper doffing and donning skills which is in accordance to G. Jain *et al* [11] where training regarding personal protection and safety was given. According to our survey all of the participants understood the risks associated and learned proper protection skills. Tracheal intubation itself is a high aerosol-generating procedure and has been recommended to be performed by the most experienced personnel to maximise first pass success and reduce personal exposure[12]. Intubation is a skill that cannot be acquired [13,14] overnight or through one time training session so, S. Pathak *et al* [7] similar to our training capsule aimed at teaching airway equipment, medications required, teamwork, and correct plan of action. This hands-on training inculcated confidence in participants and also induced a sense of team work among frontline workers which showed in their responses to the questionnaire. Critically ill patients are highly vulnerable particular to the presence of organ failures and absence of fasting, also intubation procedure is often performed by junior physicians who are not fully proficient with the procedure. Thus, emergency intubation in the ICU is more often difficult than is scheduled intubation in the operating room, and complications develop in up to half the cases[15]. due to high aerosol generation while intubation [10] this procedure was reserved for experienced anaesthesiologist while in the survey trainees understood correctly the use of intubation equipment, preparedness and assistance in the procedure. Our study was associated with better confidence levels post training in the participants as compared to B. Fuller *et al.*[16].

Conclusion

Our study is encouraging and has given new dimensions in solving the problem regarding the dearth of professionals to some extent in managing corona positive patients but final management responsibility still lies with the experienced professionals only. This short training capsule can just sensitise the health care workers in assistance and personal protection. Though the study remains need of time in building the confidence and containment of this disease but certain limitations include that all the participants were of different designations, seniority and specialities so the level of background knowledge, interest and understanding of contents was not uniform. Professionals with comorbidities and above sixty years of age attended the training with variable level of interest.

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References

1. Jebril N. World Health Organization Declared a Pandemic Public Health Menace: A Systematic Review of the Coronavirus Disease 2019 “COVID-19”. SSRN Electronic Journal. 2020.
2. Rose S. Medical Student Education in the Time of COVID-19. JAMA. 2020;323(21):2131.
3. Shang Y, Pan C, Yang X, Zhong M, Shang X, Wu Z et al. Management of critically ill patients with COVID-19 in ICU: statement from front-line intensive care experts in Wuhan, China. Annals of Intensive Care. 2020;10(1).
4. Mouli T, Mishra S. Effectiveness of simulation based teaching of ventilatory management among non-anaesthesiology residents to manage COVID 19 pandemic - A Quasi experimental cross sectional pilot study. Indian Journal of Anaesthesia. 2020;64 (14):136.
5. Goligher E,Kenny L.Core competency in mechanical ventilation. Critical Care Medicine. 2012;40(10):2828-2832.
6. Rodríguez-Llamazare,Arroyo-Hernández L, Hernández –Cárde nas C. Mechanical Ventilation Education for All. Chest. 2021; 159(1):38-39.
7. Rigatelli G, Zuin M, Rigatelli A, Zuliani G, Roncon L. Intubation and Ventilation amid COVID-19: Comment. Anesthesiology. 2020;133(2):464-465.
8. Rao S. A Multicenter Cross-sectional Questionnaire-based Study to Know the Practices and Strategies of Ventilatory Management of COVID-19 Patients among the Treating Physicians. Indian Journal of Critical Care Medicine. 2020;24(8):643-648.
9. Erfani Khanghahi M, Ebadi Fard Azar F. Direct observation of procedural skills (DOPS) evaluation method: Systematic review of evidence. Medical Journal of The Islamic Republic of Iran. 2018;32(1):254-261.
10. Pathak S, Gupta B, Jain G, Mishra P. Preparedness to combat COVID-19 via structured online training program regarding specific airway management: A prospective observational study. Indian Journal of Anaesthesia. 2020;64(9):796.
11. Jain G, Gupta B, Gupta P, Rao S. Online training for sensitization on airway and ventilatory management as preparedness to combat COVID situation. Indian J Anaesth. 2020
12. Price S, Tavazzi G, et al. Respiratory management in severe acute respiratory syndrome coronavirus 2 infection. Eur Hear J Acute Cardiovasc Care. 2020;7: 204–6.
13. Green M, Tariq R, Green P. Improving Patient Safety through Simulation Training in Anesthesiology: Where Are We?. Anesthesiology Research and Practice. 2016;2016:1-12.
14. Lorello G, Cook D, Johnson R, Brydges R. Simulation-based training in anaesthesiology: a systematic review and meta-analysis. British Journal of Anaesthesia. 2014;112(2): 231-245.
15. Martin M, Decamps P, Seguin A, Garret C, Crosby L, Zambon O et al. Nationwide survey on training and device utilization during tracheal intubation in French intensive care units. Annals of Intensive Care. 2020;10(1).
16. Fuller B, Ferguson I, Mohr N, Drewry A, Palmer C, Wessman B et al. A Quasi-Experimental, Before-After Trial Examining the Impact of an Emergency Department Mechanical Ventilator Protocol on Clinical Outcomes and Lung-Protective Ventilation in Acute Respiratory Distress Syndrome. Critical Care Medicine. 2017;45(4):645-652.

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