

Letter: Neurosurgery and Coronavirus (COVID-19) Epidemic: Doing our Part

To the Editor:

Coronavirus COVID-19 is responsible for the current ongoing worldwide epidemic¹ and it is manifesting a significantly high potential of quick global diffusion. Coronaviruses, including human COVID-19, produce upper and lower respiratory tract infections such as laryngitis, bronchitis, pneumonia, and acute respiratory distress syndrome (ARDS), being in such extreme cases responsible of the most of the disease-related fatalities, as we quickly learned in the last weeks, in the subgroups of patients harbouring other pre-existing comorbidities.²

Since the Human Coronaviruses (HCoVs) are opportunistic pathogens, growing evidence is supporting their capability to elude the immune system and affect extrapulmonary organs.³⁻⁵ Two possible mechanisms for intracranial spread of viral infections have been described. The first mechanism of central nervous system (CNS) invasion is a result of a direct hematogenous attack of the pathogen, using the bloodstream as vehicle, up to the blood-brain-barrier. In the second scenario, the virus attacks the peripheral nerve fibers of the upper respiratory tract, subsequently enters the axons of such nerves and by means of a retrograde ascent, eventually affects the CNS.⁶

At present (beginning of March 2020), the case count has risen until up to about 100 000 cases, with a total amount of about 3500 fatalities.⁷ The further epidemic potential is considered to be still clarified and is definitely unclear the CoVid-19 potential for CNS involvement. Although it has been recognized as a notably rare condition,⁸ CNS involvement was reported by several authors⁹⁻¹¹ as a possible consequence of viral infection as HCoV-OC43 and HCoV-229E ribonucleic acid (RNA) sequences has been detected in the cerebrospinal fluid (CSF) of immunocompromised patients. Moreover, the HCoV has been associated to the development of a Multiple-Sclerosis (MS), since a T lymphocytic cell cross reaction with HCoV-229E antigens and myelin basic protein has been demonstrated. Moreover, RNA of the HCoV-OC43 and HCoV-229E was more frequently identified by means of Polymerase chain reaction (PCR) investigations in MS patients rather than in healthy subjects.¹²

From our experience in the management of CNS infections, we outline, in this paper, the most probable and concrete clinical landscapes in which the professionalism of a neurosurgeon could be required in the attempt to support the decision-making process in the clinical course of a CoVid-19 patient.

LUMBAR PUNCTURE AND THE RELATED CLINICAL USE OF NEUROIMAGING

Lumbar puncture (LP) is a common medical procedure, nevertheless, it is not uncommon to be requested as neurosurgeon

to support a non-neurosurgeon colleague performing such a procedure or to directly perform it in difficult cases.¹³

Nowadays, suspected CNS infections represent one of the most common indication for a LP.¹⁴ Through a cell count LP can quickly and reliably distinguish between bacterial, fungal, tuberculous, parasitic, or viral infection according to the demonstration of the pathogen and the degree of pleocytosis along with the glucose and lactate blood concentrations.¹⁵ Moreover, the extracted CSF can be analysed in order to identify genetic viral or bacterial components through a PCR investigation or by means of an antibody testing,¹⁶ thus proving extremely helpful in case of suspected CNS viral infection.

The absolute contraindications are generally represented by the presence of an intracranial lesion determining mass effect,¹⁵ the presence of non-communicating hydrocephalus, coagulation problems related to platelet count ($<20 \times 10^9/L$), bleeding diathesis, anticoagulation therapy, local skin infection at the puncture site, severe spinal canal stenosis above the puncture site and severe spinal or cranial developmental abnormalities.¹⁷⁻²⁰

Regarding neuroradiology, a brain computed tomography (CT) scan can outline the presence of a mild or massive brain swelling, along with the presence of midline shift and brain herniations. Magnetic resonance imaging (MRI) provides the most conclusive clues about the presence of major ongoing inflammatory/infectious intracranial processes.²¹ In particular, it discloses the presence of T1-W, T2-W, FLAIR, and DWI regional hyperintense abnormalities possibly suspicious for viral encephalitis (VE). Both CT and MRI scan are effective in disclosing space occupying inflammatory foci, which are mandatory to outline and ponder before performing a LP.

Subsequently our recommendation is to obtain in any case neuroimaging in a suspected or clarified HCoV-19 patient disclosing neurologic symptoms: although rare, encephalitis was previously reported in such condition and therefore in such eventuality a safely performed LP could add relevant data to the diagnostic process.

EMERGENCY CRANIECTOMY

The clinical observations and clinical research investigations concerning patients suffering from standard VE demonstrated that in relevant number of patients, VE can be responsible of a massive brain edema eventually determining an intracranial hypertension related neurologic deterioration.^{15,22,23}

As a last chance treatment, after the failure of any possible conservative management strategy, such as hypertonic drugs, hyperventilation, corticosteroids, barbiturates, osmotic agents, and hypothermia, a hemispheric standard decompressive craniectomy (DC) can be performed.²² It has been demonstrated to produce satisfactory clinical outcomes in a relatively wide number of patients suffering from common infectious

encephalitis, including those whose origin was purely bacterial, being nevertheless the VE patients the ones experiencing a better functional outcome at follow-up.²³

Although DC seems reasonable and logical as a last chance option in case of a life threatening unresponsive to conservative treatment intracranial hypertension, in the specific case of a COVID-19 infection, the safest decision concerning the destiny of the cranial flap remains unclear in our opinion, due to the lack of strong evidences: at present, apart from the general WHO indications,²⁴ and several persistence profile studies,²⁵ no specific indications about the cranial grafts has been diffused.

CONSIDERATIONS AND FINAL RECOMMENDATIONS

Because of the rarity of the CNS involvement by COVID-19 and other Coronaviruses, we still lack of strong and reliable evidences to produce an all-inclusive decision-making algorithm. In absence of such relevant evidences, the clinical neurosurgeon appears to be, at present, strongly advised to undertake strictly multidisciplinary based decisions, discussing the clinical features of the single patient, considering that a wide number of the reported fatalities were previously affected by major clinical comorbidities.² Involvement of CNS in COVID-19 is uncommon but has been reported previously. LP can provide relevant diagnostic clues to define the diagnosis and before performing it, a conclusive neuroimaging should be acquired in order to rule out intracranial hypertensions related features.

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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