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MANAGING OBSTETRICAL PATIENTS DURING SEVERE ACUTE RESPIRATORY SYNDROME OUTBREAK

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Abstract: Severe Acute Respiratory Syndrome (SARS) is a newly described infectious disease caused by a coronavirus. Two outbreaks occurred in Toronto in the spring of 2003, resulting in the closure of 3 hospitals, including 2 obstetrical units.

Strategies, devised using information about the coronavirus available at the time, as well as epidemiologic and infectious disease containment measures, were initiated to protect obstetrical patients and staff. In the first outbreak, the obstetrical unit of an affected Toronto hospital was kept open while other clinical services were closed. In the second outbreak, the obstetrical unit was closed along with all other clinical activities. This report details the stepwise processes used to make decisions during the SARS outbreaks and the implementation of the decisions made. It is recommended that these or similar protocols be used when an obstetrical unit is confronted with a large-scale nosocomial infectious outbreak that has a mechanism of transmission similar to that of SARS.

Résumé : Le syndrome respiratoire aigu sévère (SRAS) est une nouvelle maladie infectieuse causée par un coronavirus. Deux flambées épidémiques se sont produites à Toronto, au printemps de 2003, et ont forcé la fermeture de 3 hôpitaux, y compris 2 unités d'obstétrique.

À partir de l'information disponible à l'époque sur le coronavirus, on a mis en place des stratégies et des mesures de confinement des épidémies et des maladies infectieuses, dans le but de protéger les patientes et le personnel des services d'obstétrique. Lors de la première flambée, l'unité d'obstétrique d'un hôpital de Toronto affecté est demeurée ouverte, alors que les autres services cliniques étaient fermés. Au cours de la seconde flambée, l'unité d'obstétrique en question a été fermée, tout comme tous les autres services cliniques. Le présent rapport présente les étapes du processus mis en place pour la prise de décision pendant les flambées épidémiques du SRAS et pour l'application des décisions prises. Nous recommandons l'utilisation de ce protocole ou d'un protocole semblable lorsqu'une unité d'obstétrique fait face à une flambée infectieuse nosocomiale de grande envergure, dont le mode de transmission est comparable à celui du SRAS.

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INTRODUCTION

Severe Acute Respiratory Syndrome (SARS) is a newly described acute viral infection caused by a coronavirus.¹⁻³ The first outbreak occurred in Guangdong Province, in southern China, in November 2002.¹ Global travel resulted in SARS outbreaks in Hong Kong, Taiwan, Singapore, Hanoi, and Toronto.⁴⁻⁶ SARS is characterized by a sudden onset of fever, nonproductive cough, dyspnea, headaches, and myalgia, and by laboratory findings of leukopenia and elevated liver enzymes, as well as pulmonary infiltrates on chest X-ray.⁷⁻¹⁰ Patients may deteriorate rapidly, exhibiting blood oxygen desaturation and adult respiratory distress syndrome (ARDS) and requiring ventilatory support. The clinical classification of SARS according to Health Canada¹¹ is depicted in the Table.

The first outbreak of SARS in Toronto occurred in late March 2003 (hereafter referred to as SARS 1).¹²⁻¹⁴ A second outbreak occurred in late May 2003 (hereafter referred to as SARS 2). Both Toronto outbreaks were determined to be nosocomial, mostly limited to hospital exposures. Both resulted in the closure of some hospitals to protect patients, physicians, nurses, and other hospital workers from SARS, and to prevent the outbreak from becoming an epidemic. During SARS 2, 4 hospitals in Toronto were directed by the Ontario Ministry of Health and Long-Term Care to form a SARS Alliance and to dedicate specific wards and intensive care units (ICUs) to SARS patients. North York General Hospital (NYGH) was one such hospital. Indeed, the SARS patient volume and rapidly expanded SARS wards and ICU quickly transformed NYGH into the facility with the largest exposure to, and experience with, SARS in North America.

The obstetrical unit at NYGH is a designated Advanced Level 2 unit and delivers an average of 5200 births a year. The hospital has a neonatal intensive care unit (NICU) capable of caring for neonates delivered at 32 weeks' gestation and later. This report details the processes developed by the obstetrical unit of NYGH to manage labour and delivery during SARS 1 and to close and re-open its unit during SARS 2, while ensuring that women under the care of NYGH obstetricians received care at other area hospitals. The goals were to maintain patient safety and public protection, and to prevent health-care and support workers in the unit from contracting SARS. The processes adopted by NYGH

SARS CLINICAL DECISION GUIDE: CASE DEFINITIONS (HEALTH CANADA)¹¹

Case Definitions	Clinical Symptoms	Epidemiologic Link/Contacts	Other
Probable case	A person meeting with suspect case definition together with radiographic evidence of infiltrates consistent with pneumonia or respiratory distress syndrome (RDS) on chest X-ray (CXR)	One or more of the following exposures during the 10 days prior to onset of symptoms: <ul style="list-style-type: none"> • close contact* with a person who is a suspect or probable case or • recent travel or visit to an identified setting in Canada where exposure may have occurred (e.g., hospital, household, workplace, school) or • recent travel to an area with recent local transmission outside of Canada 	No other known cause of the current illness
Suspect case	Fever (temperature higher than 38°C) and cough or difficulty breathing	One or more of the following exposures during the 10 days prior to onset of symptoms: <ul style="list-style-type: none"> • close contact with a person who is a suspect or probable case or • recent travel or visit to an identified setting in Canada where exposure may have occurred (e.g., hospital, household, workplace, school) or • recent travel to an area with recent transmission outside of Canada 	No other known cause of the current illness
Persons under investigation	Fever (temperature higher than 38°C) and one or more of chills, rigors, malaise, headaches, myalgia	One or more of the following exposures during the 10 days prior to onset of symptoms: <ul style="list-style-type: none"> • close contact with a person who is a suspect or probable case or • recent travel or visit to an identified setting in Canada where exposure may have occurred (e.g., hospital, household, workplace, school) or • recent travel to an area with recent local transmission outside of Canada 	No other known cause of the current illness
*Close contact: having cared for, lived with, or had face-to-face (within 1 m) contact with, or having had direct contact with respiratory secretions or body fluids of a person with SARS.			

are proposed as a template for managing obstetrical programs and patients during a large-scale contagious infective disease.

SARS VIRUS TRANSMISSION

Knowledge is rapidly accumulating on the method or methods by which the SARS coronavirus is transmitted from person to person. Although it is likely that droplet transmission is the primary route, it is possible that all the methods of transmission have not yet been identified. The following are accepted to be valid by infectious disease specialists, microbiologists, and public health authorities, after evaluation using clinical epidemiologic methodology, viral serology, electron microscopy, and genetic sequencing³:

1. Symptomatic patients transmit the disease agent.^{7-11,15} The corollary is that virus carriers who are as yet asymptomatic do not spread the virus.
2. Viral spread is by droplets from the oropharynx, nasopharynx, trachea, and lungs, and from stool.

3. The incubation period is believed to not exceed 10 days. With rare exceptions only, an exposed person who becomes ill shows symptoms before the 10th day of exposure.
4. Experience in Taiwan suggests the possibility of fomite transmission.⁵ The virus is also possibly transmitted during high-risk procedures, such as intubation and cardiac arrest resuscitation.

Based on these 4 principles, a process of care of obstetrical patients was developed at NYGH. SARS 1 and SARS 2 differed in intensity and scope, calling for a modified program approach for each outbreak.

SARS 1: MARCH 27 TO APRIL 22, 2003

In late March 2003, hospitals in the Greater Toronto Area were put on "Orange Alert" by a directive from Toronto Public Health. Specifically, only medically urgent hospital admissions were recommended. Further, all hospital staff, patients, and visitors had to pass a screening test for SARS at a specified designated entrance,

and were allowed access to the building only if they showed no symptoms and had not visited a SARS-affected hospital or country. On March 27, 2003, with 6 patients having been admitted for Suspect or Probable SARS, as defined by Health Canada criteria,⁸ NYGH was closed except for life-threatening emergencies and potential SARS-related conditions. The Emergency Department had been assessing 3 to 4 patients a day for Suspect SARS.

Also on March 27, the obstetrics unit moved to newly designed facilities, occupying the entire floor of a new wing with a separate main entrance, separate elevators, and separate air-handling systems. This was a pre-designed move to modernize and increase the capacity of the labour and delivery unit and the postpartum ward. No obstetrical staff or patients were known to have been exposed to a SARS contact or to have visited a SARS-affected site.

During this period, the average daily census on the SARS ward ranged from 6 to 8 patients with Probable or Suspect SARS. No pregnant woman was affected. Experience and information about SARS were limited to a few case reports from Hong Kong. Multiple directives and information about SARS were issued daily by provincial health authorities, Toronto Public Health, and the Web site of the Ontario Medical Association. Many of these directives were subject to variable interpretation and had to be related to conditions prevailing locally at the hospital level. Therefore, a decision was made to keep the obstetrics unit open at NYGH with the following measures introduced:

1. All staff adopted a 4-point protection plan that included wearing an N95 respirator mask, a face-shield or glasses, a gown, and non-latex gloves during any patient contact.
2. All staff employed frequent hand-washing with an ethanol-based gel.
3. All patients wore N95 respirator masks for the entire duration of hospital stay.
4. Non-intervention procedures, such as biophysical profiles, routine obstetrical ultrasounds, and non-stress tests, were scheduled at a facility outside the hospital.
5. The 4-point protection plan was employed throughout all procedures during labour and delivery, including vaginal examination, amniotomy, application of fetal scalp clips, spontaneous vaginal delivery, operative vaginal delivery, and Caesarean delivery.
6. Only 1 visitor, a "significant other," was permitted to accompany the woman on admission for labour. Both the woman and her partner were masked for the duration of labour.
7. No visitors were allowed during the postpartum stay, which was reduced to between 12 and 24 hours when both mother and baby were well. A nurse made a home visit to the new mother and baby on day 3 postpartum and reported any problems to the obstetrician on call.

8. When a baby was admitted to the NICU, the mother stayed on a self-care regimen in a special room in the NICU.
9. Upon discharge, women were instructed to observe home quarantine and to self-monitor for symptoms for 10 days.
10. The obstetricians adhered to a 12-hour in-house call structure to minimize possible cross exposure.

Although there were SARS patients in the SARS ICU and SARS ward, no patient, partner, or hospital staff in the obstetrics unit contracted SARS at NYGH during SARS 1. The obstetrics unit and the NICU were the only services fully operational in the hospital during this period.

Although it later became clear that the second outbreak of SARS represented a continuation of the first outbreak, on May 17, 2003, SARS was officially declared to be over by the Premier of Ontario.

SARS 2: MAY 23 TO JULY 10, 2003

With its rapidity and intensity, the SARS 2 outbreak posed a greater challenge for the obstetrics program than did SARS 1. However, by the time SARS 2 was recognized, more information was available about SARS and most of the literature cited in this article was available.

On May 23, 2003, several health-care workers in 1 of the surgical units of NYGH developed a SARS-like illness. Two patients from that floor were diagnosed as Probable cases, using the Health Canada definition. Unprotected no-mask exposure of patients and staff during the previous week, when SARS was presumed contained, had become a significant risk factor for many staff and patients. With 31 cases, NYGH had become the hospital with the largest SARS population and the greatest exposure to SARS in North America (see Figures 1 and 2). The hospital shut down all units except the obstetrics unit and the SARS ICU, and a corridor was left open to permit assessment of hospital staff who might develop SARS-like symptoms. By noon on May 27, the rapid increase in Suspect and Probable cases of SARS presenting at the hospital led to the closing of the obstetrics unit because the daily SARS patient census in the hospital was high, and a disproportionately high ratio of patients required ICU care. Furthermore, a significant number of health-care workers were becoming ill, mostly from a specific surgical ward (see Figure 3).

The following procedures were adopted during SARS 2:

1. All physicians and health-care workers were directed to leave the hospital and observe "work quarantine" for 10 days. The obstetrician on call remained in the unit with the minimal number of nurses to deliver women already admitted in labour by the hour of closure.

Under work quarantine, all essential workers, including medical and hospital personnel, were allowed to go directly from home to work, and to return directly from work to

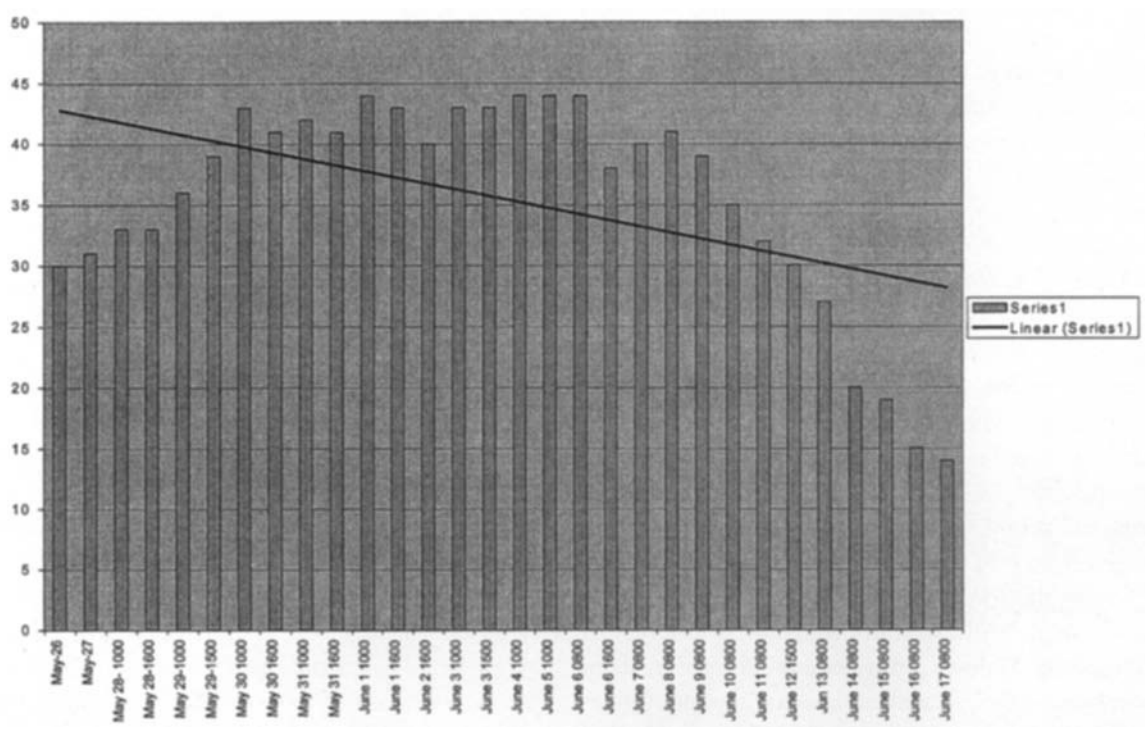


Figure 1. Total in-patient census at North York General Hospital during SARS 2.

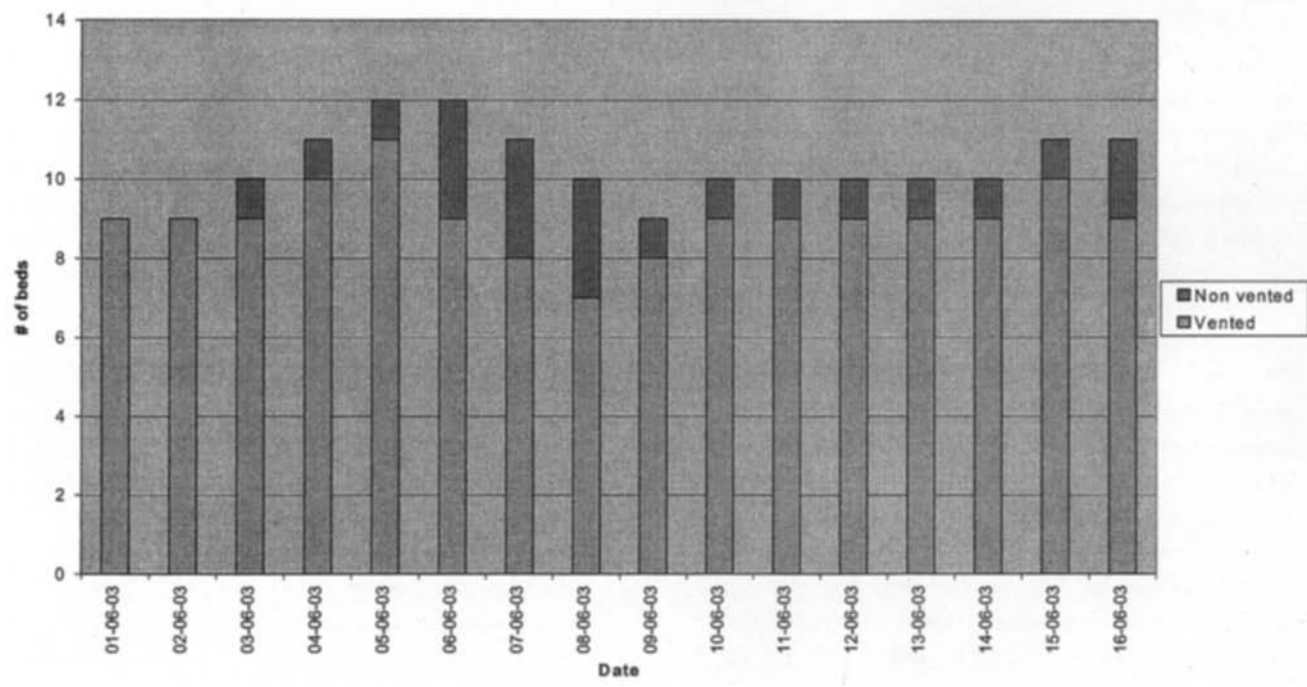


Figure 2. NYGH daily ICU patient census: ventilated (vented) and non-ventilated (non-vented).

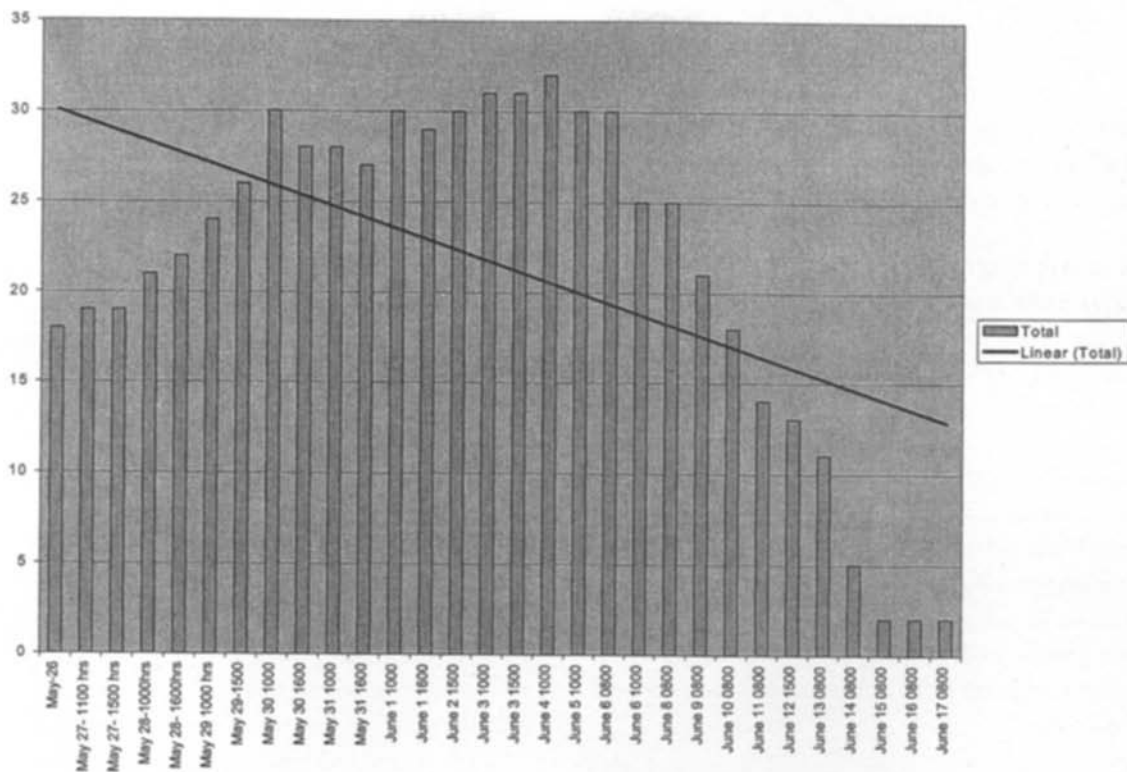


Figure 3. NYGH daily census of admitted health-care workers.

home. In transit, contact with the public was to be avoided. At work and at home, masks were to be worn and isolation from other people observed.

2. A teleconference was arranged for about 3 hours later (and then daily), to include the Chiefs of Obstetrics, the nursing leadership of 10 Toronto area hospitals, and 2 neonatologists of the Child Health Network (CHN) of Toronto, an organization that coordinates and addresses issues related to obstetrical and pediatric care in the Greater Toronto Area.
3. The teleconference served as a forum to advise area hospitals of developments related to SARS at NYGH, and to arrange a system for directing women in labour to area hospitals, based on their daily capacity and on geographic location whenever possible.
4. Should a woman in labour inadvertently arrive at NYGH, an ambulance was stationed 24 hours at the main entrance to provide immediate transfer to another hospital. This arrangement was maintained for the duration of closure of the obstetrics unit. Only 1 woman arrived in labour, fully dilated. Her baby was delivered by hospital personnel in the ambulance, in the parking lot.
5. Obstetricians, who were all placed on work quarantine, could continue to provide prenatal care in their offices outside the hospital, taking precautions of screening the women and adopting the 4-point protection plan against SARS transmission.

6. The nursing staff came to work on their regular shifts. Each morning at 0800 hours and every 6 hours thereafter, the charge nurse telephoned all area hospital obstetrics units for an update on their unit capacity. NYGH patients were instructed by their physicians to call the obstetrics unit at NYGH when in labour or if the membranes ruptured or for any other obstetrical occurrence that could need triaging.
7. Each woman was then directed to an appropriate obstetrical unit after notification of the potential receiving hospital. The appropriate Ontario Antenatal forms and information were faxed to the receiving unit once consent was received for acceptance of care.
8. Elective procedures, such as induction of labour and Caesarean deliveries, were booked by NYGH obstetricians at the obstetrics unit at NYGH, who then placed the booking according to available capacity of the receiving institutions. A log was kept of every woman directed to another hospital for a 24-hour follow-up on outcomes.
9. NYGH obstetricians kept to an on-call schedule from home. Their duties were to advise by telephone the nurses in the labour and delivery unit who were available, also by telephone, to triage obstetrical patients.

During this entire period, all of NYGH obstetrical patients who went into labour were directed from their home by the

nursing team in the obstetrics unit, as outlined above. Although none of the women came to NYGH, an ambulance was kept on 24-hour standby outside the hospital to attend to any woman who came to the hospital in labour. NYGH obstetricians did not seek temporary admitting privileges at any of the neighbouring hospitals. Patients were attended to and delivered by physicians who ordinarily had privileges in the respective receiving hospitals.

RE-OPENING THE OBSTETRICAL UNIT AND LIVING WITH SARS AND OTHER CONTAGIONS

During SARS 2, NYGH was 1 of 4 Toronto hospitals designated as a SARS treatment facility by the Province of Ontario's Ministry of Health and Long-Term Care, and developed the capacity for this role by opening a SARS Assessment Clinic adjacent to the Emergency Department, with a dedicated corridor passage and elevator to the SARS ICU and the SARS ward. Further, negative air-pressure strategy was implemented for 1 ICU, 2 SARS patient wards, and for the labour and delivery unit.

As SARS 2 began to dissipate by June 16, planning for re-opening the obstetrics unit began. Five measures were adopted prior to re-opening:

1. The hospital designated a specific ICU and specific ward for SARS patients.
2. Other areas were also designated for the treatment of SARS patients and sequestered by access and by geography.
3. The rest of the hospital was sanitized and disinfected, even if the areas had not been used for SARS patients during either outbreak. The obstetrics unit was re-opened to full clinical activity on Monday, July 14, 2003, the 50th day following closure due to SARS 2.
4. Barrier protection against droplet transmission in the obstetrics unit and throughout the hospital was re-introduced, as practised during SARS 1. This transition lasted until the discharge of the last SARS patient from the hospital on August 22, 2003.
5. Asymptomatic women with unprotected exposure to suspect cases or environments of SARS were to be attended by regular staff using the 4-point protection plan. They were to be discharged following the shortest length of stay compatible with the safety of mother and baby.

DISCUSSION

To date, we are aware of no reports of cases of Suspect, Probable, or Proven SARS in a woman who was pregnant during SARS 1 or SARS 2. The effects of SARS on an obstetrical patient are therefore not yet known, and important questions for the obstetrician remain, should another outbreak of SARS occur.

1. Does the SARS virus cross the placenta into the fetal mem-

branes, amniotic fluid, or cervical mucus?

2. Is the virus transmitted at the time of delivery via amniotic fluid, placenta, or blood?
3. Should health-care workers attending Proven and Probable patients wear a Stryker suit? Wearing this so-called "moon suit" was adopted as policy for the intubation of SARS-afflicted patients at NYGH as a precaution against infection from tracheal secretions or aspiration fluids. Such measures were based on Health Canada reports of health-care infections following intubation of a SARS patient.^{14,16} For now, at NYGH, the policy in the obstetrics unit is to obtain consultation from an infectious diseases specialist regarding the advisability of wearing such a suit in the rare event that an overtly symptomatic woman with Suspect or Probable SARS presents for labour and delivery.
4. Is the SARS virus transmitted into breast milk, and if so, should a SARS-infected woman breastfeed?
5. What are the effects of the medications used in treating SARS, including high-dose steroids levofloxacin and interferon?^{24,15} Although there is ample literature and clinical experience with short-term ventilation of pregnant women, SARS resulted in the use of a combination of these drugs and sustained ventilation for 2 to 3 weeks in non-pregnant women.

CONCLUSIONS

SARS is a new severe infectious disease in humans, caused by a coronavirus. Although no experience in an obstetrical patient has been described, the nosocomial basis of spread of SARS^{10,12-14} is a potentially serious problem for health-care workers. The potential for public exposure to the disease, particularly through the sick and hospitalized patient, makes it a significant public health problem. An explosive infectious disease outbreak, such as that exhibited by SARS 1 and SARS 2 in Toronto, calls for decisive monitoring of the local patterns of disease spread. In taking measures for the control of such a disease, the obstetrician should collaborate with infectious diseases practitioners, public health workers, and medical program leaders of their hospital and those of nearby health-care institutions. SARS presented opportunities for research into "Best Practice" scenarios, which should result in a better understanding of the effects of the acute viral illness and its treatment on the mother and her baby. The lessons learned from SARS 1 and SARS 2 will introduce significant changes to how medicine is practised worldwide.

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