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## Management of obstetrics and gynaecological patients with COVID-19

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### ABSTRACT

The widespread SARS-CoV-2 implies the application of procedures aimed to detect, isolate, and appropriately manage affected patients in the setting of obstetrics and gynaecologic emergency room and in inpatient setting, such as during labour, delivery, and postpartum. Here we report specific recommendations for the management of suspected and confirmed gynaecologic and obstetrics patients with COVID-19. The checklist developed by the Società Italiana di Malattie Infettive e Tropicali (SIMIT-2, available in English, Italian, Chinese) represents the first step to classify patients who need to be managed following the SIMIT-1 flowchart, applying all the appropriate infection control procedures. In this scenario, the management of pregnant women needs to follow the same procedures as the general population. Nevertheless, as for other potentially severe respiratory infections, pregnant women could be more vulnerable. In this regard, the maternal and foetal interests can be conflicting, such as the choice of the time and mode of delivery or the use of steroids for foetal maturation. Moreover, available evidence suggests a maternal-foetal transmission via contact with respiratory secretions and seems to exclude in utero transmission. Therefore, the appropriate management of breastfeeding is unclear, and the temporary separation of the infant from the mother could be an option. Finally, in general, delivery represents a moment of a high risk of infection for healthcare providers, and specific behaviours are mandatory.

### SOMMARIO

L'ampia diffusione del SARS-CoV-2 rende mandatorie l'applicazione di procedure volte a rilevare, isolare e gestire i pazienti affetti, sia nel pronto soccorso ostetrico-ginecologico sia in regime di degenza, come durante il travaglio, il parto e il postpartum. Per tale ragione, qui riportiamo raccomandazioni per la gestione in ostetricia e ginecologia di casi sospetti o confermati di COVID-19. La checklist sviluppata dalla Società Italiana di Malattie Infettive e Tropicali (SIMIT-2, disponibile in inglese, italiano, cinese) rappresenta il primo passo per classificare i pazienti che devono essere gestiti seguendo lo schema SIMIT-1 e applicando tutte le procedure necessarie per il controllo delle infezioni. In questo scenario, la gestione della donna in gravidanza deve seguire le stesse procedure della popolazione generale. Tuttavia, come per altre infezioni respiratorie potenzialmente gravi, le donne in gravidanza potrebbero essere più vulnerabili. Di conseguenza, gli interessi materni e fetali possono contrastare, come la scelta del momento e della modalità del parto o l'uso degli steroidi per profilassi della prematurità fetale. Inoltre, i dati disponibili sembrano escludere la trasmissione intrauterina del SARS-CoV-2 suggerendo invece la possibilità di un'infezione post-partum. Pertanto, la gestione appropriata dell'allattamento al seno è incerta, e la separazione temporanea del bambino dalla madre potrebbe essere necessaria. Infine, in generale, essendo il parto un momento ad elevato rischio di infezione per gli operatori sanitari, comportamenti specifici sono obbligatori.

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## INTRODUCTION

In December 2019, a novel coronavirus was identified as the cause of some pneumonia cases in Wuhan, a city in the Hubei Province of China (1). In the following weeks, the infection rapidly spread across China and other countries around the world.(2) On February 12th, the World Health Organization (WHO) designated the disease as COVID-19 (Coronavirus Disease 2019) (3).

Coronaviruses are an important cause of the common cold, probably second only to rhinoviruses in frequency (4). Nevertheless, in 2002 and 2012 two different coronaviruses causing severe respiratory illness in humans emerged (SARS-CoV and MERS-CoV), and this new recently isolated virus has 79% nucleotide identity to SARS-CoV and about 50% to MERS-CoV.(4) The genomic sequence of the new virus has been early identified with laboratory confirmation achieved by the Chinese Centre for Disease Prevention and Control (CDC) before January 23rd. Based on the phylogenetic similarity with SARS-CoV, the Coronavirus Study Group of the International Committee on Taxonomy of Viruses proposed the name Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) to designate the 2019-nCoV virus (5).

Bats seem to be the natural reservoir of both SARS-CoV and MERS-CoV, and the phylogenetic analysis shows consistently data with a bat reservoir for also the SARS-CoV-2. Noteworthy, it seems that another animal played the role of intermediate host between bats and humans (4). However, human-to-human transmission has been confirmed in China (6) and is thought to occur mainly via respiratory droplets (7), with a preliminary estimate of the median incubation period of 5-6 days (ranging from 0-14 days) (8). Preliminary shedding studies have shown that the transmission can occur during the early phase of the disease in asymptomatic patients, contributing to the overall diffusion (2,9). This impacts dramatically on the effectiveness of screening of suspected cases and prevention measures.

Different studies found that clinical characteristics of COVID-19 mimic those of SARS, although there are some clinical aspects that differentiate COVID-19 from other respiratory infections, such as SARS, MERS, and seasonal flue. Clinical

symptoms at presentation are not specific and the disease usually presents with respiratory symptoms such as fever, cough, and dyspnea (2,9). Pneumonia seems to be the most frequent serious manifestation of infection, and it presents with bilateral infiltrates on chest imaging (1). From a Chinese report of 44,500 confirmed cases, 81% of them were mild, 14% were severe, and 5% critical (11). The WHO on February 19th gave some data on the case fatality rate (CFR). Although the CFR for COVID-19 has been reported significantly lower than for SARS and MERS, it was estimated ranging between the 1.4% and 2.1% versus the 9.6% and 40% for SARS and MERS, respectively (10). Within China, the confirmed CFR, as reported by the Chinese Centre for Disease Control and Prevention, is 2.3%, with a risk of serious illness that rises with age and with the presence of comorbidities (1). In the same WHO report published on February 19th, data based on the estimated number of total infections calculated through modelling suggest an overall Infection Fatality Rate (IFR) ranging from 0.3% to 1% (12). Although antiviral agents are under evaluation for efficacy in COVID-19 such as remdesivir and lopinavir/ritonavir, the clinical impact is still unknown and further studies are needed for verification (13,14). Conversely, recent evidence suggests a possible application of chloroquine and hydroxychloroquine as a molecule able to reduce the exacerbation of pneumonia, duration of symptoms, and delay of viral clearance, with limited severe side effects, although further evidence is required (15).

Regardless of adopted preventive measures, the number of cases is growing globally. On March 8th the total confirmed cases were 105,586, with 80,859 cases confirmed in China and 24,727 cases confirmed outside China and a total of 101 countries that have now to face this new virus. On March 11th, the WHO made the assessment that COVID-19 can be characterized as a pandemic (8).

In Italy, the first two cases were isolated at the end of January, and on March 8th, 5883 cases with 234 deaths have been reported. Noteworthy, reported numbers are likely underestimates since milder cases are less likely to be reported and tested to identify the SARS-CoV-2 by polymerase chain reaction performed on specimens collected from the upper respiratory airways

(nasopharyngeal and oropharyngeal swab).

A review has been published recently giving numbers on R0 for COVID-19. It seems that the speed of the spread is much faster than that reported for SARS (16). So, even if the CFR for COVID-19 is far lower than that for SARS the high transmissibility could eventually results in more severe cases and deaths (17).

In this scenario of a widespread infection, only the application of public health interventions, such as early case isolation, some forms of mobility restrictions, social distancing, and behavioural changes at the population level can be effective in controlling the spread. Additionally, there is emerging evidence that nosocomial transmission plays a major role in transmission, accounting for infection of 29% of affected healthcare providers (HCP) and 12% of hospitalized patients.(18) In this regard, obstetrics and gynaecologic departments have to cope with a consistent flow of patients presenting every day at the Accident and Emergency (A&E) unit and in the delivery room. The presence of a procedure with the goal of prompt detection and effective triage and isolation of potentially infectious patients is essential to prevent exposure among patients, HCP and visitors. Moreover, obstetricians and gynaecologists have to consider how to manage pregnant women and infants in the case of suspected infection, particularly in the delivery room and during breastfeeding. On that basis, the presence of a multidisciplinary team responsible for implementing procedures to face this new situation is of paramount importance as well as the development of specific protocols and recommendations, such as those here reported that has been accepted for the management of suspected and confirmed COVID-19 cases at our institutions.

## MATERIALS AND METHODS

A thorough consultation of medical literature and of public health authorities and scientific societies guidance documents was performed. A multidisciplinary team composed of the heads of Obstetrics and Gynaecologic, Paediatrics, Infectious Diseases, Intensive Care Unit, and Public Health Departments discussed and developed the recommendations.

## RESULTS

Here we report the procedures and recommendations collegially discussed and approved for the management of women presenting to an obstetric triage unit or admitted to maternity ward.

### *General approach (Figure 1):*

1. Any woman visiting the A&E department must be screened for the presence of symptoms and epidemiologic risk factors with the checklist developed by the Società Italiana di Malattie Infettive e Tropicali (SIMIT-2) (available in English, Italian, Chinese at (<http://www.simit.org/IT/index.xhtml>)).
2. The Flowchart reported in SIMIT-1 card must be applied to each patient (<http://www.simit.org/IT/index.xhtml>).
3. Early recognition of COVID-19 suspect cases at the triage entrance is vital to immediately implement infection control procedures. This is particularly true for women presenting with an obstetric urgency-emergency (19).
4. Any case has to be classified in one of three main groups in order to identify suspect cases.

**Group 1:** Asymptomatic patient AND epidemiologic risk factors.

Epidemiologic risk factors are defined as at least one of the following during the 14 days prior to symptom onset:

- History of travel to or residence in China during the 14 days prior to symptom onset.
- History of travel or frequentation of a "red zone" (high prevalence setting according to national indications).
- Close contact with a confirmed or probable case of SARS-CoV-2 infection.
- Worked in or attended a health care facility where patients with confirmed or probable SARS-CoV-2 acute respiratory disease patients were being treated.

These women have no indications for admission, and there is no indication to perform a

nasopharyngeal swab to asymptomatic patients. Clinicians must stress the importance of:

- Checking body temperature every day and paying attention to the possible onset of symptoms. In the case of symptoms, patients must contact the Health Services to ask for a consultation and to receive specific instructions. A specific phone contact must be provided.
- Notifying the case sending an email to the Hygiene and Public Health Service.

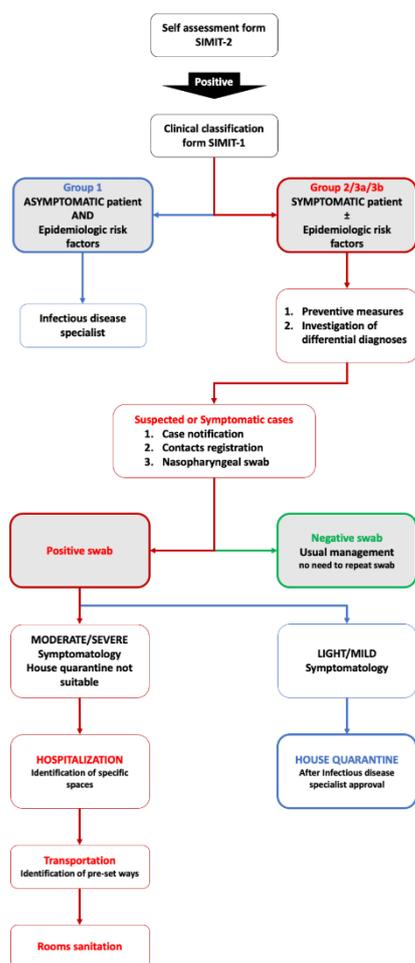


Figure 1. Flow chart for the general management of a patient referring to the obstetrics and gynaecologic department.

**Group 2:** Symptomatic patient AND epidemiologic risk factors.

These women represent suspect cases. Patient with a severe acute respiratory infection

(fever of any degree, cough, and dyspnoea) AND with no other aetiology that fully explains the clinical presentation AND at least one of the following during the 14 days prior to symptom onset:

- History of travel to or residence in China during the 14 days prior to symptom onset.
- History of travel or frequentation of a “red zone” (high prevalence setting according to national indications).
- Close contact with a confirmed or probable case of SARS-CoV-2 infection.
- Worked in or attended a health care facility where patients with confirmed or probable SARS-CoV-2 acute respiratory disease patients were being treated.

Definition of close contact includes a person involved in any of the following situations that must have taken place 14 days before or after the beginning of symptoms in the confirmed COVID-19 case:

- HCP or people providing direct care for SARS-CoV-2 patients who have NOT USED personal protective equipment (PPE) and laboratory personnel who has NOT USED personal protective equipment during specimen handling.
- Working or sharing the same closed environment with SARS-CoV-2 patients.
- Living in the same household as a SARS-CoV-2 patient within a 14-day period after the onset of symptoms in the case under consideration.
- Aircraft passengers who were seated in the same row as the case, or in the two rows in front or two rows behind a confirmed COVID-19 case, trips close contacts, crew members.

**Group 3a:** Symptomatic patient WITHOUT epidemiologic risk factors.

If a patient presents with fever > 37.5°C and cough, even if without a clear epidemiologic risk factor, it will be managed as a suspect case.

**Group 3b:** Inpatient women with onset of symptoms during the hospital stay WITHOUT epidemiologic risk factors.

If a woman develops fever  $> 37.5^{\circ}\text{C}$  and respiratory symptoms while inpatients the case must be managed as a suspect case.

The clinical suspect must rise only in women with no other possible symptoms cause, and isolation must be respected until the final swab result.

#### 5. Infection control procedures.

Once the suspect case is identified, the infection control procedures must be immediately implemented in order to prevent SARS-CoV-2 diffusion. HCP should immediately adhere to Standard Contact and Droplets Precautions upon patient arrival and during visit.

##### I. The suspect case:

- Must wear a surgical mask.
- Must be isolated in a single room at a negative pressure with a minimum of 6 air changes per hour (if not available the patient can be isolated in a room with adequate air changes).
- It must be kept at least 2 meters during the interview.

##### II. The health care providers:

- Must wear a facemask, favouring FFP2 based on local situational analysis of supplies (FFP2 or FFP3 facemask are recommended if handling airways generating aerosol such as nasopharyngeal swab, intubation, bronchoscopy, broncho aspiration, etc.)
- Must wear a non-sterile gown.
- Must wear two pairs of gloves.
- Must wear eye protection.
- Must perform correct and scrupulous hand hygiene.
- Must implement staff cohorting (the suspect case should be assisted by the same team of HCP).

III. The number of contacts must be reduced to a minimum. No visitors are allowed.

IV. All non-dedicated, non-disposable medical equipment used for patient care should be cleaned and disinfected.

V. Even in the case of an obstetric urgency/emergency the staff should firstly

implement infection control procedures as far as possible (19).

Regarding the infection control procedures by HCP during the interaction with suspect/confirmed cases, the standard surgical-style mask can able to prevent both the acquisition and the transmission of SARS-CoV-2, limiting the recommended use of FFP2 or FFP3 facemask by HCP during procedures generating aerosol.(20) These recommendations are based on evidence supporting the droplet transmission as the main transmission route of the SARS-CoV-2, similar to other respiratory viruses such as influenza (20), with controversies about the role of airborne transmission route (21).

Conversely, the prophylactic continuous use of the surgical-style mask to prevent the transmission of respiratory disease is supported by more limited evidence.(22) This because a comprehensive and appropriate application of all the infection control procedures is required to appropriately limit the transmission (22). However, prophylactic continuous use of the surgical-style mask, at least by HCP, can be considered an appropriate recommendation based on local situational analysis of supplies and prevalence of patients affected by COVID-19.

The actual proportion of asymptomatic patients affected by SARS-CoV-2 is still undefined, with evidence supporting asymptomatic patients as a possible source of infection with viral load comparable to symptomatic patients (9,20,23) Moreover, the prophylactic use of the surgical-style mask might improve the perception of safety, reducing stress and frustration among HCP, and may help to improve adherence to other infection control procedures acting as a physical barrier to prevent touching the face (24).

On that basis, the prophylactic use of the surgical-style mask by HCP can be recommended to prevent the acquisition of SARS-CoV-2 from any patient regardless of symptoms, as well as prevent the transmission of SARS-CoV-2, being any asymptomatic HCP a potential source of infection (9,20,23). Similarly, prophylactic use of the surgical-style mask by all patients could be recommended (25).

#### 6. Notification and diagnosis.

Guidance from local health authorities for the definition of suspect case must be followed. Whenever possible, an infectious disease

specialist should be involved in the decision whether a patient has signs and symptoms compatible with COVID-19 and whether the patient should be tested.

In any suspect case, three steps must be implemented:

I. Immediate notification of the case.

II. Immediate implementation of contact tracing measures:

- All the people entering the room must be registered. They will have to monitor their signs or symptoms for the following 14 days.
- Close contacts must be identified and must be informed that they will have to undergo active monitoring, including restriction from work in any healthcare setting until 14 days after their last exposure. In the case of symptoms, they should immediately notify and self-isolate.

III. Collection of the diagnostic respiratory specimens (nasopharyngeal swab).

- This specimen must be collected using the PPE by the person who provides care to the patient and in the same room where the patient is isolated.
- The specimen can be stored at 4°C for up to 72 hours.
- The notification form must be sent to the laboratory along with the specimen.
- Given varying differential diagnosis in people presenting respiratory symptoms, testing for other respiratory pathogens is encouraged.

7. Nasopharyngeal swab interpretation.

From the collection of the diagnostic respiratory specimens until the result, the patients must be monitored in isolation.

I. Negative result: With a negative result, there is no indication to swab repetition, and the patient can be discharged with medical charges exemption 5G1.

II. Positive result: If the test results positive, the infection is confirmed.

In Italy, at the moment, the final confirmatory test is performed at the National Institute for Infectious Diseases Spallanzani, Rome. The suspect case can be confirmed only after this official confirmation. Repetition of sampling is needed to confirm microbiological recovery. In general, a patient can be considered negative only after 2 consecutive negative results within 24 hours. The current indication is to repeat a second sample, in patients with resolution of symptoms, after 7 days from the first positive results.

8. Choice of inpatient or outpatient management.

I. Outpatient management:

- After consultation with the Infectious Diseases Specialist, a patient confirmed with COVID-19 but with mild or moderate symptoms (and no other Obstetric or Gynaecological indication for admission) can be considered for home care if the residential setting is suitable.
- The patient must inform its general practitioner about its clinical situation by telephone call.
- The Hygiene and Public Health service must be informed about this choice.
- Patients can be discharged with medical charges exemption 5G1.
- The woman is advised to go immediately home by her own personal transport, to self-isolate, and to wait for specific indications from the Hygiene and Public Health service. Any appointment will be rebooked in 14 days (19).

The following recommendation has to be provided for the home care of the patients with suspected COVID-19:

- A single separate room, well ventilated, must be reserved for the patient.
- The number of visitors must be reduced.
- Family members must use different rooms without sharing spaces.
- A dedicated bathroom with windows must be used if possible.
- Caregivers should use precautions while looking after the patient.

- Thorough hand hygiene must be respected.

Based on the gestational age, a daily phone follow-up to monitor obstetric symptoms, such as fetal movements, vaginal discharges, uterine contractions, should be considered in pregnant women with COVID-19.

In case of emergency, the pregnant woman will be transferred to the hospital calling the emergency number (118), with neither husband nor another trustworthy person should accompany her. Before arriving at the hospital, the triage nurse should be informed, calling the number provided to the patient in order to allow HCP to get organized.

## II. Inpatient management:

Patients critically ill must be immediately transferred to an Intensive Care Unit setting for adequate support. Patients with mild or moderate COVID-19 symptoms, but with an Obstetric or Gynaecological indication for admission should be managed as follows:

- Confirmed cases must be transported from the room of first evaluation to the final designed room using short and predefined routes, always respecting precautions.
- If elevators are used to move infected patients these must be sanitized immediately after the use.
- Appropriate rooms must be identified for the isolation of the patient in the Obstetric ward, Gynaecological ward, and Delivery Room.
- Staff providing patient care should be the same during each shift.
- If a surgical operation is necessary for obstetric or gynaecologic reasons precautions as for other infective diseases should be adopted. It is paramount to alert and inform the anaesthesiologist given its high exposure risk during airways management. In operation scheduling, it would be appropriate to perform the surgical intervention last in the operative list.

## 9. Environmental Cleaning and Disinfection.

Routine cleaning and disinfection procedures are important for SARS-CoV-2 in healthcare settings. A cleaning service must be available for this procedure. Noteworthy, after the usual obstetric and gynaecologic evaluation of suspect or confirmed COVID-19 patient, ultrasound transducers should be cleaned and disinfected based on the manufacturer specifications as well as other surfaces.

### *Specific situations: Pregnancy, labour, and delivery.*

#### 1. General management of pregnant women.

In the absence of specific vaccine or treatment, the only available public health tools to control person-to-person transmission are isolation and quarantine, social distancing and community containment measures (26). Moreover, considered the fact that nosocomial transmission plays an important role in diffusion, it is important to try to reduce as much as possible the attendance for routine/non-urgent antenatal care in women with suspected or confirmed COVID-19. This could be done with woman cooperation. Routine appointments for women with suspected or confirmed COVID-19 should be rearranged until the end of the recommended period of isolation. More urgent appointment rearrangements will need the discussion with a senior obstetrician to balance risks and benefits.

The same can be said for planned inductions of labour or planned caesarean sections in women with suspected or confirmed COVID-19. An individual assessment should be made to determine whether it is safe to delay the appointment with the aim to minimize the risk of infectious transmission to other women, HCP and, postnatally, to her infant.(19) If obstetric care cannot be delayed all precautions should be adopted in order to reduce transmission.

#### 2. Management of pregnant women with COVID-19.

Much is unknown about COVID-19 in pregnancy with less than 20 reported cases.(27,28) The management of pregnant women with COVID-19 (suspected or confirmed) should be similar to the management of non-pregnant

women, with the consideration that pregnant women, as for other potentially severe respiratory infections, such as influenza, SARS, or MERS, could be more vulnerable to developing severe sequelae. Data on illness associated with other virulent coronaviruses can provide insight into COVID-19 effects during pregnancy.(29) However, given the limited available evidence on COVID-19 in pregnancy,(27,28) it is not clear if pregnant women with COVID-19 will suffer from a more severe disease.(29) In consideration of the possible impact of the disease on pregnant women, The Clinical Practice Guidelines no. 225(30) for SARS during pregnancy stressed the importance of informing the woman about:

- Possible effects of SARS-CoV viremia on the foetus.
- Possible foetal risks caused by maternal respiratory failure.
- Option of termination of pregnancy in the event of severe maternal compromise up to 22 weeks of gestations (originally 24 weeks).
- Obstetrical management between 24 and 34 gestational weeks or after 34 gestational weeks, including discussion about the mode of delivery, type of anaesthesia, possible use of antibiotics and corticosteroids (betamethasone), possible preterm delivery in the case of severe maternal impairment, and possible perimortem caesarean delivery in the case of fatal maternal complications.

After the admission of a suspect or confirmed case of COVID-19 in a pregnant woman, a multidisciplinary meeting should be set in order to plan the management. The woman should be informed about the conclusions, and a discussion with her should be conducted (19). Available literature addressing the topic of COVID-19 management in pregnancy reports the following general principles regarding the management of pregnant women with confirmed or suspected COVID-19 (29):

- Early isolation and implementation of infection control procedures.
- Careful evaluation of specific needs, such as oxygen therapy, antibiotic therapy to prevent bacterial secondary

infections, and early mechanical ventilation in the case of respiratory failure.

- Close monitoring of maternal-foetal wellbeing:
  - a) Maternal observation with vital signs monitoring. If a woman develops signs of sepsis, it is important to consider the wide range of possible differential diagnosis and investigate the possible aetiology, following the protocol for sepsis in pregnancy.
  - b) Given the high rate of foetal compromise observed in the reports of cases with COVID-19 in pregnancy (27,28), a pregnant woman with COVID-19 should have her foetuses monitored with continuous electronic monitoring during labour (19).

Moreover, specific aspects to take into account in a pregnant woman affected with COVID-9 are:

- a) Changes on foetal heart rate patterns can be an early sign of maternal respiratory deterioration.
- b) The target of blood oxygen saturation in spontaneous breathing is 92-95% when oxygen therapy is needed for severe respiratory conditions (31).
- c) WHO advises against the use of corticosteroids on clinical management of severe acute respiratory infection unless indicated for another reason (32,33).

However, given the benefits of betamethasone for foetal lung maturation, and the lack of evidence of harm in women with COVID-19, this therapy should be administered when indicated (19).

- d) Given the wide differential diagnosis in people presenting with acute respiratory symptoms, the Infectious Disease Specialist could decide to start an antiviral or antibiotic therapy, especially before test results for COVID-19 (31).
- e) At the moment, some antiviral agents are under evaluation for the treatment of COVID-19 but no data are available in pregnancy. Remdesivir is being studied in a randomized controlled trial in patients with SARS-CoV-2 and it has been used in one case in the USA. Nothing is

known on the passage of this drug into breastmilk, but data from a patient breastfeeding with Ebola shows no adverse effect in the infant (34).

- f) Imaging investigations (such as chest X ray and computed tomography) should be performed as for non-pregnant women, implementing all the measures to protect the foetuses from radiations exposure (19).
- g) If maternal stabilisation is needed, this has to be considered a priority before delivery, as in other maternal emergencies (19).

### 3. Management of labour and time of delivery in patients with confirmed or suspected COVID-19.

The Clinical Practice Guidelines for SARS during labour and delivery could be considered for a patient with COVID-19 (30).

- A multidisciplinary team consisting of Obstetrician, Nurses, Paediatricians, Infection Control Specialist, Anaesthesiologist should be identified in each unit and be responsible for the organization and implementation of management protocols.
- Preventive measures should always be respected while taking care of women with confirmed COVID-19 or under investigation. The use of FFP2 or FFP3 face mask is recommended at least during the second and third stages of labour based on local situational analysis of supplies.
- The team providing care during labour and delivery includes Obstetricians, Midwives, Anaesthesiologists, and Neonatologists. All of them should be trained about all the preventive measures.
- Whenever possible, dedicated health care providers should be designated to care for known or suspected COVID-19 patients. Moreover, based on the obstetrics conditions, women should be assisted by the minimum required number of HCP limiting traffic around the room.
- Maternal vital signs monitoring should continue. Oxygen saturation should be checked every hour and should be > 95%. (19)

- Foetal heart monitoring should be continuous since the high rate of foetal compromise reported in pregnant women with COVID-19. (19)
- If the caesarean section is needed, it must be performed in a specifically designated operation room and by the same team providing patient care during labour.

It is unknown if the delivery can provide some benefit to a critically ill mother with COVID-19. Therefore, the decisions regarding timing of delivery should consider the gestational age, balancing the risks and benefits (29). About COVID-19, despite the scarcity of available data, it seems that caesarean section should be performed only based on obstetric indications. However, for the most severe cases of SARS in pregnancy, caesarean delivery and general endotracheal anaesthesia were elected in order to avoid emergency airway issues and to minimize exposure risk for HCP.(30) The same could be considered also for COVID-19 critically ill patients.

Moreover, both general and locoregional anaesthesia could be used during caesarean section in pregnant women with COVID-19, as well as neuraxial analgesia is allowed for intrapartum pain control.(30) In particular epidural analgesia should be offered and recommended early in labour in order to reduce the need of general anaesthesia if urgent/emergent delivery was needed, this allows to reduce the risk of virus spreading via aerosol associated with Entonox breathing system use.(19)

### 4. Vertical transmission of SARS-CoV-2.

Whether a pregnant woman with COVID-19 can transmit SARS-CoV-2 to her foetus or neonate by vertical transmission is still unknown. A report of 18 pregnant women with confirmed COVID-19 or under investigation shows that there is no evidence of a positive laboratory test that proves vertical transmission to the newborns.(27,28) Similarly, experience from SARS and MERS in pregnancy shows no confirmed intrauterine coronavirus transmission from mother to fetuses (35). Moreover, a report of three cases has recently been published giving data on clinical characteristics and placental pathology of SARS-CoV-2 infection in pregnancy. From Pathological studies, no morphological

changes were found in the placentas and all samples were negative for the nucleic acid of SARS-CoV-2. Given the importance of this information in understanding the modality of virus transmission, it is important to send for pathological investigation any product of conception (36). Additionally, data from infections in newborns can give an insight in the mode of transmission. Three cases of infection in newborns have been reported. The first one has been diagnosed with COVID-19 when he was 17-day-old, after many close contacts with his mother and grandmother, both confirmed with COVID-19. The second one was diagnosed 36 hours after he was born; however, the possibility of close contact history cannot be ruled out and the way and timing of infection are still unclear. A third case was diagnosed 30 hours after birth suggesting the possibility of in utero transmission. However, insufficient information is available to rule out perinatal or postnatal modes of transmission (27). Based on these cases, it is more likely that the babies have been infected after birth from the environment, instead of having a vertical transmission (35). However recently a research letter published on JAMA by Dong, L. et al reported a new neonatal case where elevated IgM antibodies (that don't cross the placenta) to SARS-CoV-2 have been found in the newborn two hours after birth. The mother had been diagnosed with COVID-19 23 days before the delivery. This result could cast doubt of possible vertical transmission. Despite this RT-PCR for viral RNA on neonatal swab tested negative. At the moment there is no evidence that delayed cord clamping should be avoided after birth, except for other indications. Moreover the baby can be dried and cleaned as usual, while the cord is still intact (19). From SARS guidelines on neonatal management it was only indicated that the baby should be rapidly cleaned from maternal fluids (37).

## 5. Breastfeeding

What we know from pandemic H1N1 and from available Chinese literature on COVID-19 is that temporary separation of the infant from the mother has been adopted in order to reduce the risk of transmission to the baby. This can be considered in some cases, but no data are available to guide the length of separation. However, the

decision to adopt a routine precautionary separation has a relevant impact on bounding and feeding, and the risks and benefits must be balanced. Indeed, breast milk is the best source of nutrition for most infants and provides protection against many other illnesses. Moreover, the virus that causes COVID-19 has not been found in colostrum of women with COVID-19; conversely, antibodies anti-SARS-CoV were found in at least one case (27,33,38). On that basis, given the most likely mechanism of transmission and the available data, some authors suggest that breastfeeding benefits outweigh potential risks of transmission of the virus through milk.(19,29) Moreover, in the case of temporary separation of the infant from the mother, breast milk should be favoured if allowed by maternal clinical conditions.

The Royal College of Obstetricians & Gynaecologists has recently published advices for the postnatal management. Given the limited evidence, the mother and the healthy infant should be kept together in the immediate postpartum period, unless other reasons for separation are present (19). The mother should be informed on the benefits and risks of breastfeeding (linked to the close contact rather than to milk itself from what we know so far) and should also be instructed on the hygiene measures that must be adopted to reduce the risk of transmission. A mother with confirmed COVID-19 or who is a symptomatic person under investigation should take all possible precautions to prevent infant exposure, including washing her hands before touching the infant and wearing a face mask, if possible, during breastfeeding. In the case of breast milk with a manual or electric breast pump, the mother should wash her hands before touching any pump or bottle parts and follow recommendations for proper pump cleaning after each use (33,39).

In general, whether and how to start or continue breastfeeding should be determined by the mother in coordination with her family and HCP. Breastfeeding could be considered in women with confirmed or suspected COVID-19 with mild symptoms if they wish (33). The possible decision for separation, when appropriate, should be taken based on the benefits and risks related to the separation in consultation with infectious control experts and neonatologists (29). In any case, a baby born from a mother with

suspect or confirmed COVID-19 should be observed closely and should be tested for COVID-19 (19).

Regarding home care, it can be considered for mothers after delivery in the case the residential setting is suitable for outpatient management of COVID-19. Consultation with an Infectious Disease Specialist is suggested also to understand specific management of the neonate at home in order to reduce the risk of trans-mission.

## 6. Quarantine

Quarantine has been reported having a psychological impact both for patients and HCP (24). Alcohol abuse, dependence symptoms, and avoidance behaviours have been reported associated with the experience of quarantine as well as to the work in high-risk areas (24). Short and long term negative psychological effects, psychological distress, and disorders have been reported (24).

On that basis, the implementation of mitigation measures is of paramount importance for both HCPs and patients. Noteworthy, pregnant women have been reported as the category of patients caring more about the risk of getting infected or becoming a source of infection for others in the setting of epidemic spread of infections (40). On that basis, appropriate counselling about the impact of SARS-CoV-2 infection and COVID-19 in pregnancy is of paramount importance in this category of patients.

## DISCUSSION

At the end of 2019, the novel SARS-CoV-2 was identified as the cause of some cases of pneumo-

nia. Today, the number of cases is growing worldwide due to a widespread diffusion of the virus and probably the reported numbers are likely underestimated. In this scenario, the application of public health interventions is mandatory to limit the spread of the infection. Since very little is known about effect of COVID-19 on pregnant women and infants, a pressing need has emerged to gather information specific to the maternity setting. Noteworthy, the management of an obstetric patient can be more challenging given the characteristics of this special population and limited reported data. For these reasons, after thorough consultation of the literature and public health authorities and scientific societies guidance documents, we outlined and reported here a procedure and recommendations for the management of the obstetric and gynaecologic patient approved by a multidisciplinary team. We obviously acknowledge that current knowledge on this issue is provisional, incomplete, and therefore subject to change as new evidence becomes available.

## DISCLOSURE STATEMENT

The authors have no proprietary, financial, professional or other personal interest of any nature in any product, service or company. The authors alone are responsible for the content and writing of the paper. All the authors conform the International Committee of Medical Journal Editors (ICMJE) criteria for authorship, contributed to the intellectual content of the study and gave approval for the final version of the article.

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