DOI: https://doi.org/10.53350/pjmhs211581838

ORIGINAL ARTICLE

Management & Complications of Airway in COVID-19 suspected & confirmed cases: a retrospective cohort epidemiological study in a tertiary care centre

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ABSTRACT

Background: The outbreak of COVID-19 in Pakistan started from February 2020 and over the next few months it affected around a million people, leaving thousands dead in an already burdened healthcare infrastructure. Rising to the challenge of COVID 19 airway management, we adopted components of 'Consensus guidelines for managing airways in patients with COVID 19 to improve success of first pass intubation alongwith minimising risk of infection to self and others.

Aim: To analyse the techniques of airway management and complications of suspected or confirmed COVID status at time of their airway management.

Methodology: After ethical approval by the institutional review board, data is collected from the Hospital Information System (HIS) for cases fulfilling inclusion criteria, from April to September 2020 in a tertiary care cancer hospital, Pakistan.

Results: In our centre, forty-five intubations were performed, 71% of these intubations were out of hours and 43% performed by consultants. It had a high 1st attempt success rate of 84.4%, using Videolaryngoscope (64.4%) and 55.6% confirmed use of capnography. In all cases (100%) PPE was available and used. Minimum number of personnel in room during intubation was kept to four to five in 55.6% of cases.

Conclusion: Dedicated airway team used Personal Protective Equipment in all cases (100%) and restricted the number of personnel during the procedure. A high success rate of 1st attempt intubation, widely used videolaryngoscope, single agent induction and consultant intubators were salient features of our practice.

Keywords: Keywords: Airway, Covid 19, Intubation, Pakistan

INTRODUCTION

The outbreak of COVID-19 started from Wuhan, China in December 2019 and over the next fewmonths it spread [1] to over 200 countries, affecting millions of people, leaving around a million dead. It is caused by a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that spreads through contact, droplet and airborne routes. It primarily affects lungs leading to respiratory failure, Acute Respiratory Distress Syndrome (ARDS)[2], sepsis and multiorgan failure.

From our experience in Wuhan, China approximately 3.2% patients [3] affected by this virus would require intubation and mechanical ventilation. However, Airway management in a suspected or confirmed covid 19 cases can be very challenging due to the infectious risk to personnel or the disease itself which renders patients severely hypoxemic with reduced oxygen reserves. Both intubation and bag mask ventilation are aerosol generating medical procedures [4] (AGMP) which produce a viral load that may pose infectious risk to healthcare workers (20%)[5]. This has implications on airway management in terms of techniques employed (preoxygenation, use of high flow oxygenation, bag mask ventilation), personal protection equipment which makes visualisation and manual dexterity difficult, restricted backup equipment in intubation area, combined with fear of risk of infection to self/ staff in a medically complex patient with respiratory failure who desaturate rapidly after administration of muscle relaxant.

Following the experience of Wuhan, a number of airway management techniques, gadgets to protect against aerosols and personal protective equipment were developed to overcome the challenges of COVID-19 Airway. For airway management, preparation and planning a consensus guideline, 'Consensus guidelines for managing airways in patients with COVID 19'[6] was developed by Difficult Airway Society, the Association of Anaesthetist the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists in March 2020. It lays out a comprehensive strategy to improve success of first pass intubation alongwith minimising risk of infection to self and others.

The outbreak of COVID-19 in Pakistan started from February 2020 and over the next few months it affected around a million people, leaving thousands dead[7] in an already burdened healthcare infrastructure. Rising to the challenge of covid 19 airway management, we adopted components of 'Consensus guidelines for managing airways in patients with COVID 19[6] for safe and effective airway management along with minimising risk of infection to self and others.

Rationale: Aim of this retrospective study is to analyse the techniques of managing airway and complications of patients of COVID suspected or confirmed status at time of their airwaymanagement.

Received on 24-03-2021
Accepted on 15-07-2021

METHODOLOGY

It is a retrospective observational study of airway management practices in COVID 19 suspected or confirmed cases at time of intubation from April to September 2020 in a tertiary care cancer hospital, Pakistan. After having ethical approval from the Institutional Review Board, retrospective data will be collected from the patient record on Hospital Information System (HIS) and perioperative anesthesia record as per proforma. It includes adults of both gender with both anticipated and unanticipated difficult airways. If a patient undergoes multiple procedures during the study time period, then each intubation is taken as a separate event. However, change of endotracheal tube in an already intubated patient is excluded.

Statistical analysis: Statistical analysis is carried out using Excel and SPSS. Qualitative and categorical data is analysed as frequency and percentage; Quantitative variable data is calculated as Mean, Standard deviation, Median and Range.

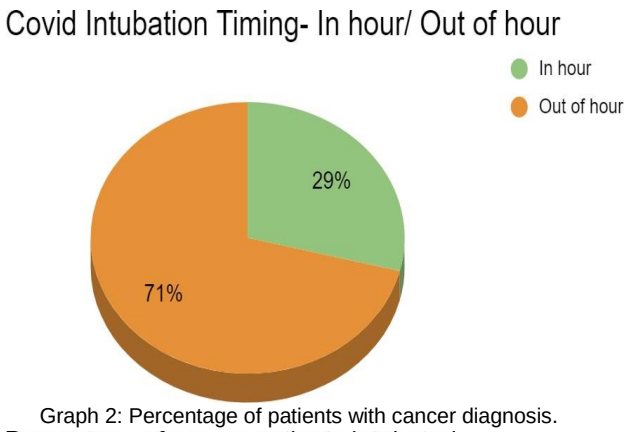
RESULTS

In our centre, 45 intubations were performed for covid 19 suspected or confirmed adult patients, with 71% having malignancy and 29% in code blue situations. A large number (71%) of these intubations were out of hours and 43% performed by consultants (Table 1). It had a high 1st attempt success rate of 84.4%, using Videolaryngoscope (64.4%) and 55.6% confirmed use of capnography. In 28% of cases face mask ventilation was employed along with preoxygenation, however no one used apneic/ per oxygenation method. Almost half (53%) cases used single induction agents (Propofol, Midazolam, Ketamine) with Propofol being most commonly used (32%). In all cases (100%) PPE was available and used. Minimum number of personnel in room during intubation was kept to four to five in 55.6% of cases.

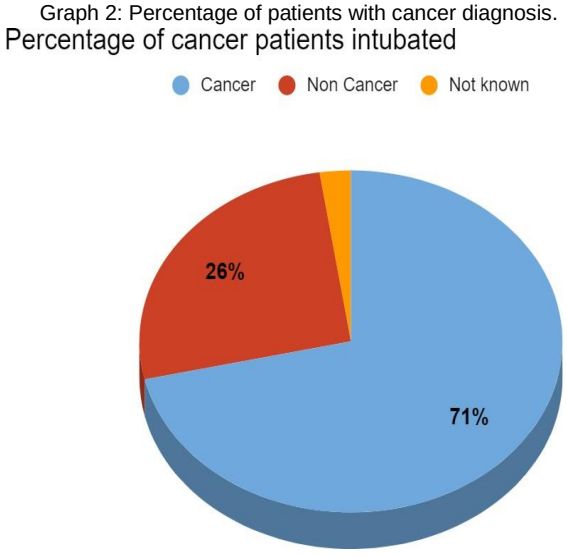
Table 1: Salient features of Airway management.

ETT-1st pass success 84%	Induction- Propofol	Complication low spO2	11.1%
Consultant intubator 43%	Videolaryngoscope 64.4%	Complication equipment	4.4%
Out of hour intubation 71%	FM ventilation 28%	No. person in room(4,5)	55.6%
Code blue intubation 29%	Capnograph used 55.6%	Personal Protective Equipment 100%	

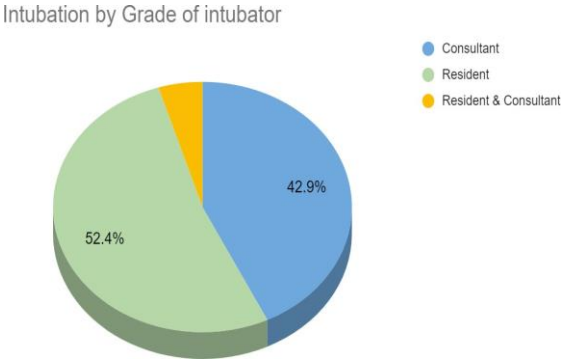
Graph 1: Timing of intubations- In regular working hour versus out of regular working hours.



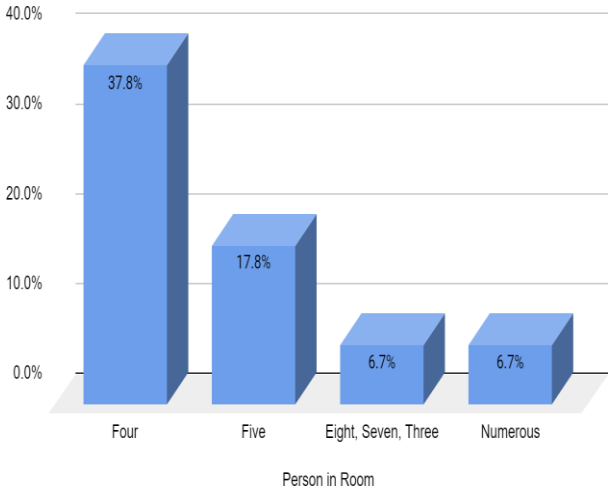
Graph 2: Percentage of patients with cancer diagnosis.



Graph 3: Number of personnel present at time of intubation.



Graph 4: Grade of personnel doing intubation.



DISCUSSION

Covid 19 airway management presented a unique challenge of dealing with a novel disease with evolving scientific evidence. A global effort was made to learn from areas which were hit early on in the pandemic. Wuhan, China shared its experience[8] as early as in March 2020, retrospective observational case series was closely analysed to learn lessons for future practice recommendations. Given the magnitude of pandemic, disease severity and infectivity, earlyreports from China led not only to consensus guidelines[6] but also resource allocation at national and hospital level.

At our institute airway management incorporated elements of 'Consensus guidelines for managing airways in patients with COVID 19'[6] developed by Difficult Airway Society, the Association of Anaesthetist the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists. As recommended by the UK Department of Health, dedicated airway teams[9,10,11], a concept derived to build on the learning curve of teams was adopted. Airway team had regular drills to ensure training, teamwork and proper compliance with local hospital guidelines. We had to rethink the entire process to ensure material, personnel and process is inline to achieve safe and effective airway management.

We had a high first pass success rate of endotracheal intubation (84%), and no patient required emergency/rescue cricothyroidotomy or surgical airway. The success rate is inline with reported cases from China[8,9], Italy[10] and the United Kingdom.[11]

The high success rate could partly be attributed to the presence of consultant anesthetists in the dedicated airway team[12] 43% of intubations being performed by them. It was a major resource commitment on part of the hospital as 71% of intubations were out of hours.

Sajayan et.al[12] reported experience of a UK tertiary centre, where a dedicated airway team with direct consultant supervision had very high first pass success rate of intubation.

Use of a video laryngoscope was recommended[13] for better view at laryngoscopy and first pass intubation. It also ensures the maximum distance[14,15] between intubator and patient having aerosol generating procedure. Video laryngoscopes had disposable blades which reduced the infective risk associated with cleaning and transfer to CSSD for sterilization. In 64.4% of cases video laryngoscope was used. However, with use of video laryngoscopy more than one attempt at intubation was made in 20% cases. Bougie/ stylets was used as an aide to intubate with video laryngoscope in 41% cases[16]. Driver et al study in Journal American Medical Association 2018 favours the use of introducer (stylet/ bougie) along with video laryngoscope.

In almost all (98%) rapid sequence induction was carried out, with pre-oxygenation (100%) and avoidance of facemask ventilation (72%). Face mask ventilation causes excessive aerosol generation with increased risk of infection. However, It may become necessary in case of significant oxygen desaturation.[17] This can be avoided with good technique of pre-oxygenation[18] (head-up, adequate time 3 minutes with FiO_2 1.0, eight vital capacity breaths, end tidal oxygen concentration >0.9) and peroxygenation with use of nasal cannulae oxygen (preferably low flow to avoid aerosol generation) for apneic oxygenation. A Meta analysis[19] of 8 studies with 1837 patients concluded that apneic oxygenation was associated with improved oxygen saturation peri-intubation, reduced hypoxemia and higher first pass intubation.

Drugs used for rapid sequence induction were Propofol, Midazolam and Ketamine. In 32% of cases Propofol was used as a sole induction agent. Co-induction with two induction agents to maintain hemodynamic stability was done in about 40% of cases. Phenylephrine, an alpha-1 agonist was used in 19% cases to maintain hemodynamic stability. Propofol use is also common in other centres [20] for Covid intubation. It might be linked to familiarity with propofol use and lack of availability of other drugs like Ketamine.

Of the non-code blue intubations, four (~11%) had persistent low oxygen saturation despite successful intubation and ventilation with 100% oxygen. One had an immediate cardiac arrest following rapid sequence induction for type 2 respiratory failure on non-invasive ventilation. Equipment related issues (4.4%) were either malfunction or delay in setting it up.

To our disappointment, only in 55.6% capnography was used to confirm the endotracheal intubation. Capnography is a rapid and non-invasive method of confirming tracheal tube intubation. In covid lungs[21], with pneumonic patches, coarse crept and atelectasis, lung auscultation, alternative methods of confirming intubation, has limited value. Use of a stethoscope with personal protective equipment (hoods/ cap, face shield/ goggles, mask) makes it even more difficult to use it properly.[22] Use of continuous capnography in ICU is recommended by Association of Anaesthetist of Great Britain and Ireland (AAGBI)[23] and National Audit Project (NAP4)[24] by Royal College of Anaesthetist in 2011 .

Even in case of cardiac arrest, American Heart Association (AHA)[25] recommends use of capnography to confirm intubation, to monitor quality of chest compressions and return of spontaneous circulation (ROSC). The end tidal CO2 concentration is lower in the range of 10-20 mmHg in case of cardiac arrest but is not zero unless endotracheal is misplaced or quality of compression is poor.

From an infection prevention point of view, use of personal protective equipment and minimising the number of personnel is of paramount importance. Intubation is an aerosol generating medicalprocedure (AGMP) during which the airway team is exposed to a high viral load.[26] The Public Health England[27] and Centre of Disease Control & Prevention (CDC) recommendation[28] for Personal Protective Equipment (PPE) is: Proper fitting N-95 mask, long sleeves impermeable Gown, double Gloves and face shield/ goggles. We had pre planned strategy, proper donning and doffing[29] drills as cognitive aides to minimise risk of contamination and infection under stressful conditions. In our study, the Airway team used appropriate PPE in all (100%) cases.

To minimise risk of infection, the number of personnel in the airway team was reduced to as minimum [6] as possible. However, no fixed number was suggested as a

more complex and difficult airway may require more assistance. Therefore, it was as per clinical condition and anesthesiologist discretion.

CONCLUSION

Intubation practice for covid 19 shows universal use of PPE and restricted number of personnel during the procedure. A high success rate of 1st attempt intubation, widely used videolaryngoscope, single agent induction and consultant intubators were salient features/ hallmarks of our institutional practice.

Conflict of interest: None declared by the authors

Author contribution: AI, HS: Conduction of study **AI**: Concept, **HS, AI**: Manuscript editing

REFERENCES

1. Perrone M, Orr R, Hing W, Milne N, Pope R. The impact of backpack loads on school children: A critical narrative review. International journal of environmental research and public health. 2018;15(11):2529.
2. Ramprasad M, Alias J, Raghuveer A. Effect of backpack weight on postural angles in preadolescent children. Indian pediatrics. 2010;47(7):575-80.
3. Shamsoddini A, Hollisaz M, Hafezi R. Backpack weight and musculoskeletal symptoms in secondary school students, Tehran, Iran. Iranian journal of public health. 2010;39(4):120.
4. Vaghela NP, Parekh SK, Padsala D, Patel D. Effect of backpack loading on cervical and sagittal shoulder posture in standing and after dynamic activity in school going children. Journal of Family Medicine and Primary Care. 2019;8(3):1076.
5. Kendall FP, McCreary EK, Provance PG, Rodgers M, Romani WA. Muscles, testing and function: with posture and pain: Williams & Wilkins Baltimore, MD; 1993.
6. Dockrell S, Simms C, Blake C. Schoolbag weight limit: can it be defined? Journal of school health. 2013;83(5):368-77.
7. Knapik J, Harman E, Reynolds K. Load carriage using packs: a review of physiological, biomechanical and medical aspects. Applied ergonomics. 1996;27(3):207-16.
8. Akbar F, AlBesharah M, Al-Baghli J, Bulbul F, Mohammad D, Qadoura B, et al. Prevalence of low Back pain among adolescents in relation to the weight of school bags. BMC musculoskeletal disorders. 2019;20(1):37.
9. Haselgrove C, Straker L, Smith A, O'Sullivan P, Perry M, Sloan N. Perceived school bag load, duration of carriage, and method of transport to school are associated with spinal pain in adolescents: an observational study. Australian Journal of Physiotherapy. 2008;54(3):193-200.
10. Saleh AG, Mohammed AH. Effect of Backpacks Carried by Secondary School Students in Tanta City on the Musculoskeletal System. Bull Fac Ph Th Cairo Univ. 2013;18(2):69.
11. Aprile I, Di Stasio E, Vincenzi MT, Arezzo MF, De Santis F, Mosca R, et al. The relationship between back pain and schoolbag use: a cross-sectional study of 5,318 Italian students. The Spine Journal. 2016;16(6):748-55.
12. Rai A, Agarwal S. Effect of Postural Discomfort on School Going Children Carrying Heavy Backpacks. International Journal of Science and Research (IJSR). 2014;3(12):2482-4
13. World Health Organization: Situation Report April 2020 (last accessed on 2nd April 2020). https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/
14. Meng L, Qiu H, Wan L, Ai Y, Xue Z, Guo Q, Deshpande R, Zhang L, Meng J, Tong C, Liu H, Xiong L.Intubation and Ventilation amid the COVID-19 Outbreak: Wuhan's Experience.Anesthesiology. 2020 Mar 26. doi: 10.1097/ALN.0000000000003296.
15. Lingzhong Meng, Haibo Qiu, Li Wan, Yuhang Ai, Zhanggang Xue, Qulian Guo, RanjitDeshpande, Lina Zhang, Jie Meng, Chuanyao Tong, Hong Liu, Lize Xiong; Intubation and Ventilation amid the COVID-19 Outbreak: Wuhan's Experience. *Anesthesiology* 2020. doi: https://doi.org/10.1097/ALN.0000000000003296.
16. COVID-19: Guidance for infection prevention and control in healthcare settings.
17. Department of Health and Social Care (DHSC), Public Health Wales (PHW), Public Health Agency (PHA) Northern Ireland, Health Protection Scotland (HPS) and PublicHealth England.27/03/20.
18. COVID-19: protecting health-care workers,The Lancet, Volume 395, Issue 10228,2020,922, https://www.ncbi.nlm.nih.gov/pubmed/32199474
19. Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19.Anaesthesia, 75: 785-799. doi:10.1111/anae.15054
20. Pakistan Government Covid Statistics:http://covid.gov.pk/stats/pakistan (last accessed29th Aug 2020)
21. Wenlong Yao, Tingting Wang etal.Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: lessons learnt and international expert recommendations,
22. British Journal of Anaesthesia,Volume 125, Issue 1,2020,Pages e28-e37doi: 10.1016/j.bja.2020.03.026.
23. The Covid 19 intubation experience in Wuhan. Br J Anaesth. 2020 Jul; 125(1): e25–e27.Published online 2020 Apr 27. doi: 10.1016/j.bja.2020.04.058
24. Sorbello, M., El-Boghdadly, K., et al.(2020), The Italian coronavirus disease 2019 outbreak: recommendations from clinical practice. Anaesthesia, 75: 724-732. doi:10.1111/anae.15049 NHS England, https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/specialty-g uide-itu-and-coronavirus-v1-16-march-2020.pdf Available from. (accessed on 2020)
25. Covid Intubation Team (CIT)- an experience at tertiary UK centre. Trends in Anaesthesia & Critical Care. 2020 Aug; 33: 27–29. Published online 2020 Jun 10. doi: 10.1016/j.tacc.2020.05.004
26. Audrey De Jong, Airway management for Covid 19 : a move towards universal video laryngoscope? The Lancet Respiratory Medicine. Vol 8, Issue 6, June 2020. doi: 10.1016/S2213-2600(20)30221-6
27. Luo M., Cao S., Wei L. Precautions for intubating patients with COVID-19. Anesthesiology. 2020;132:1616–1618
28. Hall D., Steel A., Heij R., Eley A., Young P. Videolaryngoscopy increases 'mouth-to-mouth' distance compared with direct laryngoscopy. Anaesthesia. 2020 doi:10.1111/anae.15047.
29. Driver BE, Prekker ME, Klein LR, et al. Effect of use of a bougie vs endotracheal tube and stylet on first-attempt intubation success among patients with difficult airways undergoing emergency intubation: a randomized clinical trial. *Journal of the American Medical Association* 2018; 319: 2179–89.
30. Casey JD, Janz DR, Russell DW, et al. Bag-mask ventilation during tracheal intubationof critically ill adults. *New England Journal of Medicine* 2019; 380: 811–82.
31. Nimmagadda U, Salem MR, Crystal GJ. Preoxygenation: physiologic basis, benefits, andpotential risks. *Anesthesia and Analgesia* 2017; 124: 507–17.
32. Lucas Oliveira J. e Silva, Daniel Cabrera. Effectiveness of Apneic Oxygenation During Intubation: A Systematic Review and Meta-Analysis, Annals of Emergency Medicine, Volume 70, Issue 4, 2017,Pages 483-494.e11, doi: 10.1016/j.annemergmed.2017.05.001.
33. Wenlong Yao, Tingting Wang. Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: lessons learnt and international expert recommendations. Br J Anaesth. 2020 Jul; 125(1): e28–e37.2020 Apr 10. doi: 10.1016/j.bja.2020.03.026
34. Marini JJ, Gattinoni L. Management of COVID-19 Respiratory Distress. *JAMA.*2020;323(22):2329–2330. doi:10.1001/jama.2020.6825
35. Dimie Ogoina, Hendris James.COVID-19: the need to redesign head coverings of personal protective equipment for manual stethoscopes. Trans R Soc Trop Med Hyg. 2020 Aug 11 : traa063. 2020 Aug 11. doi: 10.1093/trstmh/traa063
36. AAGBI Safety Statement. The use of capnography outside the operating theatre. Updated statement from the Association of Anaesthetists of Great Britain & Ireland (AAGBI).
37. Cook T M, Woodall N. Fourth National Audit Project. Major complications of airway management in the UK: results of the fourth national audit project of the royal college of anaesthetists and the difficult airway society. *Br J Anaesth.* 2011; **106**: 617-642
38. Adult Advanced Cardiovascular Life Support 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2015;132[suppl 2]:S444–S464. DOI: 10.1161/CIR.0000000000000261
39. Weissman DN, de Perio MA, Radonovich LJ. COVID-19 and Risks Posed to PersonnelDuring Endotracheal Intubation. *JAMA.* 2020;323(20):2027–2028. doi:10.1001/jama.2020.6627
40. Public Health England. Guidance: COVID-19 personal protective equipment (PPE). https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevent ion-and-control/covid-19-infection-prevention-and-control-guidance-high-risk-pathway-k ey-principles. Accessed September 22, 2020
41. US Centers for Disease Control and Prevention. Interim infection prevention and control recommendations for patients with suspected or confirmed coronavirus disease 2019 (COVID-19) in healthcare settings. Accessed September 22, 2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.htm l
42. US Centers for Disease Control and Prevention. Using personal protective equipment. Accessed September 22,2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html.