In Reply: The Coronavirus Disease 2019 Global Pandemic: A Neurosurgical Treatment Algorithm

To the Editor:

We read with great interest the Correspondence by Burke et al,[1] "The Coronavirus Disease 2019 Global Pandemic: A Neurosurgical Treatment Algorithm", which appeared online in *Neurosurgery* in April 2020. In this interesting work, the authors proposed a set of algorithms concerning different aspects of the management of the SARS-CoV-2 disease from the neurosurgical viewpoint (scheduling of surgical cases, scheduling of clinic cases, contingency planning for intensive care unit (ICU) utilization and research directives) with the intention to help neurosurgeons in developing local protocols to manage the sanitary crisis.

SARS-CoV-2 represents the last pandemic in a long line. As a matter of fact, there are many examples of pandemics that drastically changed the course of history, such as Spanish Flu and European Plague. What distinguish SARS-CoV-2 from other pandemics is its rapid diffusion in developed countries. Treatment of infected patients is requiring resources that, although considered as "available", are actually limited as a consequence of the temporal case concentration with the risk of not being able to guarantee the appropriate care to everyone.

Lombardy region was the first to be heavily hit in Italy. Actually, hospitals are overwhelmed and health workers are overstressed. In this difficult scenario, although SARS-CoV-2 represents the major concern, the population keeps suffering also from other acute and chronic pathologies, complicating the management and allocation of the limited economical and sanitary resources. As a natural consequence, criteria of choice and priorities must be set by the different health systems. Answers are related to the political philosophy of different countries: an individualistic approach, where each patient a priori is always worthy of treatment, or a "society-first" policy, where sanitary, economical, and sociological aspects are weighted on the ground of the common interest.

Looking at our country, the 32nd article of the Italian Constitution states that "the Republic safeguards health as a fundamental right of the individual and as a collective interest, and guarantees free medical care to the indigent".[2] The Italian Government was focused first on the protection of any single citizen at any cost. At the moment, in fact, Italy decided to allocate any possible resources to retrieve respirators, doctors, nurses, and whatever is needed to be loyal to the promise of the 32nd Article. Following such ideals, the Lombardy Government tried to slow down the diffusion of the virus (lock-down since March 8th), incremented ICU units, and reorganized hospitals, identifying COVID-19 and COVID-19-free wards, re-defining priorities, re-allocating resources based upon necessities, but always trying to take care of everyone.[3,4]

Looking at our daily practice, the COVID-19 outbreak forced neurosurgeons to review their priorities. While life-threatening conditions such as the great majority of traumatic and hemorrhagic events represent clear and obvious urgencies (exactly on the same level of SARS-CoV-2), the treatment priorities for elective patients created controversy. May neoplastic and not-urgent vascular pathologies be considered disease that can be postponed, if they are not associated with rapid neurologic deterioration? In other words, is it actually ethical to tell a patient that a surgery for a brain tumor needs to be postponed because ICU-bed and sanitary operators are totally committed and dedicated to COVID-19 management? Is it ethical to treat a COVID-19 interstitial pneumonia and postpone the treatment of a low-grade glioma, for which malignant transformation is unpredictable in terms of time? Should we operate unruptured aneurysms at this moment? How shall we consider a glioblastoma (average life expectancy after surgery and adjuvant treatment of 15-18 mo)[5] in comparison to a SARS-CoV-2 patient who is reasonable to suppose that can be discharged home with an apparently untouched life expectancy after intensive care?[6] May we consider the actual pandemic in the same way as an overwhelming event causing multiple injured, where resuscitation councils guidelines advise to privilege patients with greater survival chances?[7,8]

Lombardy Government identified 4 neurosurgical "hubs" and dedicated the other neurosurgical facilities to SARS-CoV-2 patients.[9,10] Such an organization guaranteed free most effective treatments for everyone, despite COVID-19 disease (private practice was stopped). Hence, in a Country that safeguards life above all, the question of surgery on 70-yr-old patient affected by a life-threatening edematous supratentorial meningioma, has just one simple answer: yes, up to the last bed, nurse, respirator, surgeon is available.

As a last food for thought, we truly feel that what deserves attention is how to dedicate resources to patients who really benefit from the investment. Hence, what COVID-19 pandemic made clear to our eyes is the need for predictors that may help in a decisional process. Machine learning on Big Data is a powerful instrument to investigate the future.[11] In this view, it appears of paramount importance the creation of medical registries supported by single Nations and World Health Organization to collect factors enabling to create predictive models useful for the future. An example of the use of registries and machine learning to predict functional impairment after intracranial tumor surgery is in press.[12] Along with such mathematical approaches, the other side of the moon is represented by consensus reached among experts, through elements of quick reference and discussion (Delphi studies, Consensus Conferences, and internet-based surveys). At this regard, many surveys and guidelines have been shared in the medical community since virus outbreak, with the purpose to share clinical

experiences when no clear guidelines exist. Despite the course of this infection remains unpredictable along with the future impact that this pandemic will have, sharing local guidelines appears as an optimal starting point. The San Francisco group should be commended and acknowledged for having raised the issue, sharing their experience and practical algorithms in management of neurosurgical patients at their Institution in COVID-19 times.

Disclosures

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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