How to manage the ENG/EMG

The Covid-19
Changes

A dialogue between Belgium, Brasil, Italy and You
How and where

Covid-19 targets and mechanisms
Targets for Covid-19

Not long after the SARS-CoV-2 outbreak began, scientists discovered that the viral "spike" protein binds to a receptor on human cells known as angiotensin-converting enzyme 2 (ACE2). Another human protein, an enzyme called TMPRSS2, helps to activate the coronavirus spike protein, to allow for cell entry. The combined binding and activation allows the virus to get into host cell.

In the nasal passages, the researchers found that goblet secretory cells, which produce mucus, express RNAs for both of the proteins used by SARS-CoV-2 to infect cells.

In the lungs, the RNAs for these proteins have been mainly found in cells called type II pneumocytes. These cells line the alveoli (air sacs) of the lungs and are responsible for keeping them open.

In the intestine, the researchers found that cells called absorptive enterocytes, which are responsible for the absorption of some nutrients, express the RNAs for these two proteins more than any other intestinal cell type.

Date:April 22, 2020
Source:Massachusetts Institute of Technology
Mechanisms of Covid-19

1. Infection
   - SARS-CoV-2
   - ACE-1
   - ACE-2

2. Dysregulated Inflammation
   - AngII
   - Inflammatory Cytokines
   - DAMPs

3. Hypo-Inflammation
   - Endothelial Dysfunction
   - AngII
   - DAMPs

- Virus infects cell via ACE-2
- Initial local inflammation & endothelial activation
- ↓ AngII metabolism
- Disordered cytokine release
  - Pro-inflammatory cytokine and pro-apoptotic mediators
- ACE-1 shedding occurs
- Increased ACE-1 activity
- Rapid ↑ AngII, positive feedback loop inflammation and coagulation.
- Leukocyte infiltration augmented by AngII.
- ACE-1 activity falls
- ↓ AngII to sub-physiologic levels
  - Loss of AngII vasoconstrictive and auto-regulatory effects
  - Microvascular dysfunction
  - ↑ ACE-2 expression
  - If severe, vasodilatory shock
Covid-19 neurological syndromes

- Up to 35-40% of patients reported neurological symptoms.
- From mild and transitory to severe central stroke damage.
- Nerves, roots, spinal cord may be affected by an inflammatory disease related to Covid-19 infection.
- In some patients the neurological symptoms were the first signs of viral disease.
The new fear

Normal activity was subjected to safety procedures for diseases transmitted by blood (HIV, Hepatitis B and C).

Now even **simple interhuman contact may be harmful** for ALL the people present in a medical structure: health workers, patients, staff.

Is the test useful or harmful? Necessary or not? Is better to do it or to postpone it?
How do we feel?

The different types of patient have been classified, based on the results of the swab test, into:

- Covid + (positive)
- Covid-uncertain (suspected positivity, awaiting swab outcome)
- Covid - (negative)

But........... The reality is few swab tests, even less Ab blood tests

How we should consider an asymptomatic patient?????

As for HIV, HCV, HBV we must consider all patients and also ourselves potentially contagious

We are all afraid to bring the virus at home

Crosscontamination – potential medicolegal problem?

COVID – 19 WORLD
COVID impact
we restart but the problem is still there
PATIENTS X DEADS

MAY 14YH 2020

Fonte: Universidade Johns Hopkins (Baltimore, EUA), autoridades locais
Números atualizados pela última vez em 14 de maio de 2020 18:42 GMT
PATIENTS X DEADS

MAY 14YH 2020

Fonte: Universidade Johns Hopkins (Baltimore, EUA), autoridades locais
Números atualizados pela última vez em 14 de maio de 2020 18:42 GMT
PATIENTS X DEADS

MAY 14TH 2020

Fonte: Universidade Johns Hopkins (Baltimore, EUA), autoridades locais
Números atualizados pela última vez em 14 de maio de 2020 18:42 GMT
BRAZIL (better BraSil)
PATIENTS X DEADS

Fonte: Universidade Johns Hopkins (Baltimore, EUA), autoridades locais
Números atualizados pela última vez em 14 de maio de 2020 18:42 GMT
Patient screening

**Inpatients**: to examine who is hospitalised in COVID-19 + and non COVID-19 use the protections according to the guidelines given by the institutions or hospitals.

**Outpatients**: phone pre-screening through secretarial staff at least 24 hours before or electronic form to be filled in.

On the day of exam a questionnaire is handed out to the patient and any accompanying person.
HAVE you had COVID 19? YES □  NO □

If the answer is YES, is it cured (negative buffer?) YES □  NO □

Are you in quarantine? YES □  NO □

MAJOR SYMPTOMS at present or in the past 14 days
Fever> 37.5 ° YES □  NO □
Cough YES □  NO □
Breathing difficulties YES □  NO □
Ageusia, anosmia YES □  NO □
Conjunctivitis YES □  NO □
Diarrhea? YES □  NO □
Epidemiological screening

- EXPOSURE TO VERIFIED CASES COVID 19 (positive swab test) YES ☐ NO ☐
- EXPOSURE TO SUSPECTED CASES YES ☐ NO ☐
- CONTACTS WITH FAMILIES OF SUSPECTED CASES YES ☐ NO ☐
- COHABITANTS WITH FEVER OR INFLUENTIAL SYMPTOMS (no swab) YES ☐ NO ☐
- CONTACTS WITH FEVER OR INFLUENTIAL SYMPTOMS (no swab) YES ☐ NO ☐
- ATTENDANCE OF HEALTH ENVIRONMENTS WITH ASSESSED / SUSPECTED CASES YES ☐ NO ☐
- WORK YES ☐ NO ☐ ☐ SMART WORKING ☐ A IN CONTACT WITH OTHER SUBJECTS ☐ WITH PROTECTION DEVICES ☐ WITHOUT USING PROTECTION DEVICES
- In which place ______________________________ (eg type: office, public exercise, transport other)
- HAVE YOU TRAVELLED IN THE LAST 14 DAYS? YES ☐ NO ☐
Covid-19 screening computerized card

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Yes</th>
<th>No</th>
<th>Date of first symptom onset</th>
<th>Other symptoms</th>
<th>Contact with confirmed case</th>
<th>Date of contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnée</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Douleurs thoraciques</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhinorrhée</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Douleurs pharyngées</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toux sèche</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toux grasse</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhée sans cause apparente</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Céphalées</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myalgies</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fièvre</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausées</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vomissements</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ageusie</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anosmie</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syndrome confusionnel aigu</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conjonctivite</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engelures</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chute soudaine sans cause apparente</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggravation of chronic respiratory symptoms</td>
<td>O</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Un ou plusieurs items sont positifs : 

→ contactez le médecin responsable de la consultation qui décidera de maintenir, reporter ou annuler le rendez-vous

DéCISION DU MéDECIN

- Consultation maintenue
- Consultation maintenue en télémédecine
- Consultation annulée
- Consultation reportée

Conclusions
### Covid-19 Screening Computerized Card

<table>
<thead>
<tr>
<th>Symptom</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>dyspnea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chest pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pharyngeal pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rhinorrhea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry cough</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diarrhea without apparent cause</td>
<td></td>
<td></td>
</tr>
<tr>
<td>headache</td>
<td></td>
<td></td>
</tr>
<tr>
<td>myalgia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nausea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ageusia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>anosmia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>acute cutaneous syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conjunctivitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>frostbite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sudden fall without apparent cause</td>
<td></td>
<td></td>
</tr>
<tr>
<td>worsening of chronic respiratory symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>symptom onset</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Doctor's Decision**
- Consultation maintained
- Telemedicine consultation
- Consultation canceled
- Postponed consultation

If one or more items are positive, contact the doctor who will decide to maintain, postpone or cancel the appointment.

Date: 4/05/20
Waiting room and medical room

- Patients are allowed access if wearing a surgical mask and gloves (wear new gloves after hand disinfection only inside the medical office, shoe covers)
- Taking patient and accompanying person body temperature
- Triage questionnaire completed on the arrival
- Plexiglass shield for the secretarial desk
- **Number of people: interpersonal distance must be kept**
- Separated entry and exit whenever possible
- Only patients admitted
- Accompanying person (with mask and gloves) only if minors or seriously handicapped patients
- **2 workers in the lab (MD + TNP)**
PERSONAL PROTECTIONS
Exposure risk for healthcare personnel

<table>
<thead>
<tr>
<th>Epidemiologic risk factors</th>
<th>Exposure category</th>
<th>Recommended Monitoring for COVID-19 (until 14 days after last potential exposure)</th>
<th>Work Restrictions for Asymptomatic HCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged close contact with a patient with COVID-19 (beginning 48 hours before symptom onset) who was wearing a cloth face covering or facemask (i.e., source control)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCP PPE: None</td>
<td>Medium</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing a facemask or respirator</td>
<td>Medium</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing eye protection</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
<tr>
<td>HCP PPE: Not wearing gown or gloves</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
<tr>
<td>HCP PPE: Wearing all recommended PPE (except wearing a facemask instead of a respirator)</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
<tr>
<td>Prolonged close contact with a patient with COVID-19 (beginning 48 hours before symptom onset) who was not wearing a cloth face covering or facemask (i.e., no source control)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCP PPE: None</td>
<td>High</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing a facemask or respirator</td>
<td>High</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing eye protection</td>
<td>Medium</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing gown or gloves</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
<tr>
<td>HCP PPE: Wearing all recommended PPE (except wearing a facemask instead of a respirator)</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
</tbody>
</table>

ENG/EMG test requires close contact with the patient **who must wear** the mask
Wearing the correct mask

Based on this comparison, it is reasonable to consider China KN95, AS/NZ P2, Korea 1st Class, and Japan D5 FFRs as “equivalent” to US NIOSH N95 and European FFP2 respirators, for filtering non-oil-based particles such as those resulting from wildfires, PM 2.5 air pollution, volcanic eruptions, or bioaerosols (e.g. viruses). However, prior to selecting a respirator, users should consult their local respiratory protection regulations and requirements or check with their local public health authorities for selection guidance.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter performance – (must be ≥ 95% efficient)</td>
<td>≥ 95%</td>
<td>≥ 94%</td>
<td>≥ 95%</td>
<td>≥ 94%</td>
<td>≥ 94%</td>
<td>≥ 95%</td>
</tr>
<tr>
<td>Test agent</td>
<td>NaCl</td>
<td>NaCl and paraffin oil</td>
<td>NaCl</td>
<td>NaCl</td>
<td>NaCl and paraffin oil</td>
<td>NaCl</td>
</tr>
<tr>
<td>Flow rate</td>
<td>85 L/min</td>
<td>95 L/min</td>
<td>85 L/min</td>
<td>95 L/min</td>
<td>95 L/min</td>
<td>85 L/min</td>
</tr>
<tr>
<td>Total inward leakage (TIL) – tested on human subjects each performing exercises</td>
<td>N/A</td>
<td>≤ 8% leakage (arithmetic mean)</td>
<td>≤ 8% leakage (arithmetic mean)</td>
<td>≤ 8% leakage (individual and arithmetic mean)</td>
<td>≤ 8% leakage (arithmetic mean)</td>
<td>Inward Leakage measured and included in User Instructions</td>
</tr>
<tr>
<td>Inhalation resistance – max pressure drop</td>
<td>≤ 343 Pa</td>
<td>≤ 70 Pa (at 30 L/min) ≤ 240 Pa (at 95 L/min) ≤ 500 Pa (clogging)</td>
<td>≤ 350 Pa</td>
<td>≤ 70 Pa (at 30 L/min) ≤ 240 Pa (at 95 L/min)</td>
<td>≤ 70 Pa (at 30 L/min) ≤ 240 Pa (at 95 L/min)</td>
<td>≤ 70 Pa (w/v/valve) ≤ 50 Pa (no valve)</td>
</tr>
<tr>
<td>Exhalation resistance – max pressure drop</td>
<td>≤ 245 Pa</td>
<td>≤ 300 Pa</td>
<td>≤ 250 Pa</td>
<td>≤ 120 Pa</td>
<td>≤ 300 Pa</td>
<td>≤ 70 Pa (w/v/valve) ≤ 50 Pa (no valve)</td>
</tr>
<tr>
<td>Flow rate</td>
<td>85 L/min</td>
<td>Varied – see above</td>
<td>85 L/min</td>
<td>Varied – see above</td>
<td>Varied – see above</td>
<td>40 L/min</td>
</tr>
<tr>
<td>Exhalation valve leakage requirement</td>
<td>Leak rate ≤ 30 mL/min</td>
<td>N/A</td>
<td>Depressurization to 0 Pa ≥ 20 sec</td>
<td>Leak rate ≤ 30 mL/min</td>
<td>visual inspection after 300 L/min for 30 sec</td>
<td>Depressurization to 0 Pa ≥ 15 sec</td>
</tr>
<tr>
<td>Force applied</td>
<td>-245 Pa</td>
<td>N/A</td>
<td>-1180 Pa</td>
<td>-250 Pa</td>
<td>N/A</td>
<td>-1,470 Pa</td>
</tr>
<tr>
<td>CO₂ clearance requirement</td>
<td>N/A</td>
<td>≥ 1%</td>
<td>≤ 1%</td>
<td>≤ 1%</td>
<td>≤ 1%</td>
<td>≤ 1%</td>
</tr>
</tbody>
</table>

*Japan JMHLW-Notification 214 requires an Inward Leakage test rather than a TIL test.*
P100 and ffP3

GVS Eclipse P100 (USA)

Rating: 99.97% (minimum)

GVS Eclipse P3 (Europe)

Rating: 99.95% (minimum)
Personal protective equipment – Body protection

Wearing personal protective equipment may be useful for self-protection and to avoid cross-contamination between patients.

Double gloves (medium under, large over) are useful for dressing/undressing procedures.

Avoid touching your face while doing the test or undressing.

Face Protection

Goggles – convenient for ease of movement and providing space for glasses; easily mist up even if aerated

Face shield - must cover the whole face, providing less ease of movement; reduced fogging of the glasses
Table 1. Recommendations of rational and appropriate use of Personal Protective Equipment (PPE) in health personnel and patients during clinical neurophysiology studies. Adaptation of the WHO recommendations (World Health Organization, 2020c).

<table>
<thead>
<tr>
<th>Area</th>
<th>Staff or Patient</th>
<th>Activity</th>
<th>Personal Protection Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health Care Environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>In-hospital Environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient's Room</td>
<td>Healthcare Professionals including technicians.</td>
<td>Providing care direct to patients with COVID-19.</td>
<td>Medical mask&lt;br&gt;Apron or Gown&lt;br&gt;Gloves&lt;br&gt;Goggles&lt;br&gt;Full-face screen</td>
</tr>
<tr>
<td></td>
<td>Procedures in patients with COVID-19 generating aerosols</td>
<td></td>
<td>Mask N95 or FFP2 standard or similar. &lt;br&gt;Goggles &lt;br&gt;Goggles &lt;br&gt;Full-face screen. &lt;br&gt;Apron or Gown</td>
</tr>
<tr>
<td>Cleaners</td>
<td>Providing care direct to patients with COVID-19.</td>
<td></td>
<td>Medical mask&lt;br&gt;Apron or Gown&lt;br&gt;Hard work Gloves&lt;br&gt;Goggles&lt;br&gt;Full-face shield&lt;br&gt;Work covered shoes</td>
</tr>
<tr>
<td>Other areas for patient transit. (e.g. corridors.)</td>
<td>All the staff, including HP</td>
<td>Any activity that doesn't involve direct contact with COVID-19 patients</td>
<td>No PPE required.</td>
</tr>
</tbody>
</table>

Appropriate use

Personal Protective Equipment

PPE
Body parts

Any differences in performing the tests?
Lower limbs

- Distance from the face is maximal and the patients may wear face mask and gloves
- Surgical mask and face protections are recommended for the examiner
- Head cap, disposable gown and double gloves may be useful for the examiner
Upper limbs (not shoulders)

- The distance to the face is reduced and patients may wear face mask **but not gloves** *(careful cleaning/disinfection of hands)*
- Surgical mask and face protections are recommended
- Head cap, disposable gown and double gloves may be useful for the examiner.
Shoulder, chest, back

- Distance to the face is reduced and patients may wear face mask and gloves
- Surgical mask or fFP2/KN95 and face protections are recommended
- Head cap, disposable gown and double gloves may be recommended for the examiner
Cranial nerves

- Performed on the face and the patients cannot wear face mask, gloves are worn.
- FfP2/KN95 mask and face protections are necessary
- Head cap, disposable gown and double gloves are recommended for the examiner.
- The patient may have a cough reflex!
Perineal EMG

• Probable contamination of the perineal area
• Performed near the anatomic area, the patients must wear face mask and gloves.
• Surgical mask or ffP2/KN95 and face protections are recommended
• Head cap, gown and double gloves recommended the examiner
Botulinum toxin injections

• Same recommendations for ENG and EMG tests
• Depending on the part of the body that is injected
Safety behaviors

• While wearing PPE: avoid touching already worn PPE
• Remove gloves if torn or damaged
• Change the second pair of gloves between one patient and another
• Carry out hand hygiene before putting on new gloves
• When removing PPE, be careful to avoid any contact between the dirty components and the area of the face or skin that is not intact
• Decontaminate PPE as non-disposable goggles and face shields
Tricks for neck and hands

Self-made neck protection

Use of double gloves – reduced exposure to disinfectants

Neck protection ??
Guidance for clinical neurophysiology examination throughout the COVID-19 pandemic. Latin American chapter of the IFCN task force - COVID-19

Clinical Neurophysiology

23 April 2020

COVID-19 Personal Protective Equipment (PPE) for Healthcare Personnel

Preferred PPE – Use N95 or Higher Respirator

Acceptable Alternative PPE – Use Facemask

Face shield or goggles

N95 or higher respirator

When respirators are not available, use the best available alternative, like a facemask.

Facemask

N95 or higher respirators are preferred but facemasks are an acceptable alternative.

One pair of clean, non-sterile gloves

Isolation gown

One pair of clean, non-sterile gloves

Isolation gown
HOW TO PUT ON AND TAKE OFF
Personal Protective Equipment (PPE)

How to put on PPE (when all PPE items are needed)

Step 1
- Identify hazards & manage risk. Gather the necessary PPE.
- Plan where to put on & take off PPE.
- Do you have a buddy? Mirror?
- Do you know how you will deal with waste?

Step 2
- Put on a gown.

Step 3a OR Step 3b
- Put on face shield.
- Put on medical mask and eye protection (e.g., eye visor/goggles)

Note: If performing an aerosol-generating procedure (e.g., aspiration of respiratory tract, intubation, resuscitation, bronchoscopy, autopsy), a particulate respirator (e.g., US NIOSH-certified N95, EU FFP2, or equivalent respirator) should be used in combination with a face shield or an eye protection. Do user seal check if using a particulate respirator.

Step 4
- Put on gloves (over cuff).

How to take off PPE

Step 1
- Avoid contamination of self, others & the environment
- Remove the most heavily contaminated items first

Remove gloves & gown
- Peel off gown & gloves and roll inside, out
- Dispose gloves and gown safely

Step 2
- Perform hand hygiene

Step 3a
If wearing face shield:
- Remove face shield from behind
- Dispose of face shield safely

Step 3b
If wearing eye protection and mask:
- Remove goggles from behind
- Put goggles in a separate container for reprocessing
- Remove mask from behind and dispose of safely

Step 4
- Perform hand hygiene
AAEM instructions
PPE Guidance for All Patient Interactions During COVID-19

Patient With Positive or PUI COVID
• For healthcare worker
• N95 Mask
• Face Shield or protective goggles
• Gown
• Shoe covers
• Gloves
• Hair covering optional
• If N95 can’t be worn PAPR (powered air-purifying respirators) suit

For the patient – not in a waiting room with other patients, examined in an isolation room if possible
• Surgical mask if possible

Thoroughly clean all equipment, room, etc. after procedure and before seeing any other patient. Regarding EDX testing, see AANEM’s document Special Precautions While Performing EDX Testing for further information.
PPE Guidance for All Patient Interactions During COVID-19

**All Other Patients**
For healthcare worker
- Surgical Mask
- Face Shield or protective goggles (strongly recommended)
- Gloves

For the patient – follow social distancing rules for waiting patients (i.e. having patients wait in car until ready for procedure. No additional people enter the building with the patient unless the patient needs assistance)
Surgical mask if possible
Máscaras cirúrgicas fornecem apenas proteção de barreira contra grandes gotículas, não filtrando pequenas partículas presentes no ar (não se destinando a proteção dos profissionais de saúde). Entretanto, nas escassez de máscaras – N95, recomendamos que ao examinar sintomáticos respiratórios, os profissionais de saúde utilizem máscaras cirúrgicas, descartando as mesmas tão logo finde o atendimento.

O papel da máscara cirúrgica é basicamente para controlar o paciente sintomático respiratório, evitando a contaminação da área circulante quando o mesmo tosse ou espirra (deve ser oferecida máscara cirúrgica aos pacientes que se apresentam na recepção e apresentem sintomas respiratórios).

Nos casos em que o profissional for examinar pacientes em unidades de Terapia Intensiva, com confirmação ou suspeita de infecção pelo COVID-19, recomendamos a utilização de: máscaras - N95, Protetor Facial que cubra a região frontal e lateral da face (óculos de uso pessoal e lentes de contato, não são considerados métodos adequados de proteção), uso de aventais descartáveis e luvas.

As recomendações acima foram elaboradas com auxílio do Dr Jefferson Abrantes, CRM DF 17759, neurologista, neurofisiologista, intensivista titulado. Mestre e doutor em neurologia pela Universidade Federal do RJ.

Guidance for clinical neurophysiology examination throughout the COVID-19 pandemic. Latin American chapter of the IFCN task force - COVID-19

Daniel San-Juan, Christian Ramos Jiménez, Cecilia Ximénez Camilli, Luis Adrián de la Cruz Reyes, Enya Gabriela Aguirre Galindo, Gustavo Eduardo Ramos Burbano, Maria Magdalena Penela, Monica Beatriz Perassolo, Armando Tello Valdés, Jorge Gutierrez Godoy, Ana Lucila Moreira, Paulo Andre Teixeira Kimaid

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6.1. Recommendations for neurophysiology staff with risk factors for COVID-19

Pregnant women and patients over 60 years of age with comorbidities such as obesity, diabetes mellitus, systemic high blood pressure, cardiovascular disease, chronic lung disease or immunosuppression states have an increased risk of contracting the disease and dying (D. Wang et al., 2020; Yi et al., 2020). For this reason, CN staff with the above risk factors should avoid conducting CN studies as much as possible and take extreme precautions when there is no other option.
It is important to the CN technologist to **know the policies to contain COVID-19 infection**.

As a first instance, technical staff should have theoretical knowledge of the infectious agent (COVID-19). In this way, they will be aware of the infection mechanism of the virus and will be able to recognize the means or routes of contagion. The CN technologist should also follow the health institution's hygiene recommendations.
According to the U.S. CDC, sterilization is the process that destroys or eliminates all microscopic life forms and is performed in hospitals or clinics using physical or chemical methods, e.g. dry heat, ethylene oxide gas, steam under pressure, hydrogen peroxide plasma and liquid chemicals. Disinfection is the process that eliminates most or all microorganisms, except bacterial spores on inanimate objects, these are eliminated in health facilities by using chemical liquids or wet pasteurization. Cleaning is the removal of visible dirt (e.g. organic and inorganic material) from objects and surfaces and is usually done manually or mechanically using water with detergents or enzymatic products (Centers for Disease Control and Prevention, 2016).
In general, cleaning and disinfection measures should be implemented on any surface that had contact with the patient. Hospital grade cleaning agents are recommended (Table 2) and it is suggested that the bathrooms be cleaned at least twice a day and when needed. Dirty surfaces should first be cleaned with a detergent and then applied to the hospital grade disinfectant, in accordance with the manufacturer's recommendations for volume and contact time. After contact time has elapsed, the disinfectant is rinsed with clean water. SARS-CoV2 will be inactivated after 5 minutes of contact with household laundry disinfectants (World Health Organization, 2020d).
Which tools are preferred?
NCS – felters strong disinfection or use steel
Single use disposable adhesive electrodes
Measuring and marking instruments

One set for each patient may be useful to avoid losing time in disinfection
Maintenance and cleaning

Equipment Maintenance & Cleaning

- Perform hand hygiene frequently
- Remove all unnecessary and disposable items from machine
- Use antiseptic wipes to clean all surfaces before starting a study and between patients
- Disinfect EMG machine and electrodes per institutional guidelines
- Consider using disposable electrodes
- Consider clear plastic bag to cover EMG equipment
Table 2. Survey of medical grade disinfectants. Severe acute respiratory syndrome coronavirus 2 is sensible to all this medical grade disinfectants (Acosta-Gnass and Stempniak, 2008), considering that it is a RNA virus with an external lipid membrane.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Concentration</th>
<th>Level of Disinfection</th>
<th>B</th>
<th>VL</th>
<th>VH</th>
<th>M</th>
<th>H</th>
<th>E</th>
<th>Mechanism of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine</td>
<td>100 ppm</td>
<td>Intermediate/low</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>IE, DP, IAN</td>
</tr>
<tr>
<td>Iodine</td>
<td>30-50 ppm</td>
<td>Intermediate</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>RP</td>
</tr>
<tr>
<td>Hydrogen Peroxide</td>
<td>3-25%</td>
<td>Intermediate</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>ROH</td>
</tr>
<tr>
<td>Alcohols</td>
<td>60-95%</td>
<td>Intermediate</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>DP</td>
</tr>
<tr>
<td>Phenols</td>
<td>0.4-5%</td>
<td>Intermediate/low</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>IE</td>
</tr>
<tr>
<td>Quaternary Ammonias</td>
<td>0.4-1.6%</td>
<td>Low</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>IE, DP</td>
</tr>
<tr>
<td>Peracetic Acid</td>
<td>0.001-0.2%</td>
<td>Alto</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Oxidant</td>
</tr>
<tr>
<td>Chlorhexidine</td>
<td>0.05%</td>
<td>Low</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Cytoplasmic</td>
</tr>
<tr>
<td>Glutaraldehyde</td>
<td>2%</td>
<td>Chemical Sterilizing</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Alkylation of DNA, RNA</td>
</tr>
</tbody>
</table>

Electromyography

- The use of needle electrode is already considered a risky procedure
- Cleaning and disinfection of the cable
ENMG test in Covid-19 room

- A precaution, if possible, is to perform the EMG examination in a Covid-19 room and to power the equipment with an **Uninterruptible Power Supply (UPS)** to avoid that the power cable is necessary (usually touches the ground), and to wear high protection mask (ffP3 or N100) and full head/body protection if you works with a patient who creates aerosols (type NIV without helmet).
- if available, use dedicated equipment that is left in the intensive department.
- Careful cleaning and disinfection after use
Instrument cleaning and protection

Specific alcohol-based wipes are available for disinfection. A cling film (PVC) may be used to cover the amplifier, the keyboard, etc. in order to easily disinfect and not damage the machine and erase characters. The argument is debated by some colleagues who prefer one way or another.
Electronic devices

2. In outpatient or intrahospital specialized clinics, the procedures should be performed at that site.

Select and wear the appropriate PPE (Table 1) (American Clinical Neurophysiology Society, 2020b). For electronic devices such as cell phones, tablets, touch screens, remote controls, and keyboards, eliminate visible contamination if present.

1. Follow the manufacturer’s instructions for all cleaning and disinfection products.

2. If no manufacturer guidance is available, consider using alcohol-based wipes or sprays containing at least 70% alcohol to disinfect touchscreens. Dry surfaces thoroughly to prevent fluid build-up (Centers for Disease Control and Prevention, 2020b).

3. Consider using washable cases for electronic devices.
Before starting the diagnostic study, the CN technologist should:

1. Obtain the responsible physician’s approval for the CN study.

2. Obtain as much information as possible about the patient's condition including COVID-19 status.

3. Verify equipment, material and supplies necessary to perform the examination.

4. Determine the appropriate PPE level, see Table 1 and Figures 1-2.

5. Remove all disposable items that are not needed from the neurodiagnostic equipment.

6. Pick up hair, remove jewelry and makeup, watches and unnecessary personal items. If lenses are required, attach them to the face.

7. Clean all surfaces of the neuro-diagnostic equipment.

8. It is advisable to cover the equipment with a clear plastic liner, taking care not to block the computer fans. It is important also to cover the cables especially those that may have contact with the ground.

9. Wash hands with the appropriate technique (minimum 20 seconds).

10. Wear the appropriate PPE equipment (Table 1) Figure 2 (Liang, 2020).
1. Dispose the non-reusable CN (e.g. electrodes) material.

2. Plan the cleaning procedure for equipment and reusable material. See section 13.

3. Remove the PPE equipment (Figure 2) following the recommendations of its dispensing or reuse in the area where you conducted the study, it can be a separate room, but avoid walking in other areas.

4. Wash hands with appropriate technique.

5. Proceed to the disinfection process of diagnostic equipment and electrodes with a new appropriate PPE equipment. Table 1.

6. Remove the PPE. Figure 2.

7. Perform hand hygiene.
Laundry and medical waste

In general, the management of laundry and medical consumable waste should also be performed in accordance with hospital or clinic routine procedures (Raymond Y.W. Chinn, MD, HICPAC Advisor, Sharp Memorial Hospital, San Diego, California) (Centers for Disease Control and Prevention, 2020d).
Air cleaning/disinfection

The best systems are those with multi-factorial filtering and sterilization and in particular those with the following composition: HEPA filters of level H13-H14 capable of retaining with efficiency of 99.97% particles (therefore also viral) of size equal to 300nm, associated with activated carbon filters and UVC lamps without external dispersion with powers equal to or greater than 1200uw / cm2 and frequencies of 185nm - 254nm and 280nm possibly all associated using multiple emitters.

"There is no evidence that ozone performs a sterilizing function against the new coronavirus and consequently protects against contracting the infection." Italian Ministry of Health 8 May 2020
Questions

• Rescheduling the exams if a patient is not in the right condition
• **Impact on the examination length – 15-30 minutes more**
• Impact on the daily number of patients
• EMG/ENG sessions dedicated to a specific body district?
• Ease while doing tests wearing PPE
• **Increase in special waste**
• Disinfection and recycling of PPE?
• **Costs will increase with the use of disposable electrodes and PPE ( +/- 15-20 euros each patient)**
• Long-term exposure to disinfectants: side effects?
• **Theory vs. reality: all we showed you is possible or necessary ?**
Thank you for your attention

Special thanks to all the people who gave us precious advices and shared their experiences:

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A special thought goes to my former colleagues from the IRCCS C. Mondino Pavia

In memoriam
Prof. Arrigo Moglia
20/01/1947 – 15/04/2020

Italian health workers Covid-19 victims
162 doctors, 40 paramedics