Noninvasive ventilation initiation in clinical practice: A six-year prospective, observational study

Chris Harris RRT1, Refik Saskin MSc2, Karen EA Burns MD FRCP C MSc3,4

BACKGROUND: Despite evidence supporting the role of noninvasive ventilation (NIV) in diverse populations, few publications describe how NIV is used in clinical practice.

OBJECTIVE: To describe NIV initiation in a teaching hospital that has a guideline, and to characterize temporal changes in NIV initiation over time.

METHODS: A prospective, observational study of continuous positive airway pressure ventilation (CPAP) or bilevel NIV initiation from January 2000 to December 2005 was conducted. Registered respiratory therapists completed a one-page data collection form at NIV initiation.

RESULTS: Over a six-year period, NIV was initiated in 623 unique patients (531 bilevel NIV, 92 CPAP). Compared with bilevel NIV, CPAP was initiated more often using a nasal interface, with a machine owned by the patient, and for chronic conditions, especially obstructive sleep apnea. Whereas CPAP was frequently initiated and continued on the wards, bilevel NIV was most frequently initiated and continued in the emergency department, intensive care unit and the coronary care unit. Patients initiated on bilevel NIV were more likely to be female (OR 1.8, 95% CI 1.08 to 2.85; P=0.02) and to have an acute indication compared with CPAP initiations (OR 7.5, 95% CI 1.61 to 34.41; P=0.01). Bilevel NIV was initiated more often in the emergency department than in the intensive care unit (OR 5.8, 95% CI 0.89 to 38.17; P=0.07). Bilevel NIV initiation increased from 2000 to 2005.

CONCLUSIONS: The present study illustrates how NIV is used in clinical practice and confirms that NIV initiation has increased over time.

Key Words: Acute respiratory failure; Cohort study; Mechanical ventilation; Noninvasive ventilation; Positive pressure respiration

Noninvasive ventilation (NIV) provides an alternative option to the initiation of invasive mechanical ventilation in patients with acute respiratory failure (ARF). It enables clinicians to provide ventilatory support to patients while instituting medical management to reverse the conditions precipitating respiratory failure. Meta-analyses strongly support the use of NIV as an initial treatment in specific etiologies of ARF including severe exacerbations of chronic obstructive pulmonary disease (COPD) (1) and congestive heart failure (CHF) (2). The evidence supporting the use of NIV – in addition to standard therapy – in patients with hypoxic respiratory failure, is less convincing, demonstrating reductions in endotracheal intubation rate, intensive care unit (ICU) length of stay and mortality amid significant heterogeneity (3), in weaning (4) and in postextubation respiratory failure (5,6). Further evidence is required to clarify the role of NIV in these circumstances.

Despite increasing evidence supporting the role of NIV in specific populations in well-designed studies, few publications describe how NIV is actually used in clinical practice outside of the controlled clinical trial setting. Even fewer publications describe NIV use in the presence of a clinical practice guideline. Guidelines differ from protocols, which provide a set of sequential steps to standardize patient care and policies that are not necessarily based on best current evidence. Whereas, policies and protocols are often locally developed documents that involve administrative stakeholders (7), guidelines can be nationally or locally developed and modified. Guidelines represent systematically developed statements that integrate the best current evidence to guide clinicians in the care of patients for specific clinical circumstances (7).

Experiences with NIV in clinical practice may not mirror those in clinical trials because patients in clinical practice are
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less highly selected; interventions are applied, titrated and discontinued by staff with variable interest and expertise in their application; and monitoring is less rigorous (8). For these reasons, the results attained in clinical trials may not be realized in practice. The objectives of the present prospective, observational study were to describe how bilevel NIV is initiated in a university-affiliated teaching hospital that has a guideline for NIV initiation in place, and to characterize temporal changes in NIV initiation over time.

METHODS

Study design
A prospective, observational study of NIV initiation in a quaternary care centre over a six-year period from January 2000 to December 2005 was conducted. Episodes of NIV included initiation of continuous positive airway pressure ventilation (CPAP) or bilevel NIV. Registered respiratory therapists (RRTs) completed a one-page standardized data collection form at each NIV initiation (Appendix 1). The Research Ethics Board of the University of Western Ontario (London, Ontario) approved conduct of the present study.

Setting
The present study was conducted in a quaternary care, university-affiliated teaching hospital in Canada. RRT members of the Department of Respiratory Therapy (London Health Sciences Centre, London, Ontario) were responsible for NIV initiation. A physician’s order was required for NIV (either CPAP or bilevel) initiation. The type of NIV initiated and the initial settings were determined either by the RRT or in collaboration with a physician. While any physician could request NIV, an institutional guideline implemented early in the study period (April 2000) mandated a consultation with either the departments of pulmonary or critical care medicine to provide direction in cases for which NIV could be initiated and continued for supportive care (Appendix 2).

Population
All patients in whom NIV (either CPAP or bilevel) was initiated were included. Patients could be included in the present study on more than one occasion if they experienced separate episodes of respiratory failure necessitating NIV during the same hospital admission or during separate hospital admissions.

Data collection
A data collection form was developed to collect demographic data and highlight features of NIV initiation including initiation location (eg, ICU, coronary care unit [CCU], extended ICU, emergency department [ED], multiorgan transplant unit, neuro-observation unit or ‘other’ locations), and the date of initiation and discontinuation. A cardiac surgical recovery unit was opened in April 2005, and the data collection form was modified to include the cardiac surgical recovery unit as a potential site of NIV initiation. The data form documented information regarding the reason for initiation of treatment including one or more of obstructive sleep apnea (OSA), neuromuscular weakness, COPD exacerbation, chest wall deformity, CHF, central sleep apnea, central hypventilation syndrome or ARF. Information to characterize features of NIV initiation including the initial level of inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP), or CPAP, the initial mode used (spontaneous, timed or spontaneous/timed) and the fractional concentration of oxygen used at the time of NIV initiation, were gathered. Moreover, information regarding the nature of the application (acute versus chronic), proprietary ownership of the NIV machine (patient versus hospital), the type of interface used (nasal versus face mask) and whether the admitting service or an RRT requested the consultation with either the pulmonary or critical care departments, were collected. Finally, information related to patient outcomes including intubation, death, transfer to an alternate site for continued treatment and immediate or late NIV discontinuation outcome, was recorded. One author (CH) retrospectively reviewed charts for patients with incomplete or missing data to ascertain information regarding patient outcomes.

Statistical analysis
Descriptive statistics including means (± SDs) and proportions for continuous and binary measures, respectively, were reported. The median duration of NIV use was reported with its associated interquartile range. Continuous measures were compared using the Student’s t-test, and binary outcomes using either the χ² test or Fisher’s exact test when expected values were less than five. A P≤0.05 was considered to be statistically significant. Associations between CPAP and bilevel NIV use over time were assessed using the Student’s t-test. First-time initiations, representing independent events in statistical analyses describing the characteristics of NIV initiation, sites of NIV initiation and continued use, and the initiation of NIV over time between groups initiated on CPAP and bilevel NIV, were considered. Finally, a multivariate analysis was performed using generalized estimating equations to compute the OR and 95% CIs of bilevel NIV initiation based on age, sex, chronicity of the clinical condition, the etiology of respiratory failure, location of initiation and year of initiation compared with CPAP initiation. All analyses were performed using SAS version 9.1 (SAS Institute, USA).

RESULTS

Over the six-year observation period, NIV was initiated on 685 occasions (588 bilevel NIV, 97 CPAP). NIV was initiated on at least one occasion in 623 patients (531 bilevel NIV, 92 CPAP initiations). Of these, NIV was initiated in 568 patients on one occasion, 49 patients on two occasions, and on three or more occasions in six patients.

Characteristics of NIV initiation

Considering all first-time NIV initiations (n=623), the average age of patients in whom bilevel NIV was initiated was significantly greater than those in whom CPAP was initiated (71.8±14.2 years versus 61.1±12.5 years, respectively). Compared with bilevel NIV, CPAP was initiated significantly more often in men than in women (50.1% versus 83.7%, respectively; P<0.001). Significant differences among the reasons for initiation of CPAP and bilevel NIV were found. While bilevel NIV was most often initiated for ARF, CHF and COPD (52.2%, 36.9% and 15.4% of first-time initiations, respectively), CPAP was largely initiated for OSA (85.9% of first-time initiations). Bilevel NIV was infrequently initiated for neuromuscular weakness, OSA, central hypventilation, central
TABLE 1
Features of noninvasive ventilation initiation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CPAP (n=92)</th>
<th>Bilevel (n=531)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, n (% male)</td>
<td>77 (83.7)</td>
<td>266 (50.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age, years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;65</td>
<td>56 (60.9)</td>
<td>136 (25.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>65 to 79</td>
<td>31 (33.7)</td>
<td>219 (41.2)</td>
<td></td>
</tr>
<tr>
<td>&gt;79</td>
<td>5 (5.4)</td>
<td>176 (33.2)</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal</td>
<td>76 (82.6)</td>
<td>15 (2.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Face mask</td>
<td>16 (17.4)</td>
<td>516 (97.2)</td>
<td></td>
</tr>
<tr>
<td>Machine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient owned</td>
<td>37 (40.2)</td>
<td>4 (0.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hospital</td>
<td>55 (59.8)</td>
<td>527 (99.3)</td>
<td></td>
</tr>
<tr>
<td>Chronic use</td>
<td>75 (84.8)</td>
<td>42 (7.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Consultation requested by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3 (3.2)</td>
<td>16 (3.0)</td>
<td>0.25</td>
</tr>
<tr>
<td>RRT</td>
<td>39 (42.4)</td>
<td>169 (31.8)</td>
<td></td>
</tr>
<tr>
<td>Admitting team</td>
<td>48 (52.2)</td>
<td>329 (62.0)</td>
<td></td>
</tr>
<tr>
<td>Both RRT and admitting team</td>
<td>2 (2.2)</td>
<td>17 (3.2)</td>
<td></td>
</tr>
</tbody>
</table>

Data presented as n (%) unless indicated otherwise. CPAP Continuous positive airway pressure; RRT Registered respiratory therapist.

TABLE 2
Locations of noninvasive ventilation initiation and continued use

<table>
<thead>
<tr>
<th>Location</th>
<th>Initiation</th>
<th>Continued use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPAP (n=92)</td>
<td>Bilevel (n=531)</td>
</tr>
<tr>
<td>Emergency department</td>
<td>5 (5.4)</td>
<td>142 (26.7)</td>
</tr>
<tr>
<td>ICU</td>
<td>19 (20.7)</td>
<td>157 (29.6)</td>
</tr>
<tr>
<td>Coronary care unit</td>
<td>11 (12.0)</td>
<td>94 (17.7)</td>
</tr>
<tr>
<td>Extended ICU</td>
<td>1 (1.1)</td>
<td>7 (1.3)</td>
</tr>
<tr>
<td>Cardiac surgery recovery unit</td>
<td>2 (2.2)</td>
<td>16 (3.0)</td>
</tr>
<tr>
<td>Multiorgan transplant unit</td>
<td>3 (3.3)</td>
<td>31 (5.8)</td>
</tr>
<tr>
<td>Neuro-observation unit</td>
<td>4 (4.4)</td>
<td>24 (4.5)</td>
</tr>
<tr>
<td>Other locations</td>
<td>47 (51.1)</td>
<td>60 (11.3)</td>
</tr>
</tbody>
</table>

Data presented as n (%). CPAP Continuous positive airway pressure; ICU Intensive care unit.

Noninvasive ventilation initiation

apnea and chest wall disorders. Patients treated with bilevel NIV were initiated on a higher concentration of oxygen than patients initiated on CPAP (65.8±22.8 versus 33.3±12.3; P=0.001). Average IPAP and EPAP levels used to initiate bilevel NIV were 11.5±2.3 cmH2O and 5.7±1.4 cmH2O, compared with 8.9±2.6 cmH2O in CPAP patients with significant differences in end-expiratory pressure between groups (P<0.001). Bilevel NIV was almost exclusively initiated in timed mode (99.4%). The features pertaining to NIV initiation are presented in Table 1.

Sites of NIV initiation and continued use

Locations of NIV initiation and continued use are summarized in Table 2. Whereas CPAP was most frequently initiated and continued in ‘other’ locations, primarily on the wards, bilevel NIV was most frequently initiated and continued in the ICU, ED and CCU.

Initiation of NIV over time

Figure 1 depicts temporal trends in CPAP and bilevel NIV initiation. While the proportion of CPAP initiations exceeded bilevel NIV initiations from 2000 to 2003, bilevel NIV was initiated more frequently than CPAP thereafter, although the rate was not constant. Regarding indication for initiation, consistent increases in bilevel NIV initiation between 2000 and 2005 were noted for episodes of ARF and exacerbations of COPD.

Multivariate analysis

In the multivariate analysis, women were more likely than men to undergo bilevel NIV initiation (OR 1.8, 95% CI 1.08 to 2.85; P=0.02). Bilevel NIV was more likely to be initiated in the ED than in the ICU (OR 5.8, 95% CI 0.89 to 38.17; P=0.07) and more often initiated for acute than for chronic conditions (OR 7.5, 95% CI 1.61 to 34.41; P=0.01). Compared with CPAP initiation, significant differences were not found in bilevel NIV initiation among patients between 65 and 79 years of age, and those older than 79 years of age (using the 65 years of age and younger group as the referent category). Compared with CPAP, patients were less likely to undergo bilevel NIV initiated for OSA (OR 20, 95% CI 4.76 to 100; P≤0.001) using COPD as the referent category. Bilevel NIV was more likely to be initiated in 2005 compared with 2000 (OR 32.5, 95% CI 1.07 to 982.56; P=0.045).

Processes and outcomes

The admitting team requested pulmonary or critical care consultations, in accordance with the institutional guideline (48 of 92 [52.2%] and 329 of 531 [62.0%]) for CPAP and bilevel NIV initiation, compared with 39 of 92 [42.4%] and 169 of 531 [31.8%] for consultations requested by RRTs). A consultation was not requested by either service in 19 of 92 (21.8%) for bilevel NIV initiation, compared with 39 of 92 (42.4%) and 169 of 531 (31.8%) for CPAP.

More bilevel-treated patients underwent early discontinuation (shortly after initiation) than CPAP-treated patients (24 of 531 [4.5%] versus two of 92 [2.2%]; P=0.30); CPAP was rarely discontinued at later time points (16 of 92 [17.4%]). Compared with CPAP-treated patients, more bilevel-treated patients required intubation (three of 92 [3.3%] versus 124 of 531 [23.4%]; P<0.001) and died (one of 92 [1.1%] versus 26 of 531 [4.9%]; P=0.04) during transfer to sites of continued treatment.

DISCUSSION

We found several important differences in how, where and in whom CPAP and bilevel NIV were initiated in our observational study. Compared with bilevel NIV, CPAP was initiated more often using a nasal interface – with a machine owned by the patient – and for chronic conditions, especially OSA. Bilevel NIV was most often initiated for ARF, CHF and exacerbations of COPD. Whereas CPAP was most frequently initiated and continued in other locations – primarily on the wards – bilevel NIV was most frequently initiated and continued in the ICU, ED and CCU. Compared with CPAP, patients initiated on bilevel NIV were 1.8 times more likely to be female (95% CI 1.08 to 2.85; P=0.02) and 7.5 times more likely to have an acute condition (95% CI 1.61 to 34.41; P=0.01). Bilevel NIV was 5.8 times more likely to be initiated in the ED than in the ICU (95% CI 0.89 to 38.17; P=0.07) and 20 times less likely to be initiated for OSA than for CPAP (95% CI 4.76 to 100; P≤0.001). We found a significant association between bilevel NIV initiation and time,
with bilevel NIV being 32.5 times more likely to be initiated in 2005 than in 2000 (95% CI 1.07 to 982.56; \( P=0.045 \)) (Table 3). These findings provide insight into how bilevel NIV is initiated in a teaching hospital that has a guideline in place, and characterizes temporal changes in NIV initiation over time.

The present study has several strengths. First, it is the largest observational study conducted to date focusing on NIV initiation in practice. Second, the study highlighted important differences in how, where and in whom NIV is initiated in a teaching hospital with a guideline in place to direct its use. Third, our study demonstrated that bilevel NIV initiation increased significantly between 2000 and 2005 amid increasing literature supporting the benefits of NIV use in specific populations.

Our prospective cohort study, however, also has weaknesses. First, RRTs collected a minimum dataset on a standardized one-page data collection form each time NIV was initiated. While the minimum data set was designed to address the primary research question, it did not contain additional information to describe illness severity at the time of NIV initiation. Second, we included ARF among our indications for NIV initiation, recognizing that clinicians may be unable to accurately characterize the principal etiology of respiratory failure at the time of NIV initiation. Consequently, RRTs could have selected more than one diagnostic category at the time of NIV initiation. Our prospective data collection, therefore, mirrors the clinical uncertainty that exists in ascribing a single etiology of respiratory failure at the time of NIV initiation. Third, consistent with the research question posed, we did not limit our data collection to patients with ARF, making direct comparisons of our study population to those in the literature difficult. Finally, we retrospectively reviewed charts with missing information to ascertain information regarding outcomes. Despite attempts to ensure uniformity (eg, a single author reviewing charts), data abstraction may have been subject to recall bias.

Our results share both common features and differences with other prospective (9) and retrospective (10,11) observational studies of NIV use in clinical practice. Similar to Paus-Jenssens et al (9), who reported on 75 NIV initiations in 71 patients (bilevel NIV [85%] and CPAP [15%]), we noted that 85.8% and of all NIV initiations and 85.2% of first-time NIV initiations involved bilevel NIV. With regard to initial application, we noted that CPAP was most often initiated with a nasal mask, while bilevel NIV was usually initiated with a face mask.
impede appropriate and safe NIV use (16). While it may be justifiable to continue CPAP – a technology frequently managed by patients in the domiciliary setting on hospital wards – sufficient resources should be available to enable clinicians to provide bilevel NIV in areas with enhanced monitoring capacity and appropriately trained personnel. Further prospective study is required to characterize the intensity of monitoring required for patients initiated on NIV.

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CONFLICT OF INTEREST: The authors have no competing interests to declare.

DISCLOSURE: None of the authors has a financial relationship with a commercial entity that has an interest in the subject of the manuscript.

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APPENDIX 1

<table>
<thead>
<tr>
<th>LHSC - University Hospital RESPIRATORY THERAPY SERVICES BIPAP/NCPAP Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: <strong><strong><strong><strong><strong><strong>/</strong></strong>_______/</strong></strong></strong></strong>___  Time: _______________ HRS</td>
</tr>
<tr>
<td>Location of initiation:</td>
</tr>
<tr>
<td>□ RSU  □ CSRU  □ CCU  □ Bay 6/EICU  □ EMERG  □ HOTU  □ A7-204  □ OTHER (specify):</td>
</tr>
<tr>
<td>Diagnosis/Reason for treatment (check that apply)</td>
</tr>
<tr>
<td>□ Obstructive Sleep Apnea  □ Neuromuscular weakness  □ COPD Exacerbation</td>
</tr>
<tr>
<td>□ Central Hypoventilation Syndrome  □ Other (Specify):</td>
</tr>
<tr>
<td>Application: □ Chronic Use  □ Acute Use</td>
</tr>
<tr>
<td>□ Patient Machine vs. □ Hospital Machine</td>
</tr>
<tr>
<td>□ Nasal Mask vs. □ Face Mask</td>
</tr>
<tr>
<td>Initial Settings:</td>
</tr>
<tr>
<td>□ IPAP: _____ cm H2O vs. □ EPAP (CPAP): _____ cm H2O</td>
</tr>
<tr>
<td>□ Mode: □ ST  □ S  □ T</td>
</tr>
<tr>
<td>□ Oxygen: _____________ LPM or ______%</td>
</tr>
<tr>
<td>Orders: □ By ER physician  □ BY ICU Physician</td>
</tr>
<tr>
<td>If admitted to the floors:</td>
</tr>
<tr>
<td>□ Respiratory consult ordered by admitting service/date: ______________</td>
</tr>
<tr>
<td>□ Respiratory Consult requested by RRT/date: ______________</td>
</tr>
<tr>
<td>Transfer from initial area to/with</td>
</tr>
<tr>
<td>□ MSU  □ CSRU  □ CCU  □ Bay 6/EICU  □ EMERG  □ HOTU  □ A7-204  □ OTHER (specify):</td>
</tr>
<tr>
<td>□ BIPAP/NCPAP  □ Not Transferred with BIPAP/NCPAP</td>
</tr>
<tr>
<td>If int’d, no longer indicated  □ BIPAP/NCPAP Discontinued: <strong><strong><strong><strong><strong><strong>/</strong></strong>_______/</strong></strong></strong></strong>___  Time: _______________ HRS</td>
</tr>
</tbody>
</table>

Can Respir J Vol 17 No 3 May/June 2010
Non-invasive Ventilation Guidelines (External to the ICU)

<table>
<thead>
<tr>
<th>Section:</th>
<th>Patient Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy #:</td>
<td>PCC033</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Chair, Medical Advisory Committee</td>
</tr>
</tbody>
</table>

This document is a GUIDELINE, not a policy.

BACKGROUND

The use of noninvasive positive pressure ventilation, the delivery of positive pressure mechanical ventilation to the lungs without endotracheal intubation, is increasing among patients with acute and chronic respiratory failure. This is due, in part, to its relative ease of use, lower costs and morbidity-sparing potential compared with standard invasive positive pressure ventilation.

For the purpose of this guideline, non-invasive ventilation refers to non-invasive positive pressure ventilation (NIPPV) delivered via nasal or face mask for acute treatment. "BiPAP®" is a registered product name. Chronic use, ie patients using CPAP for obstructive sleep apnea, do not fall within the parameters of this guideline.

Non-invasive positive pressure ventilatory support modes are designed to provide inspiratory and/or expiratory positive airway pressure. It is a temporary therapy which supports the patient until the underlying cause is recognized and, if possible, treated.

NIPPV is a mode of ventilation which augments breathing— it is not a life support mode. Any patient on NIPPV must be able to sustain their own spontaneous ventilation. NIPPV can help the patient by decreasing the work of breathing, improving ventilation, promoting improved oxygenation and opening and maintaining the stability of the airways.

**Indications for the use of non-invasive ventilation:**

NIPPV is an option for patients who exhibit a need for partial ventilatory support in cases such as:

- Acute respiratory failure with associated
  - Acute respiratory acidosis
  - Respiratory distress
  - Use of accessory muscles or paradoxical breathing
- Congestive heart failure

**Contraindications to the use of non-invasive ventilation**

- Inadequate respiratory drive
- Medically unstable patient (hypotensive, shock, acute MI, uncontrolled cardiac arrhythmia, uncontrolled GI bleed, rapidly progressive neuromuscular weakness)
- Unable to control airway or control secretions
- Unable to fit mask
- Uncooperative patient
- Stridor as the main cause of dyspnea
- Patient with decreased level of consciousness or restrained/imobilized

Continued on next page
Use of non-invasive ventilation in patients who are designated as DNR
Non invasive ventilation is not contraindicated in patients who have made the choice to have a DNR order. In this scenario, the use of non-invasive ventilation needs to be discussed with the patient and there should be clarification about the limits of resuscitation if the patient continues to deteriorate while on non-invasive ventilation.

Use of non-invasive ventilation in patients having palliative care Generally, due to the limited number of respiratory therapists in the hospital and the number of non-invasive ventilation units, the use of non invasive ventilation is not indicated in patients in this scenario. After discussion between the attending physician and the consultant respiriologist there may be very unusual situations when this occurs.

Patients on acute non-invasive ventilation are cared for in designated patient care areas of LHSC and SJHC. They are:

**LHSC**
- SSC - 4MSX
- UC - 7 Neuro, MOTU, CCU
- Emergency Department and ICU at all campuses

**SJHC**
- A6
- Emergency Department and ICU

Care is restricted to these areas due to the availability of:
- nurses trained by Respiratory Therapy in care of the patient using non-invasive ventilation
- oxygen (SaO2) and cardiac monitoring

Patients using non-invasive ventilation on a chronic basis at home may be managed in any area of the hospital.

**PURPOSE**
To ensure consistent and safe care of patients requiring non-invasive ventilation.

**PROCEDURE** (Also see flowchart)
Patients may be ventilated non-invasively in the Emergency Department, but when transferred out of the ER, the following procedure must be followed:

- All patients being considered for non-invasive ventilation must be referred to Respiriology for a consult. The referring physician and the Respiriologist will discuss the need for a monitored bed.
- The Respiriologist is responsible for writing the orders for non-invasive ventilation including the maximum settings, goals of therapy and the plan for evaluation.
- The Registered Respiratory Therapist (RRT) initiates the therapy, adjusts and manages settings and assesses the patient as required, depending on the medical status of the patient. Respiratory Therapy has department-specific guidelines for monitoring of a patient on NIPPV and for the equipment used.
- The Registered Nurse monitors the ongoing therapy and assesses the patient as ordered depending on the medical status of the patient.
- If a bed in an area where the nursing staff is trained in caring for a patient with non-invasive ventilation is not available, the patient is referred to ICU for consultation and possible admission.

Continued on next page
City-Wide Guidelines for the Use of Non-Invasive Ventilation - External to ICU

See guidelines for details

Note: Patient may be non-invasively ventilated in the Emergency Department, but these guidelines apply upon transfer.

Patient identified for therapy

Consult Respirology

Discuss with Respirologist whether patient needs monitored bed

Availability of trained nurses?

No → Consult ICU for possible admission

Yes → Transfer patient to designated patient care area:
   LHSC - SSC: 4MSX, CCU
   LHSC - UC: 7 Neuro, MOTU, CCU
   SJHC: A6

Respirology: Writes orders for therapy with max settings, goals of therapy, plan for evaluation
RRT: initiates therapy, adjusts, manages settings, assess patient
RN: monitors therapy, assess patient

CCU Critical care unit; CPAP Continuous positive airway pressure; DNR Do not resuscitate; GI Gastrointestinal; ICU Intensive care unit; LHSC London Health Sciences Centre; MOTU Multiorgan transplant unit; MSX Middlesex; Neuro Neuro-observation unit; RN Registered nurse; RRT Registered respiratory therapist; SJHC St Joseph's Health Centre; SSC South Street Campus; UC University Campus
REFERENCES
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