Effects on traumatic brain injured patients of COVID pandemic: which responses from neurosurgical departments?

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The life of neurosurgical departments all over the world has been changed by the COVID pandemic, and the same happened to the epidemiology and management of trauma patients. Only 5% of neurosurgical publications are coming from low and low-middle income countries (LMICs) [11], and India contributes for about half of the published papers in this category. For this reason, due importance must be given to the data related on neurotrauma care in India as in the paper from Karthjgeyan et al. published in this issue of *Acta Neurochirurgica* [6]. Furthermore, in TBI, there is a clear disproportion about the incidence of the disease (endemic in LMICs including India) and the publications/guidelines all mostly coming from high income countries [12]. The reality is that suggestions for TBI patients' management are coming from areas of the world where less than 30% of TBI patients are located. In fact, in LMICs are conducted only 8% of all neurosurgical randomized clinical trials which are the basis to generate evidence based medicine and guidelines [3].

Which specific data about Neurotrauma Care and COVID pandemic?

- 1) Social distancing and lockdown periods have produced a reduced number of traumatic brain injuries (TBI) admitted to hospital care of 25% in Ireland [4], of 49% in Italy [8], of around 40% in Austria [9] and UK [5], as well as of 60% in New York City [2].

The paper published in this issue of *Acta* [6] confirms this trend also for India with a 60% reduction in the most strict lockdown period.

Although the percentage differences are related to the different restrictive measures in each country, the number of head injuries worldwide has decreased during the most critical phases of the pandemic.

- 2) The management of neurosurgical patients (including TBI patients) during the pandemic is also affected by the necessity of reconvertng a substantial number of ICU beds (and intensivists/pneumologists) to the care of COVID patients and of recruitment of medical personnel (including neurosurgeons) suitable for new duties. These aspects have contributed to reduce the resources available for the treatment of patients with TBI. Severely head injured patients need complex ICU management and are mostly hit by the lack of available proper beds. A different and peculiar situation is described in India (and it is very common in LMICs) as reported by Karthjgeyan et al. [6]: A limited number of patients manage to reach the neurosurgical center within 6 h from injury.

In fact, in the pre-COVID era, only 40% of TBI patients were transported to the neurosurgical center within 6 h of the traumatic event, and this percentage was further reduced during the COVID period. The increased delay in arrival of trauma patients is probably responsible for the higher mortality observed in the lockdown period (59% versus 47%). Furthermore, as we all know, the chain of treatment of TBI patients is long and complex starting from the scene of accident until acute and post-acute care. The complete disruption of peripheral hospitals transformed into COVID care hospitals made it very difficult to maintain a proper admission of TBI patients to the neurosurgical center. This happened everywhere in the world, and a system of direct centralization within the frame of the Hub and Spoke system was suggested in Europe [1] and also in India [10] This system allowed

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to keep alive the care of neurotrauma patients even with important reductions of the neurosurgical and ICU beds.

- 3) Concerning the mechanism of trauma, it seems that in European countries, the observed decrease of road traffic accidents was not accompanied by a decrease in fall at home [4, 7, 8]. In India as well as in the USA, there was a significant increase of violence related injuries [2, 6]. In proportion, the same finding was observed also by Venter et al. in South Africa [13]. The reason may be related to the financial crisis accompanying the health crisis with increased socioeconomic disparities and poverty.

In conclusion, the epidemiology and management of TBI patients during the COVID pandemic deeply changed. We basically have less cases but also less resources (in particular ICU beds) to treat our patients. There has been also a disruption of the chain of treatment with prolonged time from injury to management and an increase of violence related cases. As reported by our Indian colleagues, the neurosurgical community needs to take care of these data and consequently re-organize our services.

The pandemic has radically changed some of our daily and professional activities but has not canceled the traumatic neurosurgical pathology.

We are first doctors and then neurosurgeons: The challenge we have now is to fight the COVID pandemic and at the same time keeping alive the neurosurgery and trauma care.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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