Letter to the Editor

Triage of ICU Resources in a Pandemic Surge: Good Ethics Depends on Good Data

Dear Editor,

The pace of the COVID-19 pandemic has overwhelmed some of the best resourced health systems in the world and has made the need for triage of ICU resources a real possibility. In response, several substantive values have been articulated to serve as guiding principles. The decision to not provide a patient with necessary intensive care unit (ICU) treatment is quite literally a life and death judgement, and excluded patients will almost immediately require some measures of palliation. Examples of substantive values include the statement of the UNESCO International Bioethics Committee, "Macro- and micro-allocation of healthcare resources are ethically justified only when they are based on the principle of justice, beneficence, and equity." In March 2019, the New England Journal of Medicine carried a paper that espoused four values: (1) maximise benefits, (2) treat people equally, (3) promote and reward instrumental value and (4) give priority to the worst off first. Although there is likely to be broad agreement with such values, limited guidance is available when deciding on a particular course of action if there is a direct clash between values. In the context of resource constraints, how should we respond when forced to decide between beneficence and equity?

To operationalise ethical values, consensus statements have been developed to offer a blueprint. The triage process can be divided into three parts: (1) explicit inclusion and exclusion criteria for ICU entry, (2) prioritisation based on mortality prediction and (3) reassessment of patients after an appropriate duration of ICU care to identify those who should have life support discontinued. Crisis standards of care require that these processes be conducted with consistency, transparency and accountability. Such blueprint is a tremendous resource to institutions when confronted with an unanticipated pandemic. However, COVID-19 is in truth a rolling pandemic (i.e., a series of epidemics rippling across different countries which are at differing stages of crisis). This situation offers valuable data from the earliest impacted regions such as Wuhan, Northern Italy and New York City, and ICU specific data can be used to refine the triage response of those regions which are subsequently affected.

From Lombardy in Italy, a network of 72 hospitals reported data on 1591 consecutive COVID-19 patients admitted to the ICU with a median (IQR) age of 63 (56–70) years old. Of the patients with available respiratory support data, 99% required mechanical ventilation. The median PaO_2 to FiO_2 ratio was 160 (IQR, 114–220). If there were acute respiratory distress syndrome (ARDS), the severity would be graded as moderate. The median positive end-expiratory pressure (PEEP) was 14 and 89% of patients required a supplemental FiO_2 of >50%. Prone positioning was used in 27% to improve ventilation-perfusion mismatch. At the end of the study, 58% of patients were still in the ICU and the mortality rate was 26%. Patients older than 60 years old accounted for 60.6% of ICU admissions and 79.5% of all mortality. The median (IQR) length of stay in the ICU was 9 (6–13) days.[6]

A single-centre retrospective review from Wuhan of 52 COVID-19 patients had a mean age 59.7 ± 13.3 years old and a 28-day mortality of 61.5%. ARDS was the commonest cause of ICU admission but support was also required for renal and cardiac dysfunction. Median (IQR) Sequential Organ Failure Assessment (SOFA) score of survivors was 4 (3–4) compared to 6 (4–8) for non-survivors. The median (IQR) Acute Physiology and Chronic Health Evaluation II (APACHE II) score of all patients was 17 (14–19).[7] In another two-centre study from Wuhan, 26% of 191 patients were admitted to the ICU with a median (IQR) length of stay of 8 (4–12) days. Commonest complications were respiratory failure, heart failure and shock. Of the 32 patients who required invasive mechanical ventilation, 31 (97%) died. Age and SOFA scores were predictive of mortality. In New York City, from a series that

studied 5700 hospitalised patients, 1 151 required mechanical ventilation of whom the mortality rate was 24.5%.

These data can be illuminating in making ICU triage decisions. Although COVID-19 patients require ICU care primarily for respiratory failure, they often need support for other organ systems as well. Therefore, framing the triage issue as merely an allocation of ventilators is not helpful. In addition, COVID-19 related respiratory failure can be severe and interventions such as prone positioning and safe management of PEEP reflect the necessity of both trained personnel, as well as adequate supplies of analgesia, sedative and neuromuscular paralytic agents. Resource constraints should be viewed with an overall perspective of ICU care, from manpower to consumables to infrastructure. A narrow focus only on the allocation of ventilators is unlikely to improve outcomes.

When reviewing patients for inclusion criteria, there are recommendations that ICU care should be offered as a time-limited therapeutic trial to all those who meet the set criteria. This position is justified by the published mortality data.[6–9] Providing patients and their families an accurate prognostication will help frame end-of-life decision-making and offer an opportunity for advance care planning prior to intubation. This will also manage expectations and reduce emotional distress should there be any need to limit ongoing life support in a patient who is deteriorating.

Prioritisation criteria utilise physiological scores such as SOFA, which is easy to calculate and only requires arterial blood gas, serum bilirubin, serum creatinine and plasma platelet counts to be measured in conjunction with neurological and blood pressure assessment. However, as COVID-19 patients often initially present to the ICU with only respiratory failure, SOFA and other scores such as APACHE-II are unlikely to be discriminatory. Severity of ARDS as measured by the PaO_2 to FiO_2 ratio may need to be considered as an alternative prognostication score until validated COVID-19 specific measures can be determined.

In addition, any consideration for the use of prospective instrumental value to prioritise healthcare workers ahead of other patients for ICU care should be reassessed.[3] Based on current evidence, it is highly improbable that a healthcare worker, who is unfortunate enough to succumb to COVID-19 related respiratory failure that necessitates invasive mechanical ventilation, will be able to survive, recover and contribute to the care of others in the immediate pandemic. If healthcare workers are to be given priority, alternative justifications are necessary.

The reassessment process of patients already in the ICU also needs refinement. Based on the expected median length of ICU stay of 8–9 days, it is unlikely that a reassessment at 48 or even 120 hours will identify patients who are not making sufficient progress. This does not mean that patients who have a major deterioration in their overall condition cannot be reevaluated. However, assessments of progress that are too short in interval will result in patients who may have survived having life support prematurely withdrawn. This rapid cycling of patients will result in resource consumption without achieving the goal of trying to save the most lives.[11] The tools of reassessment should be reconsidered as well. SOFA score was developed for use in sepsis and its utility in predicting outcomes in viral pneumonia with respiratory failure is controversial.[,]

Although we have strongly advocated for a data guided approach to the ethical implementation of triage of ICU resources, data must be interpreted with caution. In a pandemic, fast-tracked publications require scrutiny for methodological rigor. The context in which the data is obtained should also be analysed. In northern Italy, at the height of the pandemic, it is acknowledged that patients with respiratory failure requiring acute non-invasive ventilation may have been managed outside ICUs.[6] There is also no data on how long intubation may have been delayed because of resource constraints and how this adversely affected mortality. Ultimately, data that is local to the ICU, where triage decisions are made, is necessary, and this justifies resources made available for prospective collection and regular analysis of clinical outcomes.

The need for triage of ICU resources is a sobering moment during pandemic response and all measures should be taken to avoid reaching that point of crisis. Such measures include conserving, substituting, adapting, re-using and re-allocating resources.[5] If we are indeed confronted with difficult decisions, adaptations of consensus protocols and prognostication tools using COVID-19 specific data can provide clarity in decision making. This clarity will illuminate all stages of the triage process: (1) inclusion/exclusion criteria, (2) determination of prioritisation and (3) reassessment of probability of successful outcome.

REFERENCES

1. Mounk Y. The extraordinary decisions facing Italian doctors. Atlantic. March 11, 2020 https://www.theatlantic.com/ideas/archive/2020/03/who-gets-hospital-bed/607807. Accessed on 19 April 2020.
2. Statement on COVID-19: Ethical Considerations from a Global Perspective. Statement of the UNESCO International Bioethics Committee (IBC) and the UNESCO World Commission on the Ethics of Scientific Knowledge and Technology (COMEST). https://unesdoc.unesco.org/ark:/48223/pf0000373115. Accessed on 19 April 2020.
3. Emanuel EJ, Persad G, Upshur R, Thome B, Parker M, Glickman A, Zhang C, Boyle C, Smith M, Phillips JP. Fair Allocation of Scarce Medical Resources in the Time of COVID-19. N Engl J Med. 2020 Mar 23.
4. Christian MD, Sprung CL, King MA, Dichter JR, Kissoon N, Devereaux AV, Gomersall CD; Task Force for Mass Critical Care; Task Force for Mass Critical Care. Triage: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. Chest. 2014 Oct;146(4 Suppl):e61S–74S.
5. Hick, J. L., D. Hanfling, M. K. Wynia, and A. T. Pavia. 2020. Duty to Plan: Health Care, Crisis Standards of Care, and Novel Coronavirus SARS-CoV-2. NAM Perspectives. Discussion paper. National Academy of Medicine. Washington, DC. https://doi.org/10.31478/202003b. Accessed on 19 April 2020.
6. Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A, Cereda D, Coluccello A, Foti G, Fumagalli R, Iotti G, Latronico N, Lorini L, Merler S, Natalini G, Piatti A, Ranieri MV, Scandroglio AM, Storti E, Cecconi M, Pesenti A; COVID-19 Lombardy ICU Network. Baseline Characteristics and Outcomes of 1591 Patients Infected With SARS-CoV-2 Admitted to ICUs of the Lombardy Region, Italy. JAMA. 2020 Apr 6.
7. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, Wu Y, Zhang L, Yu Z, Fang M, Yu T, Wang Y, Pan S, Zou X, Yuan S, Shang Y. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia i n Wuhan, China: a single-centered, retrospective, observational study. Lancet Respir Med. 2020 Feb 24.
8. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Xiang J, Wang Y, Song B, Gu X, Guan L, Wei Y, Li H, Wu X, Xu J, Tu S, Zhang Y, Chen H, Cao B. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020 Mar 28;395(10229):1054–1062.
9. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. JAMA. 2020;323(20):2052–2059. doi:10.1001/jama.2020.6775
10. Truog RD, Mitchell C, Daley GQ. The Toughest Triage—Allocating Ventilators in a Pandemic. N Engl J Med. 2020 Mar 23.
11. White DB, Lo B. A Framework for Rationing Ventilators and Critical Care Beds During the COVID-19 Pandemic. JAMA. 2020 Mar 27.
12. Ferreira FL, Bota DP, Bross A, Mélot C, Vincent JL. Serial evaluation of the SOFA score to predict outcome in critically ill patients. JAMA 2001; 286: 1754–58.
13. Bellani G, Laffey JG, Pham T, Fan E, Brochard L, Esteban A, Gattinoni L, van Haren F, Larsson A, McAuley DF, Ranieri M, Rubenfeld G, Thompson BT, Wrigge H, Slutsky AS, Pesenti A; LUNG SAFE Investigators; ESICM Trials Group. Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries. JAMA. 2016 Feb 23;315(8):788–800.
14. Maves RC, Downar J, Dichter JR, Hick JL, Devereaux A, Geiling JA, Kissoon N, Hupert N, Niven AS, King MA, Rubinson LL, Hanfling D, Hodge JG Jr, Marshall MF, Fischkoff K, Evans LE, Tonelli MR, Wax RS, Seda G, Parrish JS, Truog RD, Sprung CL, Christian MD; ACCP Task Force for Mass Critical Care. Triage of Scarce Critical Care Resources in COVID-19 An Implementation Guide for Regional Allocation: An Expert Panel Report of the Task Force for Mass Critical Care and the American College of Chest Physicians. Chest. 2020 Apr 11:S0012-3692(20)30691–7. doi: 10.1016/j.chest.2020.03.063. Epub ahead of print. PMID: 32289312; PMCID: PMC7151463.
16. Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016; 315: 801–10.
17. Khan Z, Hulme J, Sherwood N. An assessment of the validity of SOFA score based triage in H1N1 critically ill patients during an influenza pandemic. Anaesthesia. 2009 Dec;64(12):1283–8.
18. Ng ES, Tambyah PA. The ethics of responding to a novel pandemic. Ann Acad Med Singapore. 2011;40(1):30–35.

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