A practical approach to airway management in patients with SARS

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During the first outbreak of severe acute respiratory syndrome (SARS) in Toronto, 9 health care workers at Sunnybrook and Women's College Health Sciences Centre (who were wearing the barriers and taking the precautions recommended at the time) were infected during intubation of 2 patients with probable SARS.[1] In the interval between the onset of hypoxemic respiratory failure and intubation, management of these patients included use of high-flow oxygen circuits (> 15 L/min), an attempt over 1 h to institute non-invasive ventilation and a difficult intubation requiring multiple attempts by junior personnel.

Airway management is a risky procedure in SARS patients because they shed respiratory droplets containing a high viral burden.[2] Health care workers must wear appropriate equipment to protect themselves from infection. Current recommendations for protective equipment and an instructive slide presentation can be found on the Web site of Mount Sinai Hospital's Critical Care Unit.[3,4] Our approach to SARS patients is summarized in the accompanying checklist (Table 1). The underlying message is: consider intubation sooner than is customary to give operators sufficient time for preparation.

1. Define the need for intubation as emergent or elective

Classification of the patient's airway status as emergent or elective is crucial and determines the appropriate management options. We define an emergency situation as one in which a patient with probable SARS has undergone a respiratory arrest. An elective situation is one in which the patient is hypoxemic and may require mechanical ventilation. In an emergency, there may be no time to move the patient to a negative-pressure isolation room, although every effort should be made to do so. If the patient has already undergone a respiratory arrest, the use of adjunctive drugs to suppress laryngeal reflexes is unnecessary, and the protected operator simply intubates using the technique of greatest familiarity.

An emergency intubation represents a failure to anticipate a respiratory arrest. Management should be reviewed subsequently to improve early recognition of clinical features predicting an imminent need for airway management (Table 2).

2. Take a focused history and perform a physical examination

As in any therapeutic approach to the airway, an examination must be undertaken before deciding on the appropriate course of action. Again, the approach depends on whether the case is emergent or elective. Use of the

Table 1: Checklist for intubation of SARS patients

1. Define the situation as emergent or elective
   - Emergent = respiratory arrest
   - Elective = impending need for mechanical ventilation
2. Take focused history and perform physical examination
   - "AMPLE" history = **a**llergies, **m**eds, **p**ast medical history, **l**ast meal, **e**vents
   - "MOUTHS" airway examination = **m**andibular depth, **o**pening of jaw, **u**vula grade, **t**eeth (especially right 3rd incisor), **h**ead extension, **s**ilhouette
3. Choose anesthetic and intubation technique
   - If no predictors of difficult mask ventilation, and the operator is very familiar with advanced procedures for failed intubation, use paralysis for intubation
   - No nebulized or topical lidocaine, no regional anesthesia (transtracheal block)
   - Use "modified awake" approach: midazolam (0.05 mg/kg iv) and fentanyl (1 μg/kg iv) every 3–5 min until patient unresponsive to deep painful stimuli, low spontaneous, minute ventilation; lidocaine (1.5 mg/kg iv) 60 s before laryngoscopy
4. Prepare equipment and personnel
   - Physician, nurse, respiratory therapist wearing standard barriers (to airborne droplets) and personal protective equipment (Stryker T4 suit or better)
   - Parallel team outside room for assistance
   - Difficult airway cart outside room
   - Fibreoptic bronchoscope loaded with endotracheal tube, outside room
   - Induction and emergency drugs
   - Intubation equipment
   - Disposable capnograph
5. Intubate
   - Paralyze after confirmation of intubation

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"AMPLE" history template (allergies, meds, past medical history, last meal, events) and a directed physical examination of the airway, such as that recommended by Davies and Eagle[5] is a minimum. Additional information, such as family history (e.g., difficult intubations, malignant hyperthermia) and co-existing disease with particular attention to conditions that might result in anesthetic–drug interactions, could alter management. The degree of hepatic and renal dysfunction associated with SARS is minor, and it is unlikely that commonly used medications, with rapid clearance, would be affected by the syndrome.[6]

3. Choose technique for intubation

The choice of technique for intubation is always a matter of operator judgement. We believe that for the elective intubation scenario, "classic" awake intubation techniques with light intravenous sedation and topical or nebulized local anesthesia are contraindicated. This reduces the pharmacologic component of management to the choice of deep sedation, either alone or in combination with neuromuscular paralysis to abolish laryngo-spinal reflexes.

We recommend a "modified awake" intubation technique because this affords the best possible compromise between patient and operator safety. With the patient unresponsive to deep painful stimuli and maintaining low, spontaneous, minute ventilation, the response to laryngoscopy and tracheal intubation will be lowest. We use a combination of the following intravenous doses: midazolam (0.05 mg/kg), fentanyl (1 μg/kg) and lidocaine (1.5 mg/kg).[7] Midazolam and fentanyl doses are repeated every 3–5 min until the patient reaches the desired level of sedation. Lidocaine is administered 60 s before laryngoscopy. Other regimens are possible provided the operator is familiar with their use.

4. Prepare equipment and personnel

The most skilled airway practitioner should intubate, as the goal is to do it rapidly, without coughing or periods of mask ventilation. The procedure is carried out in a negative-pressure room with the operator wearing personal protective equipment and isolated from the nursing unit by closed doors. Meticulous preplanning of the equipment, drugs, procedure and communication within and outside the room is required. All aspects of the procedure should be prepared for and discussed. There should be a parallel team outside the room ready to assist the physician, nurse and respiratory therapist who are inside. To counterbalance the pharmacologic effects of sedating drugs and positive-pressure ventilation resulting in a drop in blood pressure, the patient should receive a rapid bolus of crystalloid (10–20 mL/kg) to increase intravascular volume.

5. Intubate and paralyze

For a patient who is in progressive respiratory failure, the usual approach to airway management is based on the principle of maximum patient safety.[8,9] For SARS patients, strict adherence to this principle must be altered because "classic" awake intubation techniques increase the risk of transmission of infection to the care team. Such techniques preserve spontaneous respiration through the use of sedation, but require airway anesthesia. Although airway anesthesia can be achieved without the use of nebulized therapy, even alternative regional anesthesia techniques such as transtracheal block can result in undesirable stimulation of the cough reflex. Accordingly, they cannot be used in patients with SARS.

Table 2: Signs of imminent need for airway management in SARS patients

Altered level of consciousness
• Not obeying commands
• Agitation
Upper airway obstruction
• Stridor or snoring
• Delay of inspiratory breath sounds
Deteriorating oxygenation (any of the following indicators)
• FIO_2 by face mask ≥ 60%
• SaO_2 < 92%
• P/F ratio < 300
Deteriorating ventilation
• Rapid shallow breathing (> 30/min)
• Accessory muscle recruitment (scalenes, sternomastoids, intercostals)
• Paradoxical breathing (abdomen moves in direction opposite to normal inspiratory excursion)
• $PaCO_2$ > 40 mmHg if no sedation
• $PaCO_2$ > 50 mmHg if patient is sedated

Note: FIO_2 = fractional intake of oxygen; $PaCO_2$ = partial pressure of carbon dioxide in arterial blood; P/F ratio = PaO_2/FIO_2; SaO_2 = oxygen saturation by pulse oximetry.

Table 3: Protecting the patient and caregivers during airway management in SARS

Anticipate
• Intubate *sooner*: elective SARS intubation
• Not later: emergency SARS intubation
Prepare
• Physician, respiratory therapist, and nurse inside isolation room in personal protective equipment
• Parallel team outside room ready to assist
• Rehearse roles and ability to communicate *before* starting
Modify technique
• Topical, nebulized local anesthesia is contraindicated
• Use deep sedation with or without neuromuscular paralysis
Use experienced personnel only
• Avoid the need for mask ventilation
• Avoid multiple attempts

We recognize that the fundamental airway management principle in anticipated difficult intubation is to avoid neuromuscular paralysis and to maintain spontaneous respiration. If the history and physical examination disclose predictors of either difficult mask ventilation or tracheal intubation, neuromuscular paralysis should not be used during intubation, except where there has been prior preparation for a surgical airway, whether temporizing (e.g., Melker cricothyrotomy) or definitive (open surgical tracheostomy). However, it would not exceed the standard of a skilled "reasonable practitioner" to give neuromuscular paralysis when there are no predictors of difficult mask ventilation or tracheal intubation. After confirmation of successful intubation with disposable capnography, the patient should be paralyzed (if this has not already been done) to prevent droplet contamination due to coughing.

We believe that airways of patients with SARS can be managed safely for both the care team and the patient (Table 3). Intubation should be considered early in the course of hypoxemic respiratory failure, with appropriate planning as we have outlined above and in Table 2.

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