Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Gynecology Obstetrics and Human Reproduction 49 (2020) 101859

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Technical Note

Technics to put on and remove personal protective equipment before surgical or obstetrical procedure in suspected or infected COVID-19 patients (with video)

Erdogan Nohuz[a], Anthony Atallah[a], Emanuele Cerruto[a], Manon Curtis[a], Oriane Bernigaud[a], Dominique Chassard[b], Pascal Fascia[c], Lionel Bouvet[b], Gautier Chene[a,d,*]

[a] Department of Gynecology and Obstetrics, Hôpital Femme Mère Enfant, HFME, 59 boulevard Pinel, Hospices civils de Lyon, 69000 Lyon, France
[b] Department of Anesthesy, Hôpital Femme Mère Enfant, HFME, 59 boulevard Pinel, Hospices civils de Lyon, 69000 Lyon, France
[c] CPIAS Auvergne Rhône Alpes (Center for Prévention of Healthcare Associated Infections), Hôpital Henry Gabrielle, Hospices Civils de Lyon, 20 route de Vourles, 69230 Saint Genis Laval, France
[d] Université Claude Bernard Lyon 1, EMR 3738, 69000 Lyon, France

ARTICLE INFO

Article history:
Received 8 May 2020
Received in revised form 3 July 2020
Accepted 4 July 2020
Available online 8 July 2020

Keywords:
Surgical clothes
Personal protective equipment
Coronavirus
Covid-19

ABSTRACT

Coronavirus pandemic is widely changing our professional daily practice and preventive measures must be taken and taught. Before any planned gynaecological or obstetric surgery, specific technics to put on and safely remove personal protective equipment should be implemented in order to avoid any contamination for both patients and healthcare workers.

1. Introduction

Coronavirus pandemic has created a new age of uncertainty and concerns for which it becomes necessary to consider specific preventive measures. It has effects on all of our professional daily practice [1–4]. Gynaecological surgery and obstetrics are obviously affected by these new procedures [3,5].

SARS- CoV-2 or Covid-19 is a virus with a strong pulmonary tropism mainly transmitted through respiratory droplets (from coughs, sneeze or other body fluids) and conjunctival (ocular) contact. The transmission risk from human to human is very high. The incubation period in which the patients remain asymptomatic but potentially contagious is between 1–14 days. Nasopharyngeal samples (PCR technique) do not formally exclude viral infection (about 30 % of false negative) [6]. Even though some French teams regularly make a nasopharyngeal swab and/or chest scanner before a scheduled surgery, at the moment there is no current consensus and diagnostic method which may completely exclude viral transport [7]. It is now necessary to consider that every patient and every healthcare professional can potentially contaminate each other. Therefore, enhanced protective measures should be applied for both patients and heathcare professionals.

In the light of previous studies about other infectious diseases (Ebola epidemic) and with current description by the american CDC (Centers for Disease Control and Prevention) [8,9], we propose to describe the dressing and undressing procedures before and after a gynaecological or obstetric surgery. These precautions should be applied in the same way as a situation similar to emerging biological risks.

2. Preparation before the surgery

A team training concerning the procedures of clothing and undressing is necessary to avoid any errors and contamination risk. It is essential to make an accurate preparation of the equipments. The equipments allowed in the operating room must be limited to those who are strictly necessary and the use of single use devices are preferred in order to facilitate the sterilisation procedures. The surgical equipment list must be validated by nurses and surgeons

* Corresponding author at: Department of Gynecology, Hôpital Femme Mère Enfant, 59 boulevard Pinel, CHU de LYON, 69000 Lyon, France.
E-mail address: chenegautier@yahoo.fr (G. Chene).

http://dx.doi.org/10.1016/j.jogoh.2020.101859
2468-7847/

or obstetricians to limit bustles. In fact, the operating door must remain closed from the beginning to the end of the surgical procedure in order to avoid other clothing and undressing events.

The patient must be brought to the operating room with a single use surgical cap that must hidden the hair and a surgical mask that must be kept in that position if the intervention takes place under spinal or local anesthesia and until the beginning of pre-oxygenation prior to the induction of general anesthesia

The number of participants must be limited to the minimal members needed for the correct performance of the intervention, without any change of workers during the procedure. Students are not allowed to participate.

3. Personal protective equipment (PPE) dressing

Every worker in an operating room must use all the personal protective equipment (PPE) such as:

- a surgical mask or in case of confimed infected patient a FFP2 type (European classification) or N95 type (American classification) which covers nose and mouth. The main difference between surgical masks and FFP2/N95 types is the level of protection from inhaling smaller aiborne particles.The FFP2/N95 types can filter out between 94–95% of airborne particles. In case of laparoscopic procedure, there is a potential risk of contamination due to aerosolization of surgical smoke, the FFP2/N95 types are therefore needed. Press and bend the metal stick that goes on the nasal bridge. Once applied, make the fit check test: it is a airtightness test consisting in an inspiration followed by a deep exhalation that has the effect of inflating the mask. The mask should cover from the nose to the chin. Note that the presence of beard in men could limitate an optimal adherence.
- Headgear: use a surgical cap to guarantee an adequate cover of head, forehead, neck and hair.
- Double pair of gloves well tight in order to cover also the sleeves (make sure that the sleeve reach the level of the hand wrinkles to avoid a skin exposure of the wrist).
- Eye protection (with protective goggles): should be mandatory in every situation that exposes to the projection of biological liquids and in presence of aerosol (laparoscopy in particular).
- Waterproof sterile gown. Once you wear this, it is attached to the neck and waist. In case of procedures with a high risk of spots of biological liquids, we use a plastic apron that we wear before wearing the gown (in order to preserve its sterile character). This makes it possible to strengthen the tightness of the tunic when the risk of exposure to biological fluids such as blood is high (e.g. in case of caesarean section). Then we proceed to the antiseptic friction of the hands.
- Surgical shoes without holes.

All the different clothing steps are described from Figs. 1–3 and in the video.

Note that the surgical gown and the double gloves are not essential for the equipe that doesn't operate: professional wearings covered by disposable over-blouse with waterproof cuff and sleeves and a plastic apron are enough.

The use of hydroalcoholic solutions should be as extensive as possible. Desinfection by friction of the hands should concern the palm, the back, the edges, the fingertips, the circumference of the thumbs without omitting the wrists; in order to optimize the

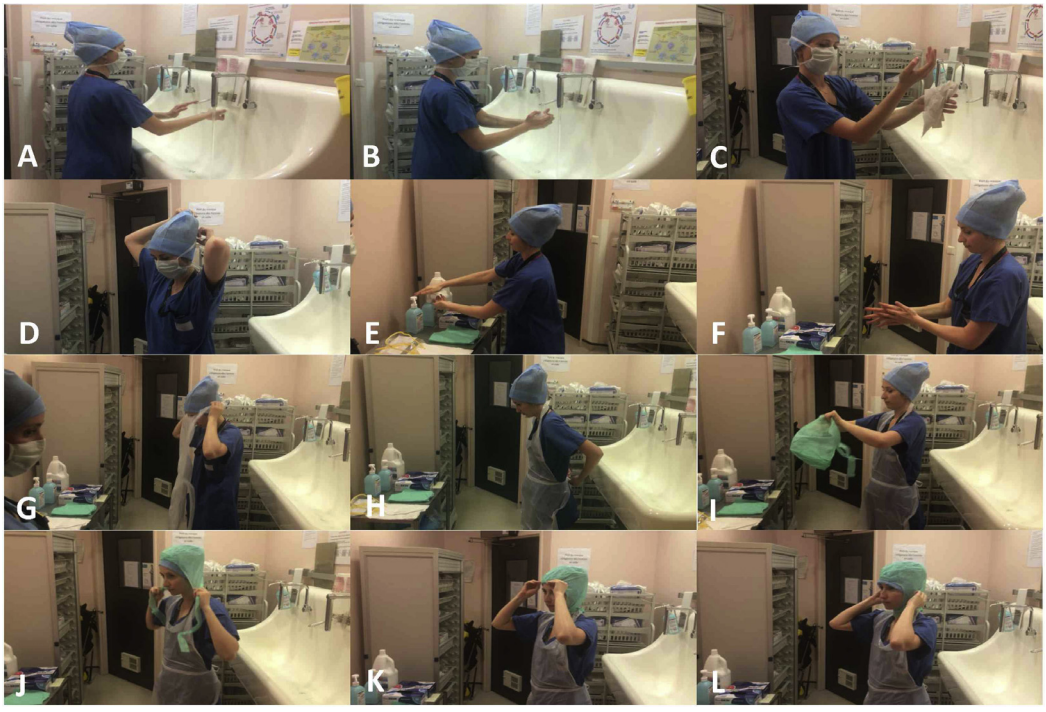

Fig. 1. Personal protective equipment dressing steps (1).
A, B and C: Hand washing with antiseptic soap and single use surgical brush, then towel-drying (in case of first disinfection)
D: Surgical mask removing
E and F: Friction of the hands with a hydroalcoholic solution
G and H: Putting on a non-sterile apron
I, J, K and L: the correct way to wear a headgear with a high covering and adjusting power

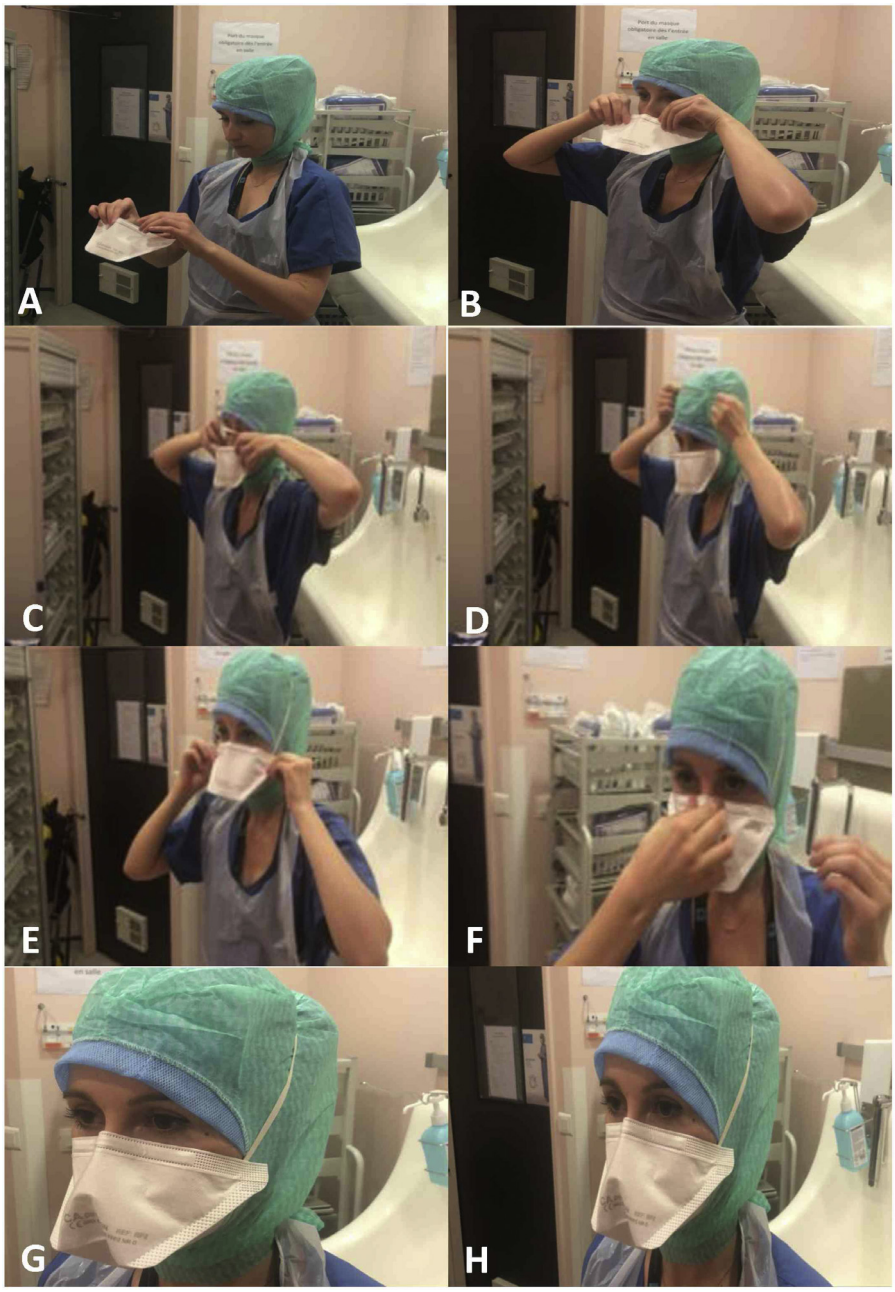

Fig. 2. Personal protective equipment dressing steps (2): correct way to wear the FFP2 mask.
A: The metal bar of the mask is pinched
B, C, D and E: The mask is positioned to cover the entire nose and chin.
F: The metal bar is pinched again to perfectly fit the nasal bridge.
G and H: Mask tightness test (fit check)

application of the hydroalcoholic solution, the right hand is positioned on the back of the left hand, the fingers interwined and vice versa [8]. It is also necessary to perform regular desinfection of the work environment with an appropriate cleaning solution.

Since ventilation prior to tracheal intubation produces aerosolized particles which can promote viral transmission, caution is needed to make sure that the surgical team is not present in the surgery room. This is an important point to consider. In fact, anesthetic induction and intubation should be performed in a closed room, only with the staff needed. The operating room should, if possible, be depressurized to limit the spread of the virus outside the operating room. If the operating room is pressurised, the door should not be opened within 5–10 min of the anaesthesia procedure. In addition, since the Covid-19 cloud may persist for longer periods of time, opening the operating room window, if present, may provide air renewal before admission of the surgical team. Local and locoregional anaesthesia techniques should therefore be preferred in order to limit the use of general anaesthesia as much as possible. Specific procedures for patient ventilation, intubation and extubation have been described by the French Society of Anesthesia & Intensive Care Medecine [9].

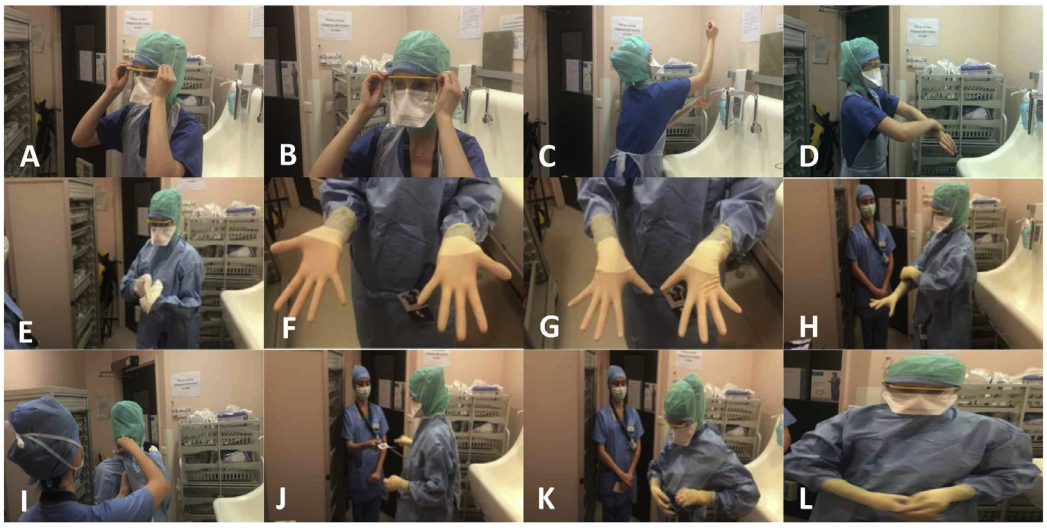

Fig. 3. Personal protective equipment dressing stages (3).
A and B: Wearing goggles
C and D: New hand friction using a hydroalcoholic solution
E, F, G and H: Double glove
I, J, K and L: Wearing sterile surgical gown

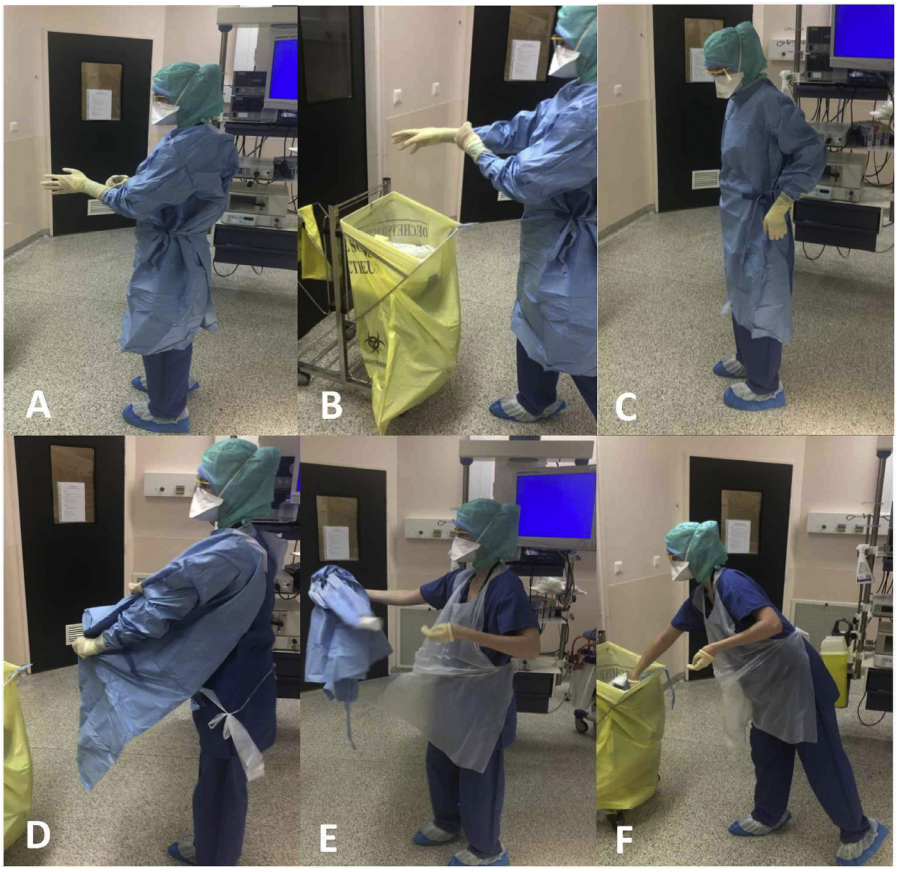

Fig. 4. Personal protective equipment undressing steps (1).
- Stages to be done indoor
A and B: Removal of the first pair of gloves
C: Tunic side belt untied
D: The surgical gown is grabbed on an area that is not dirty, then pulled forward.
E and F: The surgical gown is rolled up in a ball and then placed in a specific trash container.

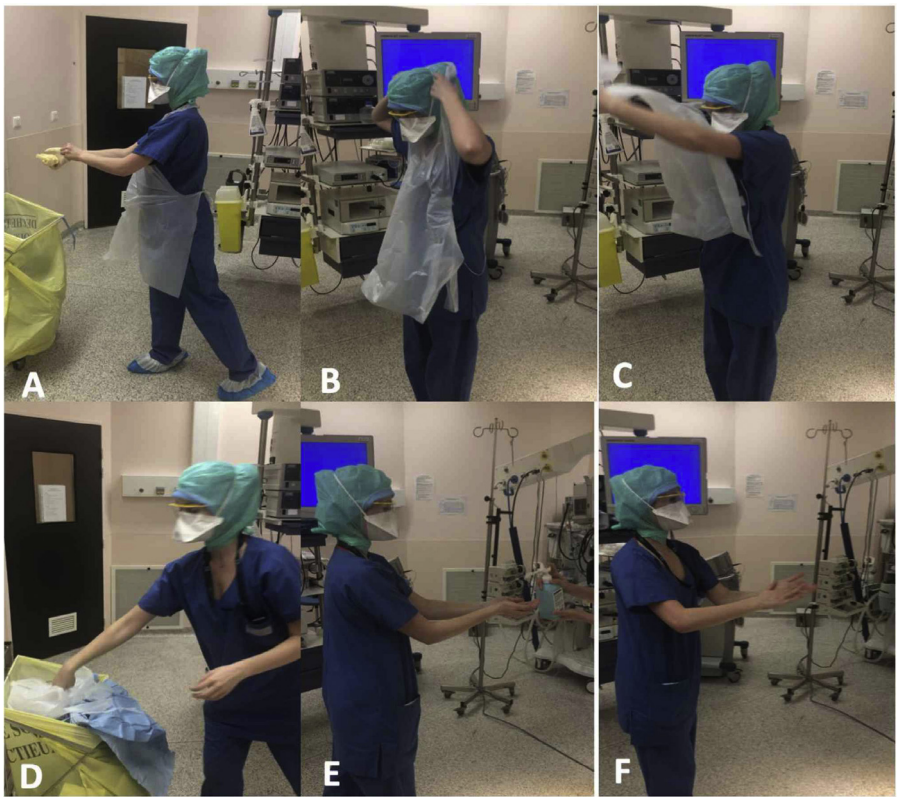

Fig. 5. Personal protective equipment undressing steps (2).
-Stages carried out indoors
A: Removing the second pair of gloves
B, C and D: Apron removal
E and F: Friction of the hands with a hydroalcoholic solution

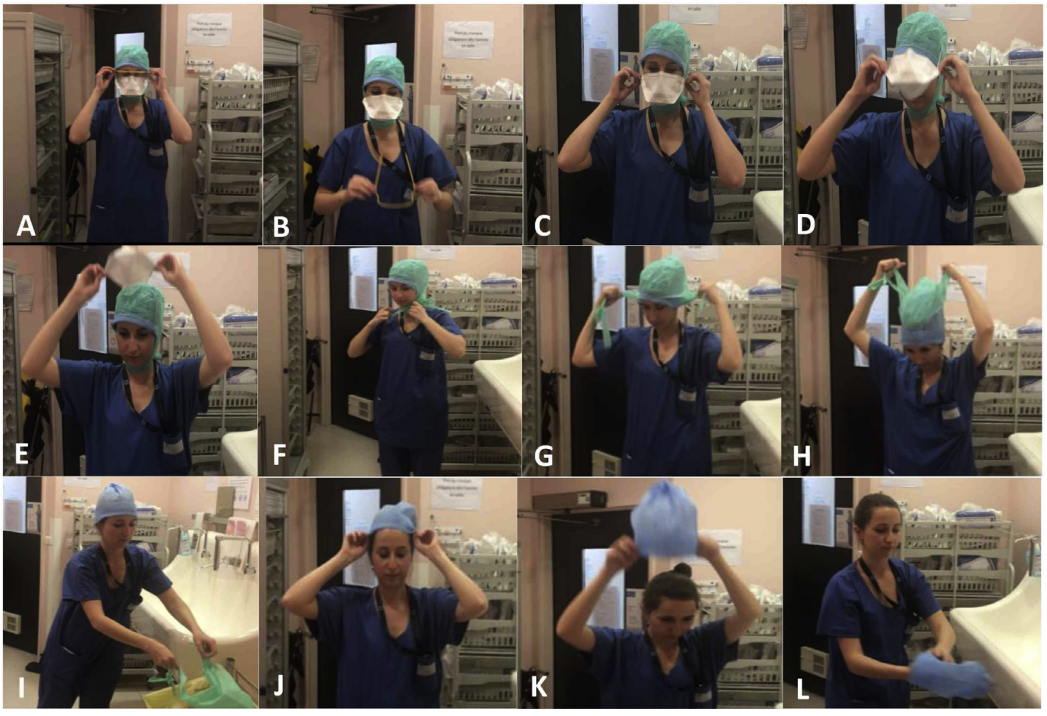

Fig. 6. Personal protective equipment undressing steps (3).
-Stages performed outside the room
A and B: Glasses removal
C, D and E: Mask removal
F to L: Headgear removal

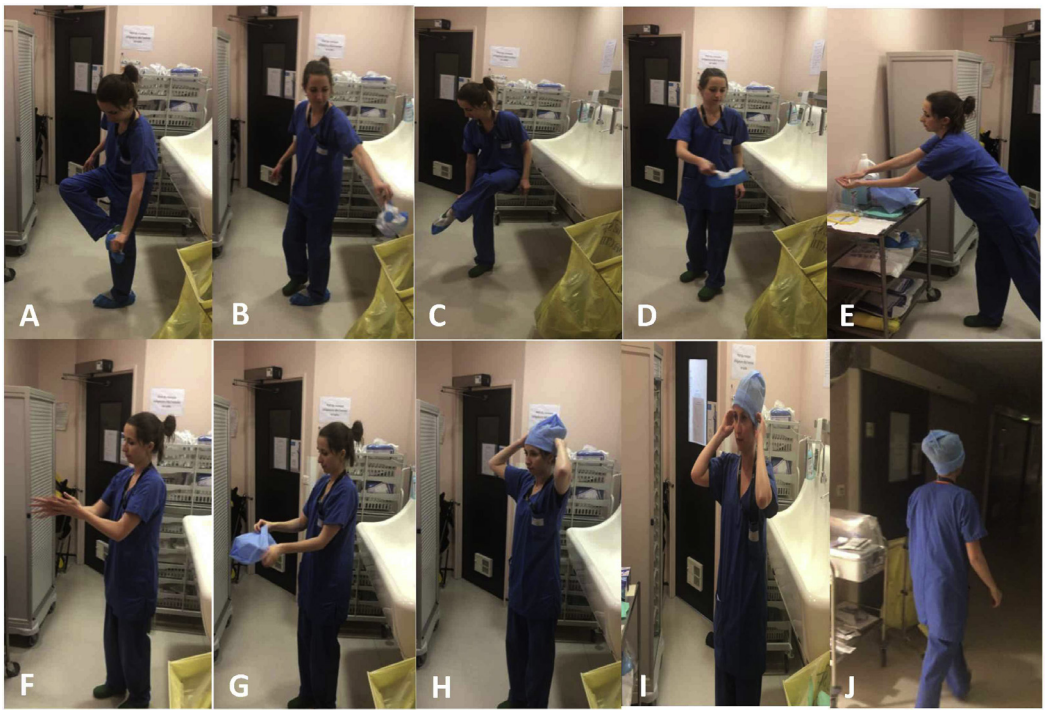

Fig. 7. Personal protective equipment undressing steps (4).
-Stages performed outside the room
A, B, C and D: Removal of shoe covers
E and F: Friction of the hands with a hydroalcoholic solution
G, H, I and J: Wearing a new headgear

4. Personal protective equipment undressing

Since the virus can survive for several hours on inert surfaces, the undress phase is a crucial point because of the risk of self-contamination. Indeed, the risk of contamination of the caregivers is at its peak during undressing at the end of the surgical or anesthetic procedure. This final step should therefore be done with the assistance of a third party (See the video).

The first step takes place in the operating room. After removing the first pair of gloves, untie the surgical gown belt. The surgical gown is then pulled forward, if possible rolled up on itself to obtain a compact ball and deposit it in a specific waste container; remove the second pair of gloves and protective apron. Rub immediately the hands with hydroalcoholic solution. Undressing continues outside the operating room. The glasses, the mask (grab simultaneously the two elastic bands) and the scrub cap must be removed in the room dedicated to the hand washing and thrown into the waste container (note that if the goggles are reusable, they will be placed in a disinfectant container provided for this purpose). Avoid hand contact with hair and face. Apply again hydroalcoholic solution and put a new scrub cap (Figs. 4–7). Changing the basic professional scrubs after a shower (if possible in the surgery changing rooms) may be logically recommended.

5. Disposal and waste removal

The risk of exposure of all the surfaces of the operating room (walls, ceiling, furniture, etc.) to viral particles must be taken into account. The disposal of contaminated waste or considered potentially contaminated must be carried out in accordance with the requirements of infection control committees (CLIN and Hygiene) and infectiologists.

6. Conclusion

We are all living this exceptional situation wich generates a lot of questions. Should we always test for COVID infection a patient before a planned surgical operation? If yes, how? and when? Should we consider the possibility to monitor patients for more than two weeks by calling them by phone and if an infection is detected, undergo a screening of all the healthcare workers who have operated the patient? What about the screening for surgeons? Should we consider at least a regular temperature measurement?

All these questions remain open . . .

Our professional procedures will have a long lasting impact and must change in order to overcome this crisis. While waiting for the Covid-19 to reveal its secrets, it is more important than ever to take into consideration and anchor in our daily practice these preventive measures. Dressing and undressing technics should be applied according to specific protocol and they should be taught to improve the safety of both caregivers as well as patients.

The last review updated on April 2020 by the Cochrane database [10] about personal protective equipment (PPE) related to Coronavirus infection found low- to very low-certainty evidence: covering more of the body would be associated on one hand with better protection but on the other hand a higher risk of self-contamnation (increased difficulty to remove PPE). The authors stated the importance of training, specific protocols, simulation exercices and new studies.

Declaration of Competing Interest

The authors declare that they have no conflict of interests.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jogoh.2020.101859.

References

[1] Peyronnet V, Sibiude J, Deruelle P, Huissoud C, Lescure X, Lucet JC, et al. SARS-CoV-2 infection during pregnancy. Information and proposal of management care. Gynecol Obstet Fertil Senol 2020;48:436–43.
[2] Akladios C, Azais H, Ballester M, Bendifallah S, Bolze PA, Bourdel N, et al. Recommendations for the surgical management of gynecological cancers during the COVID-19 pandemic - FRANCOGYN group for the CNGOF. J Gynecol Obstet Hum Reprod 2020;(April):101729.
[3] Nohuz E, Dubernard G, Lamblin G, Lebail-Carval K, Chabert P, Chene G. Gynecological surgery during the COVID-19 pandemic : take home messages. Gynecol Obstet Fertil Senol 2020 S2468-7189(20)30162-30168.
[4] European Society for Gynaecological Endoscopy. European Society ESGE Recommendations on Gynaecological Laparoscopic Surgery during Covid-19 Outbreak.https://esge.org/wpcontent/uploads/2020/03/Covid19StatementESGE.pdf.
[5] Chene G, Cerruto E, Nohuz E. The comeback of vaginal surgery during and after the COVID-19 pandemic: a new paradigm. Int Urogynecol J 2020 In press.
[6] Centers for disease control and prevention. Asymptomatic and presymptomatic SARS-CoV-2 infections in residents of a long-term care SkilledNursingFacilityKingCounty. 2020. . Washington,March https://www.cdc.gov/mmwr/volumes/69/wr/mm6913e1.htm.
[7] Greenland JR, Michelow MD, Wang L, London MJ. COVID-19 infection: implications for perioperative and critical care physicians. Anesthesiology 2020, doi:http://dx.doi.org/10.1097/ALN.0000000000003303.
[8] Ortega R, Bhadelia N, Obanor O, Cyr K, Yu P, McMahon M, et al. Putting on and removing personal protective equipment. N Eng J Med 2015;372:e16.
[9] How to remove personal protective equipment (CDC Guide 1). www.youtube.com.
[10] Verbeek JH, Rajamaki B, Ijaz S, Tikka C, Ruotsalainen JH, Edmond MB, et al. Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff. Cochrane Database Syst Rev 2019;7(7):CD011621.