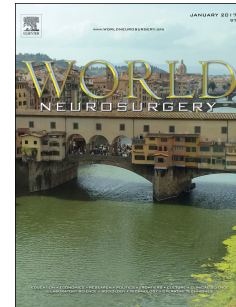


Journal Pre-proof

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Neurosurgical practice during the SARS-CoV-2 pandemic: a worldwide survey

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Abstract

Background and Objective: The SARS-CoV-2 pandemic has consistently changed medical practice throughout specialties, regardless of their contribution in facing the disease itself. We surveyed neurosurgeons worldwide to investigate the situation they are experiencing.

Design and participants: A 17-question, web-based survey was administered to neurosurgeons worldwide through the WFNS and the Neurosurgery Cocktail from March 28 to April 5, 2020 by web link or e-mail invitation. Questions were divided into three subgroups: general information, health system organization, and institutional plans for the SARS-CoV-2 outbreak. Collected data was initially elaborated using Survey Monkey[®] software. Country specific data were extracted from the WHO website. Statistical analysis was performed using R version 3.6.3.

Results: Of the 446 respondents, most were from Italy (20%), India (19%), and Pakistan (5%). Surgical activity was significantly reduced in most centers (79%) and dedicated in-hospital routes were created for SARS-CoV-2 patients (58%). Patient screening was performed only when there were symptoms (57%) and not routinely before surgery (18%). The preferred methods included a nasopharyngeal swab and chest x-ray. Health professionals were rarely screened (20%) and sometimes, even if SARS-CoV-2 positive, were asked to work if asymptomatic (26%).

Surgical planning was changed in most institutions (92%), while indications were modified for non-urgent procedures (59%) and remained unchanged for subarachnoid hemorrhages (85%).

Conclusions: Most neurosurgeons worldwide reported work reorganization and practices that respond to current international guidelines. Differences in practice might be related to the perception of the pandemic and significant differences in the health systems. Sharing data and experiences will be of paramount importance to address the present moment and challenges in the near future.

Keywords: COVID-19, neurosurgery, survey.

Journal Pre-proof

Introduction

We are in the midst of a pandemic caused by a novel coronavirus, SARS-CoV-2, first detected in Wuhan (China) in December 2019. Since then, COVID-19 has spread quickly, with more than 2,000,000 confirmed cases and more than 100,000 deaths on April 19, with 213 countries involved worldwide.¹ Given the serious public health risk, medical practice has consistently changed during SARS-CoV-2 pandemic. The impact of the COVID-19 outbreak might change in relation to the diffusion of the virus, as well as the health system of the individual country; furthermore, this pandemic is influencing different medical specialties in a variety of ways.² Most surgical subspecialties are not primarily involved in fighting the disease itself, but they must still change their organization, as most national and international societies suggest stopping all elective activity, maintaining only emergent and urgent procedures.²⁻⁸

Neurosurgeons might feel fairly useless during the SARS-CoV-2 pandemic. However, international guidelines have been introduced calling for a tailored triage according to the degree of emergency,^{3,9,10} and we believe that sharing information about the organization of neurosurgical activity throughout the world might be helpful at this time. Furthermore, it might be interesting to investigate whether there is any association between the level of infection and consequent country reorganization of the neurosurgical system, as well as the neurosurgeons' practice. We, therefore, conducted an online survey that was submitted to neurosurgeons worldwide between March 28 and April 5, 2020 through the World Federation of Neurosurgical Societies (WFNS)¹¹ and the Neurosurgery Cocktail.¹²⁻¹⁴

Materials and Methods

Study Design and group of Responders

A 17-question, web-based survey was administered to neurosurgeons worldwide through the WFNS and the Neurosurgery Cocktail from March 28 to April 5 2020 by web link or e-mail invitation (Supplementary Material).

The questions were divided into three subgroups:

1. Information on the country and its involvement by COVID-19: neurosurgeons were asked about their country of practice, its involvement by the pandemic, and duration of the emergency;
2. Health system organization and screening for health professionals: national and regional measures adopted to face the outbreak were queried, as well as the screening rate and precautions undertaken for SARS-CoV-2 positive health professionals;
3. Institutional plans for the SARS-CoV-2 outbreak: any special measures adopted for SARS-CoV-2 positive neurosurgical patients were investigated, i.e. their screening rate and method, any changes in surgical indications, planning and activity for oncologic procedures, non-emergency surgeries, and subarachnoid hemorrhages (SAHs).

Most questions were closed-ended, multiple choice. Some allowed also an open answer (Q7,15 and 17 – see Supplementary Material).

The primary goal was to collect data on neurosurgeons' perceptions of the health emergency, the national/regional measures undertaken for health professionals and throughout neurosurgical departments, and the changes in neurosurgical indications, planning, and activity.

The secondary aim was to investigate correlations between the data collected and the epidemiological scenario in each country.

The third aim was to look into differences among regions, nations and territories along with possible causes and consequences of diversities.

Data collection and Statistical analyses

Data were initially elaborated using Survey Monkey[®] software online; country specific historical data were extracted from the WHO website.¹ For open answers, the most recurring terms were

rendered as a “word cloud”, in which a population of words is represented with different sizes according to their frequency. Survey’s responses to Q3 were first converted into estimates in days (<1 week: 3 days; >1 week to <1 month: 15 days; >1 month to <3 month: 45 days; >3 months: 100 days).

Pearson’s correlation was used to estimate the correlation between the number of answers in the surveys with the number of new cases in each country and the duration of the pandemic. The latter was calculated as the difference in days from the first confirmed case to the last day of the survey. A linear regression model was fit to the data. For each country (i), a Deviation from Expected Valued (D_i) was calculated as the difference between the observed number of answers and the expected number of answers (E_i) estimated from the linear regression model, such that $D_i = A_i - E_i$, where A_i is the observed number of answers registered for country i. For each country, the median of the differences between each survey’s entry date and perception date was calculated. Statistical analysis was performed using R version 3.6.3.¹⁵

Results

On April 5, 2020 the survey was closed and 446 responses had been collected. The skipping rate for each question ranged from 0% (Q1) to 89% (Q17). Most responses (85%) were filled during only 3 days in March (Saturday 28, Sunday 29, and Tuesday 31).

General information on COVID-19 involvement

A total of 66 countries worldwide responded to the survey (Fig. 1). Most respondents were from Italy (20%), followed by India (19%) and Pakistan (5%). Statistical analysis did not reveal a significant correlation between the incidence of disease and number of responses by country (Fig. 2).

For the majority of respondents (97%), the nation was facing a SARS-CoV-2 outbreak. The duration of the health emergency was between 1 week and 1 month for most respondents (63%), between 1 month and 3 months for 32% respondents, shorter than 1 week for 3% respondents, and longer than 3 months for 2% respondents. Figure 3 shows correlations between disease activity during the survey and time-length perception of respondents from some countries.

Health system organization

Regarding the special measures adopted in neurosurgical departments to face the SARS-CoV-2 outbreak, in most cases there was a reduction of surgical activity without centralization (79%), while there was a centralization of surgery in high-volume centers in 9% cases and full closure of neurosurgical departments in 5%. No special measures to face the outbreak were reported in 7% of centers. Figure 4B shows the categorizations of special measures undertaken by countries in relation to the incidence of disease.

The overall reported screening rate of health professionals for SARS-CoV-2 was 20%; 26% respondents reported that SARS-CoV-2 positive health professionals were asked to keep working if asymptomatic.

Institution plans for SARS-CoV-2 outbreak

With respect to the precautions adopted worldwide for SARS-CoV-2 positive neurosurgical patients, in most cases hospitals reserved dedicated routes for them (58%), in 27% cases specific operating rooms were dedicated to SARS-CoV-2 patients, and in 21% cases neurosurgical units were reserved for SARS-CoV-2 patients. Other respondents (21%) replied with open answers and among them, no special measures were usually undertaken.

The overall screening rate for SARS-CoV-2 was 57% for symptomatic patients and only 18% for patients undergoing surgery. The preferred methods for screening was nasopharyngeal swab (86%), followed by chest CT scan (26%) and chest X-ray (25%).

Surgical planning was globally changed in most institutions (92%): only urgent or emergency procedures were performed in 49% cases; urgencies/emergencies and procedures that could not be postponed were performed in 45% cases. Oncologic procedures were preserved in 71% cases. The resulting reduction rate in number of surgical procedures was >70% for almost half of respondents (47%). Surgical indications for SARS-CoV-2 patients were modified in 59% cases for pathologies such as chronic subdural hematomas (CSHs) and tumors, while the *modus operandi* in treating aneurysmal SAHs did not change in 85% of centers.

Discussion

This survey, dedicated to neurosurgery and SARS-CoV-2 worldwide, demonstrated a number of interesting findings. A high number of responses (n=446) was received, suggesting a relevant global impact of COVID-19 on the neurosurgical community, even though it is a surgical specialty that is not primarily involved in fighting the disease.¹⁶

General information on COVID-19 involvement

Italy and India were the countries with the most respondents (Fig. 1). This finding is independent of the incidence of disease, as shown in Figure 2. Conversely, the US was the country with least number of respondents in relation to the incidence of disease during the study period. Although it might be tempting to relate the number of answers to perception of the health emergency, we should point out that the survey circulated widely among neurosurgeons, but we cannot state that the percentage of respondents (i.e. respondents/non respondents) was the same among the different nations. The same correlation was found with regards to the medical perception of disease activity (Q2) in different countries, and only few respondents (3%) claimed their country was not facing the outbreak during the time period studied: among them, neurosurgeons from Germany were probably the most “wrong”, since their country had between 10^4 to 10^5 SARS-CoV2 patients during the study

period (Fig. 4A). Notably, reactions and perceptions of COVID-19 impact on a country may be consistently driven by government actions, as happened in India and Pakistan, where most strict lockdown measures were undertaken with respect to other world countries,^{17,18} possibly influencing general and health professional awareness of the health emergency. Nonetheless, the differences in number of responses might be due to a heterogeneity of the survey distributions among different countries. Furthermore, the perception of the emergency might be related to the health system, with Germany having the highest rate of ICU beds/population.¹⁹ Regarding the time-length perception of COVID-19, Italian and Iranian respondents perceived the start of the health emergencies much earlier than the actual one (Fig. 3); Chinese neurosurgeons, instead, located the start of the health emergency almost at the inflection point of decrease in incidence rate, when the SARS-CoV-2 pandemic was about to reach the plateau phase (Fig. 3). The perception corresponded well to reality among the other respondents. It is tempting to interpret these data as the consequence of the strain that physicians are experiencing in countries with the longest disease involvement at the moment of the study: some might perceive that the emergency is longer than reality due to the continuous stress, or because of media pressure about other countries (i.e. China and Iran) experiencing the outbreak. On the other hand, accumulating evidence shows that SARS-CoV-2 might have been circulating in Italy well before February 21st, thus explaining the significant outbreak that took place in Lombardy in northern Italy.²⁰ Others may perceive that the emergency is shorter than reality due to epidemiology for complex reasons: Chinese people outside Wuhan experienced the outbreak at a later stage of the epidemic and individuals emigrating from Wuhan was the main infection source for other provinces, causing a rapid increase in case load when Wuhan was already in the plateau phase; the general perception in China about the national involvement might have been in reality delayed.²¹

Health system organization

With respect to health system organization, the most frequent action undertaken globally was

reduction of surgical activity without centralization (79%, yellow bars on Fig. 4B). Significant high rates were registered in India (81%) and Pakistan (85%). Centralization of surgery to high-volume centers was reported in only 9% cases and Italy was the country with the highest number of positive respondents (23%), followed by Germany (6%) and India (5%). Only 7% of respondents report that their country did not undertake any special measure. These data show how most countries acted according to international guidelines in the management of elective procedures.⁵ India and Pakistan have been reported to be the world's best respondents to the SARS-COV-2 pandemic,²²⁻²⁴ thus reflecting high rates of neurosurgical activity reorganizations. Neurosurgical centers should undertake national and regional measures to meet patients' needs with logistical capabilities, as reported by guidelines.³ Interestingly, health reorganization may vary significantly even within the same country. More than 100,000 positive cases were confirmed in Italy by April 19 with more than 30,000 in Lombardy alone.²⁰ In this region, which is still at the center of the health emergency in Italy, neurosurgical departments were urgently reorganized and centralization of surgery in high-volume centers was decided.⁶⁻⁸ Other Italian regions are still facing the health emergency, but at lower levels with incidences that tend to decrease from the north to the south.²⁰ The same incidence disproportion between regions within a country is clearly visible in even smaller European countries such as Switzerland, where the Cantons of Vaud and Geneva account for more than 4,000 cases each, while the Canton of Schaffhausen has not yet reached 100 cases.²⁵ These significant variations in a single country justify the different regional reorganizations.

Guidelines for risk assessment and management of exposure of healthcare workers vary according to the risk of SARS-CoV-2 infection (categorized as high or low) and recommend COVID-19 testing only for workers at a high risk of infection.²⁶ In this sense, the global attitude did not deviate significantly from recommendations,^{3,16} as only 21% of respondents reported ongoing screening for health professionals, mainly from Brazil (50%), Mexico (42%), and Germany (28%). A minority of respondents (26%) declared that SARS-CoV-2 positive health professionals kept working if asymptomatic and a large portion of these respondents were from Italy (36%). Indeed,

no clear national guidelines are available for SARS-CoV-2 positive health professionals,²⁷ resulting in heterogeneity of recommendations throughout the country. COVID-19 positive Italian health professionals have reached more than 13,000, with more than 100 deaths of physicians (most of them are general practitioners) and almost 30 nurses.²⁸ At Spedali Civili Hospital, in Brescia in northern Italy, SARS-CoV-2 positive health professionals are not allowed to work and daily temperature screening procedures are undertaken at the hospital entrance for both health professionals and visitors.²⁹ Nonetheless, there is a general perception that health professionals might have been asymptomatic carriers of the disease.³⁰

Institution plans for SARS-CoV-2 outbreak

Regarding precautions adopted worldwide for SARS-CoV-2 positive neurosurgical patients, the most widely undertaken measure globally was to reserve dedicated routes to SARS-CoV-2 patients (58%), while specific operating room and entire neurosurgical units were created in a minority of cases. Some respondents (21%, mainly from Austria, Germany, and UK) reported not taking any special measures for SARS-CoV-2 patients. However, guidelines clearly state that SARS-CoV-2 positive patients should be cohorted in a separate location from SARS-CoV-2 negative patients and specific hospital policy for management of known or suspected SARS-CoV-2 positive patients in the operating room should be developed.³¹⁻³² Concerning the screening of neurosurgical patients, facilities should use portable radiography when chest X-Rays are considered necessary, thus avoiding the need to bring patients into radiography departments; chest CT scan has been recently reported to have a high sensitivity (97%) for COVID-19 screening, but lower specificity and accuracy.^{33,34}

A recently published paper in JAMA analyzed the sensitivity of different RT-PCR screening sources demonstrating that bronchoalveolar lavage fluid is the most sensitive specimen (93%), followed by sputum (72%), nasal swab (63%), fibrobronchoscope brush biopsy (46%), pharyngeal swabs (32%), feces (29%), and blood (1%); the authors underline that multiple testing from

different sites improve sensitivity and reduces false-negative results.³⁵ Most guidelines at present recommend a single upper respiratory nasopharyngeal swab for suspect cases.² In this survey, most respondents referred that nasopharyngeal swab was the preferred method for screening (86%), followed by CT scan (26%), and chest X-ray (25%). Some respondents indicated more than one screening method, especially those from Italy (57%) and India (19%), where the most common combination was the nasopharyngeal swab with chest X-ray.

The COVID-19 outbreak had a relevant impact on surgical planning, with most respondents reporting a significant change in surgical activity in their institutions (92%). The majority (94%) performed only procedures that could not be postponed (i.e. tumors with evident mass effect) and/or urgent/emergency procedures, while in a few cases (6%) the entire neurosurgical department was closed. This obviously resulted in a significant reduction of the overall number of surgical procedures: most respondents claimed more than 70% reduction of surgical interventions. Procrastinating elective procedures has been one of the crucial indications delivered by international societies³⁻⁵ with many important aims: a. to contain the spread of SARS-CoV-2, by reducing visits to hospitals by people with no urgent medical issue; b. to reduce the patient load on Intensive Care Units with non-COVID-19 patients; c. to reduce the possibility of treating asymptomatic SARS-CoV-2 patients, who would be at high risk of deteriorating due to the surgical stress and would increase the risk of infecting health professionals.

Surgical indications for SARS-CoV-2 non-emergency patients (i.e. CSHs and tumors) have been modified in only 59% cases, while 41% neurosurgeons worldwide referred that their institutions continued operating on elective neurosurgical patients in the same way as the pre-outbreak era; international guidelines clearly state that non-emergency procedures should be delayed.³⁻⁷ Studying correlations between incidence of disease and actions undertaken by various countries (Fig. 4C), Middle-Eastern nations (i.e. Turkey, Egypt, Saudi Arabia, etc.) were the most reactive to the health emergency, followed by European countries (i.e. Italy, Spain, Austria, etc.), and the Americas (i.e. US, Mexico, Brazil, etc.).

As for aneurysmal SAHs, most respondents (85%) did not change their indications and treatment (Fig. 4D). Even if some of these findings might seem against guidelines, the word cloud resulting from the open answers puts “patient” at the center and sums up what international societies have been suggesting: “Postpone surgery and be conservative as much as possible, delay elective procedures, but, as for emergency symptomatic patients, try to operate with all recommended precautions” (Fig. 5). We must indeed stress that all medical efforts, institutional plans, and health system organization would be useless without the appropriate and recommended use of personal protective equipment (PPE).^{26,36,37} Although India is the world’s second most populous country, the incidence rate of SARS-COV-2 infections has risen less than other countries since the beginning of the outbreak.³⁸ The reason might be found in the earlier government actions that India undertook while the virus was spreading out from China.^{17,18,39}

Limits of the study

Our study has many limits. First, it is not an epidemiological study and does not allow drawing conclusions about the actual prevalence and incidence of the variables investigated. It does allow, though, to draw conclusions regarding the perception of neurosurgeons about the COVID-19 health emergency with respect to the actual epidemiology data. Second, although this survey spread out widely among neurosurgeons, respondents were mostly from Italy, India and Pakistan, while the rest of the world was represented with lesser numbers. Heterogeneity of the survey’s percentage of respondents (i.e. respondents/non-respondents) among different countries might have biased some responses.

Notwithstanding, this is the first survey conducted on the impact of COVID-19 on the neurosurgical community and we believe that data from this study can help neurosurgeons and global health organizations to tackle this health emergency.

Conclusions

SARS-CoV-2 pandemic has consistently changed medical practice, with an enormous impact on all specialties, regardless of their contribution in facing the disease itself. Neurosurgeons worldwide have changed their surgical planning and activity, in most cases following national and international guidelines.

Dedicated routes were put in place for SARS-CoV-2 patients in most cases and surgical activity was limited to procedures that could not be postponed, resulting in an overall reduction of surgeries by more than 70%.

The lockdown will be soon followed by the rebuilding phase, when delayed elective procedures will need to be performed, thus opening a new challenge that to be addressed, possibly by sharing current knowledge and experience worldwide.

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Figures

Fig. 1. Square pie chart with global number of responses by country.

Fig. 2. Correlation between number of answers to the survey and incidence of COVID-19 by country. **(A).** Dot plot of number of answers to the survey and number of total SARS-CoV-2 infections during the period in which the survey was open. Each dot represents a country. Scattered dots indicate no correlation between incidence of disease and number of responses. **(B).** Deviation for each country of registered number of answers to the survey from the expected value. Blue bars indicate an excess of answers; red bars indicate a lack of answers.

Fig. 3. The survey window includes different stages of COVID-19 epidemics in different countries. Cumulative incidence curves of COVID-19 epidemics for each country, showing the epidemic stage in which the survey was compiled. Red and blue dots represent beginning and end of the survey window. Green dots represent the estimated beginning of health emergency based on individual answers to the survey. The start of the outbreak should be considered to be located at a time-point overlaying the upward flection of the incidence curve (inflection point incidence growth).

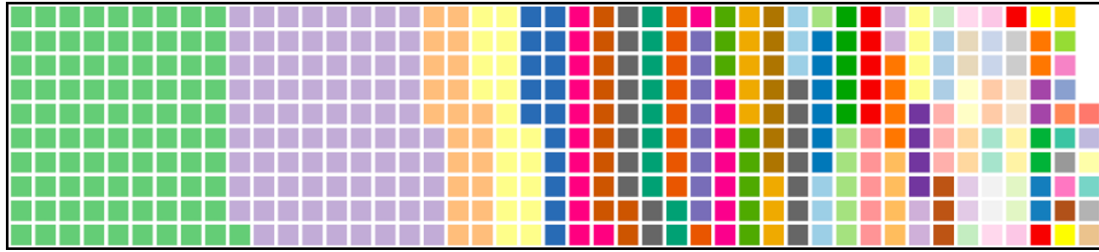
Fig. 4. Distribution of each country's response to the health emergency. **(A).** Bar chart of total number of new COVID-19 infections during the period in which the survey was open. **(B).** Bar chart of responses to Q4 ("Regarding Neurosurgical Department, has your Nation/Region adopted special measures to face SARS-CoV-2 outbreak?). **(C).** Barplot of responses to Q14 ("Do you modify surgical indications if the patient is SARS-CoV-2 positive for non-emergency surgery"). **(D).** Bar chart of responses to Q16 ("Do you modify your modus operandi in treating aneurysmal subarachnoid hemorrhage?"). The numbers on each plot represent the percentage of the total number of registered answers for each question for each country.

Fig. 5. Word cloud of answers to Q15 ("Do you modify surgical indications if the patient is SARS-CoV-2 positive for non-emergency surgery? If YES, please specify"). A word cloud is a population of words in which each is represented with different size according to its frequency.

Supplementary Material

Survey administered to neurosurgeons through the WFNS and the Neurosurgery Cocktail from March 28 to April 5 2020 by web link or e-mail invitation.

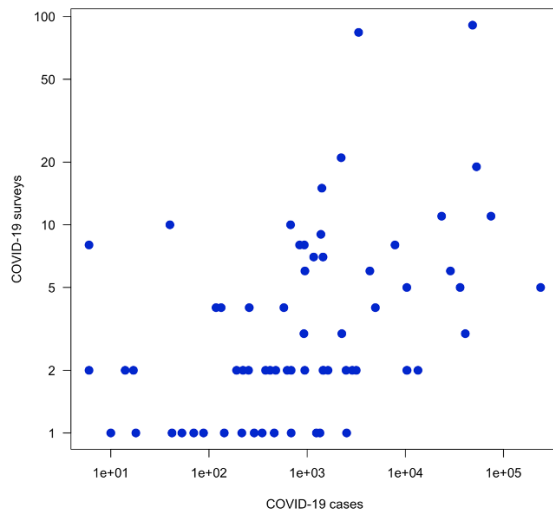
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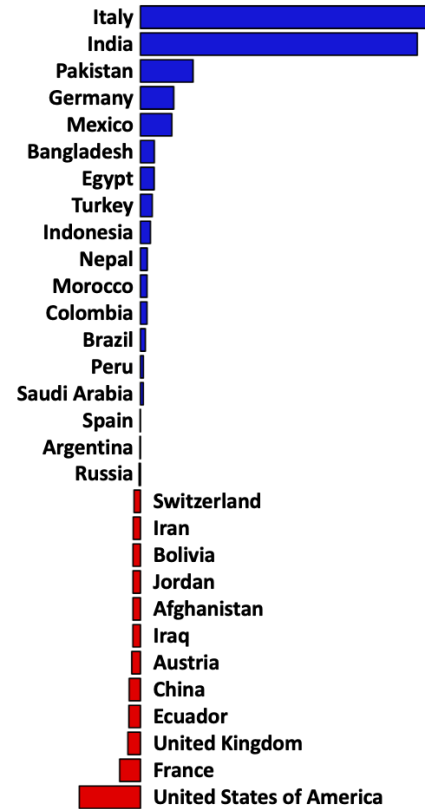
Italy (91)	Iran (6)	Chile (2)	Azerbaijan (1)
India (84)	Russia (6)	Croatia (2)	Czechia (1)
Pakistan (21)	Switzerland (5)	Cuba (2)	Honduras (1)
Germany (19)	United Kingdom (5)	Denmark (2)	Kuwait (1)
Mexico (15)	USA (5)	Kazakhstan (2)	Latvia (1)
Spain (11)	Afghanistan (4)	Libya (2)	Liberia (1)
Turkey (11)	Austria (4)	Malaysia (2)	Luxembourg (1)
Bangladesh (10)	Bolivia (4)	Maldives (2)	Moldova (1)
Egypt (10)	Iraq (4)	Netherlands (2)	Monaco (1)
Indonesia (9)	Jordan (4)	Oman (2)	Nigeria (1)
Brazil (8)	China (3)	Poland (2)	Panama (1)
Colombia (8)	Ecuador (3)	Serbia (2)	Sri Lanka (1)
Morocco (8)	France (3)	Singapore (2)	Trinidad and Tobago (1)
Nepal (8)	Albania (2)	Slovenia (2)	Venezuela (1)
Peru (7)	Algeria (2)	Syria (2)	Vietnam (1)
Saudi Arabia (7)	Belgium (2)	Tunisia (2)	
Argentina (6)	Canada (2)	United Arab Emirates (2)	

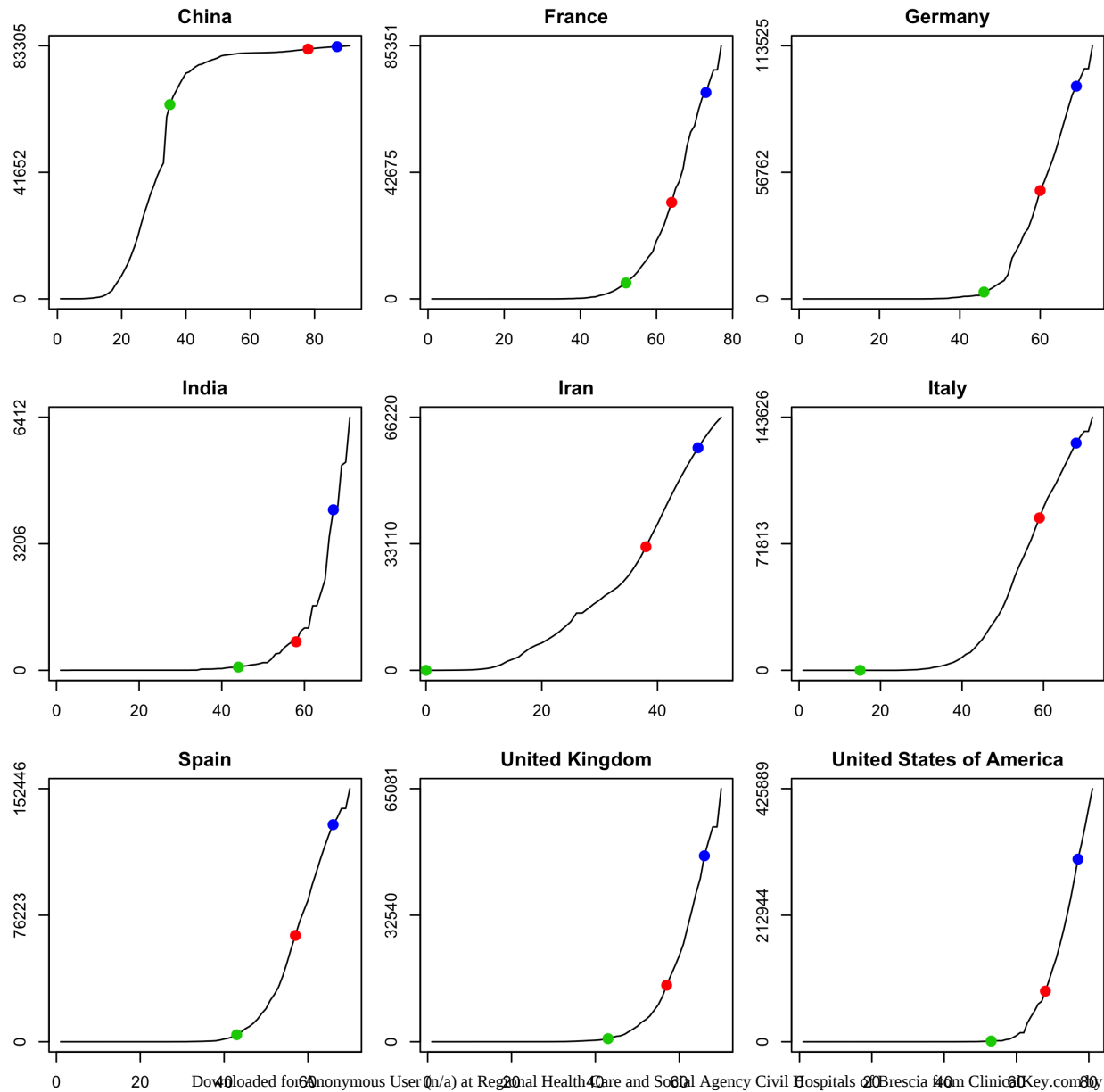
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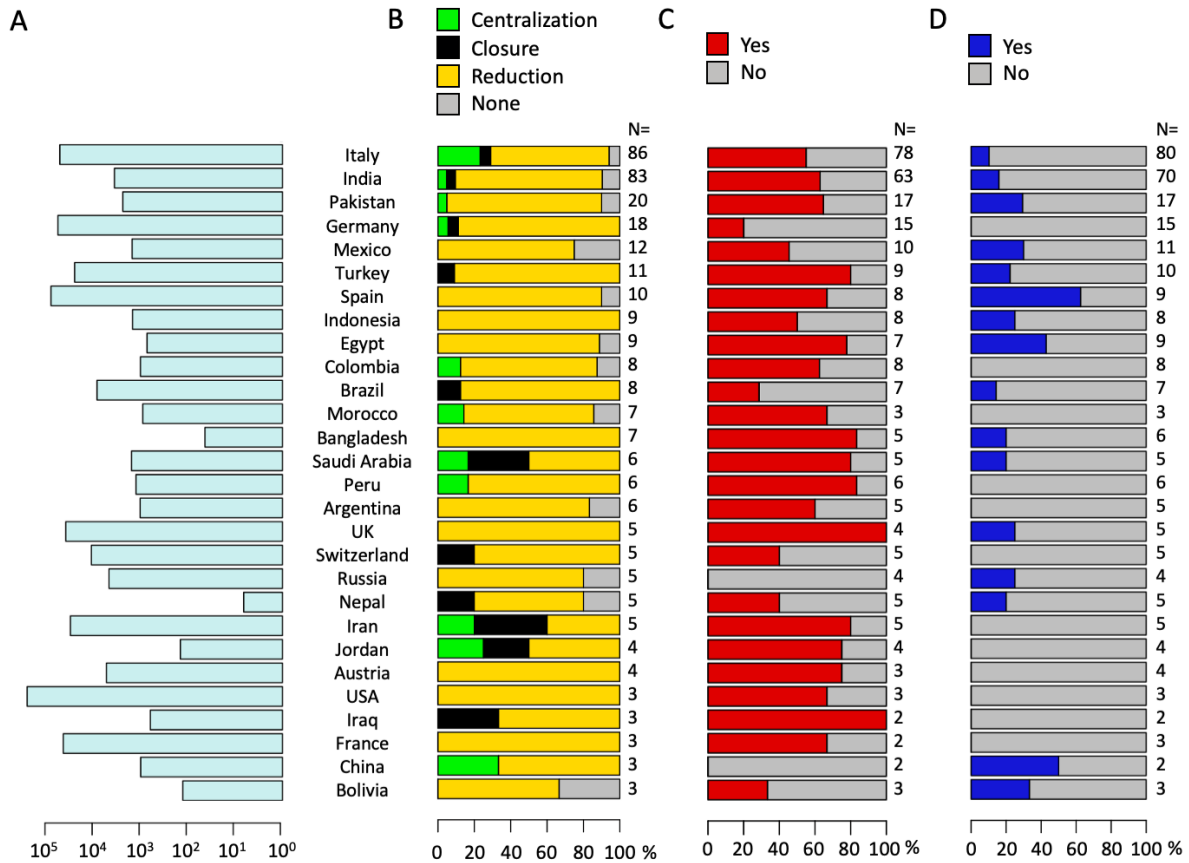
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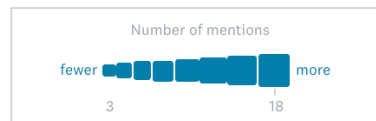






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cases much possible will perform surgery conservative PPE wait urgent
 Postpone use patient procedure surgery covid
 emergency symptomatic operate till Delay elective Yes
 precautions positive considered try



How have we changed our neurosurgical activity in the storm of 2019-nCoV pandemic?

As neurosurgeons we might feel fairly useless during the 2019-nCoV pandemic. We think, though, that it is important to share information on the organization of the neurosurgical activity in this moment.

Your participation to this brief survey is highly appreciated.

General Information

* 1. In what Nation do you practice?

2. Is your Nation facing a 2019-nCoV outbreak?

3. How long has your Nation been in this health emergency?

- ☐ < 1 week
- ☐ between 1 week and 1 month
- ☐ between 1 month and 3 months
- ☐ > 3 months

Health system organization

4. Regarding Neurosurgical Department, has your Nation/Region adopted special measures to face 2019-nCoV outbreak?

- ☐ No
- ☐ Centralization of surgery to high-volume centres
- ☐ Reduction of surgical activity without centralization
- ☐ Closure of Neurosurgical Departments

5. Are health professionals screened for 2019-nCoV?

6. Do nCoV-positive health professionals work if asymptomatic?

Institution plans for 2019-nCoV outbreak

*** 7. Within your Institution, what kind of precautions have been adopted for nCoV neurosurgical patients?**

- ☐ hospital routes reserved to nCoV patients
- ☐ O.R. reserved to nCoV patients
- ☐ Neurosurgical Unit reserved to nCoV patients
- ☐ Other (please specify)

*** 8. Are patients screened for 2019-nCoV?**

- ☐ YES, all patients before surgery
- ☐ YES, only symptomatic patients
- ☐ NO

9. How do you perform screening for 2019-nCoV?

- ☐ Nasopharyngeal swab
- ☐ Chest X-Ray
- ☐ Chest CT

10. Has your institution changed the surgical plan during the outbreak?

- ☐ YES
- ☐ NO

11. How?

- ☐ My Neurosurgical Department is closed
- ☐ We perform only urgent or emergency procedures
- ☐ We perform urgencies, emergencies and non-procrastinating procedures (e.g. tumors with intracranial hypertension, chronic subdural hematomas...)

12. Do you preserve surgical activity regarding oncologic procedures?

- ☐ Yes
- ☐ No

*** 13. How much has the number of surgical procedures been reduced compared to the pre-nCoV period?**

☐ < 30%

☐ 30-50%

☐ 50-70%

☐ >70%

*** 14. Do you modify surgical indications if the patient is nCoV positive for non-emergency surgery (e.g. chronic subdural hematoma, tumors?)**

15. if YES please specify

*** 16. if YES please specify**

*** 17. Do you modify your modus operandi in treating aneurysmal subarachnoid hemorrhage?**

Abbreviations list

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2

WFNS: World Federation of Neurosurgical Societies

WHO: World Health Organization

nCoV: Novel Coronavirus

COVID-19: COronaVirus Disease 19

SAHs: SubarAchnoid Hemorrhages

CSHs: Chronic Subdural Hematomas

ICU: Intensive Care Unit

RT-PCR: Reverse Transcription Polymerase Chain Reaction