Since February, 21st 2020, when the first person infected was reported in Lombardy, Italy rapidly became home to a massive Coronavirus Disease 2019 (COVID-19) outbreak. Currently, on 21th March, 53,578 COVID-19 cases have been confirmed in Italy. 6072 patients are now hospitalized. The number of deaths has risen to 4825 while 6072 were declared healed [4]. This data shows that Italy is, currently, the second most affected nation in the world by the epidemic, second only to China. Most of these cases occurred in Lombardy, the most populated Region of Italy, accounting for 10,060,574 people [2]. Hospitals were rapidly overcrowded by COVID-19 patients, especially intensive care units, and non-specialized doctors in infectious or respiratory diseases, including Neurosurgeons, were reassigned to the new COVID-wards to rationalize the use of resources. Hence, the regional health system, has been rapidly reprogrammed trying to contain the COVID-19 [1, 3].

In particular, for this reason, on March, 8th 2020, the Lombardy Regional Council organized an emergency task force in order to lead the response to the outbreak.

This viewpoint is intended to summarize the reorganization model provided inside the Lombard Neurosurgical network. Neurosurgeons and other non-specialized doctors were reassigned to the new COVID-wards. The Health system worked trying to contain COVID-19 in the region. The Lombard Regional Council called an emergency task force in order to reprogram the regional system. The Lombardy region accounts for 26 neurosurgical departments in 21 hospitals with more than 200 neurosurgeons and 40 residents in training. During the early days of the first outbreak, each neurosurgical department responded individually, and according to the number of COVID-19 positive patients present in the hospital, elective surgical activities, hospitalizations, and non-urgent outpatient visits were gradually reduced. Since March 8th 2020, the regional medical system, including neurosurgical activities, has been completely reorganized by the decision of the Lombard Regional Government (decree n° XI/2906).

The regional task force has determined that all non-urgent outpatient activities had to be suspended. It was decided to remodel the hospital treatment system by identifying 4 neurosurgical “hub” hospitals where concentration of all neurosurgical activities that could not be postponed would take place. Three hub hospitals guarantee 24/7 acceptance of emergency cases. The three hospitals have been chosen on geographical bases, covering roughly 1/3 of Lombard territory divided in west, central and east, all of the other departments have been assigned to one of the three hubs as a “spoke”.

The fourth “hub” hospital, the regional neuro oncological center has been re-allocated for urgent oncological patients coming from all the other departments of the region. Each department also provided some of its own neurosurgeons to be assigned to increase the staff on duty at the relative hub, accounting for personnel availability. The following clinical situations have been defined as neurosurgical emergencies.
- cerebral hemorrhages (subarachnoid and intraparenchymal) -
- acute hydrocephalus - tumors at risk of intracranial hyperten-
sion – spinal cord compressions with neurological deficit or at
risk of - traumatic cranial and spinal trauma emergencies.

The patients may access the hub in two ways: by primary or
secondary transport. Primary transport is advised when the
access is direct into the hub from the territory, the patient is
evaluated by the neurosurgeon on duty, undergoes the neces-
sary diagnostic procedures and, on symptomatic patients who
need emergency intervention or hospitalization in intensive
care, a COVID-19 swab is routinely carried out.

Secondary transport: the patient is evaluated at the “spoke”
department. If considered an urgent case, he/she is centralized
to the hub hospital after the execution of a swab for COVID-
19.

Dealing with oncological pathology, priority criteria have
been defined:

1) Class A ++ (requiring immediate treatment): patients with
intracranial or spinal oncological pathology that need
emergency treatment (rapidly evolving intracranial hyper-
tension with deteriorating state of consciousness, acute
hydrocephalus, spinal cord compression with rapid tetra-
or paraparesis).

2) Class A + (requiring treatment within a maximum of 7–
10 days): patients with oncological pathology (intracranial-
tumors with mass effect or with progressive neurolog-
ical deficit, without deterioration of consciousness).

3) Class A (requiring treatment within a month): patients
with oncological neurosurgical pathology that appears ra-
diologically of suspected malignant nature or with onco-
logical pathology that determines a neurological deficit.

Class A ++ patients will be managed like other emergen-
cies, those in the other two classes will be managed by the
oncological hub, according to clinical priorities and pro-
grammed in the allocated surgical slots.

“Emergency Hubs” have doubled the number of neurosur-
geons on duties with the collaboration of the colleagues from the
“Spoke hospitals”. This was found necessary to safely manage more than one operating theatre at the time. 2
Neurosurgeons are on duty 8–20 h and 2 neurosurgeons are
on duty 20–8 h. There is also an on-call system to provide
subspecialist cover. A complex spine on call service is provid-
ed 24/7 as well as neurovascular coverage. Once the post-
operative procedures have been completed, the patient will
be discharged home or to a physical therapy ward if necessary.

The oncological cases proposed to the “Oncological hub”
by external centers are operated by the proposing teams or by
mixed teams composed of external and residential surgeons.
In both cases, hub staff facilitate the execution of surgical
procedures by external operators.

This organization was prepared to let the majority of the
working force focus on COVID-19 patients, in the most af-
fected areas.

Even though we cannot have definitive data in such a short
period, our preliminary impressions are that this system is
sustainable, at least in the short period. This has been facilit-
ted by the public “lockdown” that has tangibly diminished the
number of traumatic cases, easing the surgical burden on
hub centers.

The COVID-19 emergency has forced a wider collabora-
tion between hospitals favoring the interchange of neurosur-
geons between hospitals that were once in competition, hope-
fully creating the basis for an interesting new standard for the
Post COVID-19 period. In difficult times such as these, the
cooperative spirit has risen spontaneously to previously unmet
levels both inside hospitals and between different
departments.

We truly hope that the COVID-19 outbreak will soon end
in our beloved country and that other countries may never
experience such a tragic emergency. Our thanks and thoughts
are to all colleagues, and not only those in the neurosurgical
community, who are risking their lives to provide the best care
to COVID-19 patients.

Compliance with ethical standards

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

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