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## Letter to the Editor Management of Neurosurgical Patients During the COVID-19 Pandemic



### LETTER:

In this document we aim to share the recent experience of a neurosurgery department located in one of the first and largest coronavirus disease 2019 (COVID-19) pandemic epicenters. We share a review of the available literature and discuss case selection, operating room, and postoperative management of neurosurgical patients.

The COVID-19 pandemic has upset health care organizations, requiring a deep reorganization in many respects. An adequate management protocol can reduce hospital viral spread, improving safety for both patients and health care professionals.

The entire world is fighting for the first time in the modern history of mankind a borderless war that has profoundly distorted the social, economic, and political setting of many countries. The rapid spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) represents the major challenge of health care systems worldwide.

In response to this spread, several conflicting actions such as social distancing, lockdowns, and quarantine of suspected or less symptomatic cases have been taken.<sup>1</sup>

The management of an ever-increasing number of patients, particularly those suffering from COVID-19 pneumonia, has deeply affected the organization of health care facilities.<sup>2</sup> Furthermore, preserving financial and human resources is crucial and an optimal preventive organization is mandatory in this phase of mass casualty.<sup>3,4</sup>

In this scenario, health care providers represent the frontline in the fight against the coronavirus. The COVID-19 outbreak has upset the way to deliver medicine among different medical specialties including neurosurgery.

Surely, SARS-CoV-2 infection may cause fever, pneumonia, and other medical issues not pertaining to the neurosurgical practice. However, management of neurosurgical cases has been deeply affected, leading to a complicated and difficult selection of patients to be candidates for hospital admission and surgery, together with their preoperative and postoperative management that must take into account their potential contagiousness.<sup>1</sup>

Because of a high viral load in the nasal cavity, brain surgery and even more so transsphenoidal surgery are high-risk surgical specialties, along with otorhinolaryngology, anesthesiology, and oral-maxillofacial surgery<sup>1,5,7</sup>; endoscopic procedures through the mouth and nose (such as in gastroenterology) could be considered at high risk, too.

Ultimately, in several hospitals, neurosurgeons have been reassigned to COVID-19 units due to the growing demand for medical personnel.

SARS-CoV-2 entails a long and incompletely known incubation period, ranging from 0–27 days after first virus exposure;

additionally, a significant rate of completely asymptomatic patients have been reported.<sup>8</sup> The aforementioned reasons represent a noteworthy risk of accidental virus transmission for all the personnel employed in neurosurgical departments, outpatient clinics, and operating rooms.<sup>1</sup>

SARS-CoV-2 transmission seems to be mainly related to respiratory droplets, but COVID-19 also shows surface stability over a long time.<sup>9</sup> For health care professionals, both transmission modalities must be considered to reduce the risk of accidental contagion.<sup>10</sup>

This requires a complete department and operating room reorganization to protect patients, as well as medical staff, from unnecessary and dangerous infections. Data coming from the first and largest COVID-19 Eastern Asian epicenters suggest that these problems will not end soon and therefore the risk of infection needs to be considered in upcoming months.<sup>11</sup>

In a single-center Chinese case series of 138 hospitalized patients, presumed hospital-related infection of COVID-19 was suspected in 41% of patients, with a reported mortality of 4.3% and an intensive care unit admission rate of 26%.<sup>12</sup>

Furthermore, the COVID-19 transmission rate to health care workers was reported to be up to 20%.<sup>13</sup> These data suggest that an inadequate hospital setting may represent a relevant route of SARS-CoV-2 spread for both patients and health care professionals.

The aim of this study was to report a series of recommendations derived from our experience and recent pertinent literature, to prevent viral spread during neurosurgical activities.

San Raffaele Hospital (Milan, Italy) is located in one of the first and largest COVID-19 pandemic epicenters worldwide; here we describe the actual organization of its Neurosurgery Department and current practice adopted.

A literature review was also performed via PubMed, Web of Science, and Google Scholar using the search terms surgery, neurosurgery, COVID-19, coronavirus, and SARS-CoV-2. Some additional studies were selected from the references of the articles retrieved. The last online research was performed on 15 April, 2020.

### CASE SELECTION

After the pandemic explosion, many hospitals have cancelled outpatient activities or reduced them to only urgent ones.<sup>2,11,14</sup> Consequently, the number of elective surgical cases have dramatically decreased, also because of the lockdown measures.<sup>2,5</sup>

Surgical treatment should be considered only in selected nonpostponable cases or emergencies.<sup>15,16</sup> Elective surgeries should be rescheduled to allow a correct assessment of patients' clinical condition and to give correct allocation in the ward.<sup>1,16</sup> The creation of COVID-positive (suspected or definitive cases) and COVID-free sectors, with dedicated health care professionals, might be desirable even inside the same department.

Patients' clinical evaluation must be performed by maintaining contact and droplet precautions. Social distancing must be

maintained for all patients except for unavoidable evaluations or maneuvers such as neurologic examination; adequate personal protection equipment (PPE) must always be used and be easily available in clinics. Each patient, even if tested negative for SARS-CoV-2 infection at real-time reverse transcriptase polymerase chain reaction (RT-PCR), should be considered and approached as potentially contagious.

Complete information about relatives' health condition, friends, and history of recent travels and contacts has to be investigated.

### PREOPERATIVE MANAGEMENT

After hospital admission, all health care figures should provide social distancing when possible and wear adequate PPE. A no-visitors policy should be adopted in the department, and patients should be encouraged to keep in contact with relatives and friends through electronic communication devices.<sup>1</sup>

Patients can be classified into 4 class-risk groups, according to their clinical, laboratory, and radiologic characteristics<sup>11,17,18</sup>:

- Group 1, Confirmed cases: COVID-19 infection performed through RT-PCR after nasopharyngeal sample or IgM-IgG serologic testing, although the latter might not indicate the presence of an active infection, but rather previous contact with the virus.

- Group 2, Suspected cases: contact history may be present, presence of some of the coronavirus infection, such as fever, respiratory symptoms, and typical findings of COVID-19 pneumonia in the chest computed tomography (CT) scan. In these patients the presence of leukopenia, particularly lymphocytopenia, should also be considered.<sup>19</sup>

- Group 3, High-risk cases: These patients are without symptoms and do not show laboratory or radiologic features suggestive for COVID-19. They have had contact with people who are positive or suspected and have had clinical manifestations of the coronavirus.

- Group 4, Low-risk: These patients have no positive history of contact; they have a negative RT-PCR test and no symptoms and manifestations of COVID-19 on chest CT scan.<sup>17,18,20</sup>

The assessment of class-risk group should be evaluated before and at hospital admission.

Whenever possible, elective surgery for confirmed cases (i.e., Group 1) should be rescheduled because this class of patients has a higher risk of intensive care needs and death.<sup>1,5,11,12,21-24</sup> Group 2 must undergo prompt laboratory RT-PCR or serologic testing in order to confirm COVID-19 infection or diagnose other viral or bacterial pneumonia. Surgery for group 2 patients should be carefully evaluated together with the anesthesiologist team, to balance the risk-benefit ratio of a surgical treatment at this time. Patients in Groups 3 and 4 should undergo laboratory testing and chest CT scan to exclude a developing infection.<sup>17,18</sup>

Early identification and isolation of infected patients minimize virus transmission to other patients and to health care professionals.<sup>1</sup>

Patients in the first 3 groups must be kept in a single room, and disinfection and isolation measures must be put in action. Contact and droplet isolation precautions through a gown, gloves, a head cap, and a facial FFP2 (N95) mask must be taken.<sup>5,11</sup> Also, patients must wear surgical facemasks or masks without exhalation valves.<sup>6,11</sup>

In the absence of clinical information or a swab test, those needing emergent neurosurgical procedures should be considered as Group 1-2 patients and require the same perioperative management as well.<sup>3</sup>

### OPERATING ROOM MANAGEMENT

A limited number of people are warranted in the operating room (OR).<sup>1</sup> Confirmed cases must be treated in a negative pressure room.<sup>5</sup> For the entire anesthesiology, neurosurgical, and nursing staff, high-protection PPEs are recommended; personnel should not wear the same PPEs inside and outside the OR.<sup>11</sup> FFP3 (N99 or equivalent) masks are suggested since FFP2 (N95) masks did not seem to adequately protect surgeons in China; triple-layered protection gowns, eye or facial protection, single-use head caps, and gloves are also recommended to prevent accidental transmission.<sup>1,11</sup>

An experienced anesthesiologist should perform the patient's intubation to reduce coaching and the number of attempts.<sup>5</sup> Video-guided laryngoscopy can be considered to attempt this goal.<sup>4,25</sup>

The surgeon should enter the OR about 20 minutes after intubation, with the abovementioned adequate PPE to minimize aerosol transmission.<sup>5</sup>

The surgical team should enter the room after 20 minutes of intubation with appropriate PPE to minimize the aerosol-based transmission.

All objects and instruments that come in contact with the patient included in Groups 1-3 must be considered contaminated.

Viruses have been reported to survive in surgical smoke; consequently, the latter must be reduced through continuous aspiration and irrigation while minimizing the effective power of electrosurgical equipment.<sup>5,9,11</sup> Care must be taken to prevent accidental needle or scalpel injury. Absorbable sutures should be considered to reduce unnecessary trips to the hospital for their removal.

### POSTOPERATIVE CARE

Patients developing fever or cough after surgery have to perform chest CT scan and laboratory testing for COVID-19. It should be noted that previous negative results do not preclude COVID-19 infection due to limitations in tests' sensibility and incubation periods.<sup>5</sup>

Confirmed coronavirus cases should be treated with oxygen delivery and medical support therapy. Multidisciplinary management with the anesthesiologist and infectious disease specialist is also recommended. It is well known that COVID-19 patients harbor a higher risk of thrombosis and secondary pulmonary infections; hence adequate treatment is warranted<sup>11,24</sup>; these

COVID-related risks add to those already present in neurosurgical patients. Unfortunately, in the neurosurgical setting the need for anticoagulant therapy has to be balanced with the risk of delayed postoperative bleeding, which may cause dramatic consequences.

Confirmed COVID-19 cases should be discharged after clinical resolution and when the RT-PCR or antibody test is negative on 2 consecutive occasions (sampling interval  $\geq 24$  hours).<sup>11</sup>

Negative cases with an uneventful postoperative course may go home, complying with a 14-day quarantine to prevent postoperative infections.

## CONCLUSIONS

COVID-19 represents one of the largest and deadliest pandemic infection of the modern era. The number of positive patients is, at the current time, still growing around the world and, unfortunately, chances are that we will have to deal with this infection for many more months to come. Hospitals are among the vectors that may amplify the spread of the disease. Adequate hospital and especially surgical unit organization are therefore essential to improve the safety of both patients and staff.

Careful management through a well-known protocol can minimize the risk for neurosurgical teams and all patients. We hope to continue providing the best possible standard of care to our patients.

**Alfio Spina, Nicola Boari, Filippo Gagliardi, Michele Bailo, Francesco Calvanese, Pietro Mortini**

Department of Neurosurgery and Gamma Knife Radiosurgery, I.R.C.C.S. San Raffaele Scientific Institute, Vita-Salute University, Milan, Italy

To whom correspondence should be addressed: Alfio Spina, M.D.

[E-mail: [spina.alfio@hsr.it](mailto:spina.alfio@hsr.it)]

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