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RESEARCH ARTICLE

How Do Hospitalized Patients Tolerate Non-Invasive Positive Pressure Ventilation: A Pilot Patient-Centered Survey

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Abstract

Background: Non-invasive positive pressure ventilation (NIPPV) is increasingly used to treat in-patients with acute respiratory failure. NIPPV tolerability is often overlooked because it is usually thought of as a life-saving intervention. Studies examining patient tolerability of NIPPV are scarce and mostly qualitative.

Objective: Our objective was to understand the hospitalized patient's experiences and NIPPV tolerability.

Methods: We conducted a pilot study using a novel NIPPV Tolerability Survey tool and conducted a cross-sectional study. Subjects were hospitalized patients admitted for acute respiratory failure, over age 18 and able to self-report. Primary endpoints were willingness for ongoing NIPPV use and future NIPPV use. Secondary endpoints were symptom relief, mask discomfort, and ADL limitations.

Results: We found that older adults (≥ 65, N = 137) were less willing to continue using NIPPV during the current stay when compared to younger adults (< 64, N = 41) (55% *vs.* 76%, p = 0.02). Older subjects reported significantly more mask discomfort, a lower rate of feeling better overall and less improvement in sleep.

Conclusions: We found significant device discomfort and poor tolerability especially in older adults, which suggests that reassessments should be performed frequently and goals of care should be addressed. Our NIPPV Tolerability Survey tool may be useful for hospital clinicians to assess how patients tolerate NIPPV and promote patient-centered care.

Keywords

Non-invasive positive pressure ventilation, Tolerability, Acute respiratory failure, Older adults, Goals of care, Patient experience

Abbreviations

NIPPV: Non-Invasive Positive Pressure Ventilation; NYPQ: New York-Presbyterian Queens; ADL: Activities of Daily Living; BiPAP: Bi-level Positive Airway Pressure; EMR: Electronic Medical Records

Introduction

Physicians and clinical providers frequently use non-invasive positive pressure ventilation (NIPPV) to treat patients with acute respiratory failure [1]. Prior studies have shown that NIPPV use may reduce respiratory distress by reducing the work of breathing, improving alveolar ventilation and hypercapnia. Use of NIPPV in the acute-care setting may reduce the incidence of endotracheal intubation and increase both ICU and hospital survival [2,3]. NIPPV use has increased

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significantly since its invention and clinical use in 1981 [4]. Despite this, evidence about its effect on patient experience remains limited.

Previous descriptive studies suggested the following patient concerns: First, patients may experience difficulty comprehending both the benefits and burdens of NIPPV [5,6]. Potential relief of dyspnea must be weighed against mask discomfort, claustrophobia, air leaks, and noise [5-7]. Second, patients may face the fear of unfamiliar technology, pain and suffering, or death and dying [6]. Third, patients may perceive a low level of involvement in treatment decision making, a lack of alternatives, and limited opportunities for discussion given the urgency of the initial presentation [6,8]. Data suggest that some of these concerns, particularly anxiety and loss of control may be addressed by engaging with healthcare professionals [6-10]. Prior studies also found that NIPPV discomfort can be improved by using alternative mask designs or NIPPV titration strategies [11-14].

Most of these patient-experience oriented studies were limited by small sample size or inclusion of only patients with one diagnosis (e.g. COPD, cancer). Moreover, because these studies were performed in non-US patient populations, these findings may be less generalizable to patients in the US [5-10,15].

This study aims to explore the patient's perspective on NIPPV use in the hospital setting in a larger sample of ethnically diverse patients with a variety of medical diagnoses. We examined specific patient characteristics that were associated with tolerance of acute use of NIPPV.

Methods

Study design, settings, and participants

The study was approved by the New York-Presbyterian Queens (NYPQ) Institutional Review Board. This pilot cross-sectional survey study was performed in an urban, mixed academic-community hospital from October 2017 through February 2018. NYPQ is a 500-bed community teaching hospital located in Queens County, NY, the most racially/ethnically diverse community in the US [16].

Development of survey and pilot testing

An interdisciplinary team consisting of Geriatrics/Palliative Care, Pulmonary/Critical Care, Internal Medicine, and Respiratory Therapy developed a 13-item survey instrument (NIPPV Tolerability Survey). Initial survey questions were piloted with a small number of admitted patients for understandability. The survey consisted of four sections: Relief of symptoms, mask discomfort/anxiety, impact on activities of daily living (ADL), and willingness for ongoing and future NIPPV use. In the survey, we referred to NIPPV as bi-level positive airway pressure (BiPAP), as it is commonly known in our institution. Based on the pilot testing results, we eliminated several questions due to poor understandability or redundancy. We reworded other questions for clarity, based on feedback (See Supplement 1).

Eligible subjects included all admitted patients aged 18 and over, placed on NIPPV for acute respiratory failure, able to communicate and self-report. Interpretation service was used if subject's primary language was not English. NIPPV subjects were identified in consultation with Respiratory Therapy personnel through use of the NIPPV order set in the electronic medical record (EMR). Exclusion criteria included refusal to participate, inability to respond to questions, having been interviewed previously during the same admission, use of chronic CPAP, or under 18-years-old.

Due to limited staffing, we used a convenience sampling approach: Once per week conducted by trained research assistants, all eligible subjects identified on those days were invited to participate. The survey was administered after obtaining consent. Subjects were asked to rate each concern using a Likert-type scale. Some questions asked for yes, no, and unsure options and some asked for elaboration when prompted. EMR was used to collect data including patient demographics, primary diagnoses, code status, and disposition.

Main outcomes and predictors

We had observed anecdotally and clinically that many older patients did not appear to tolerate NIPPV and would like to explore whether there were age-associated differences. Therefore, we set out to assess the following two primary outcomes: Subject's willingness for ongoing use of NIPPV and willingness for future use of NIPPV. Secondary outcomes consisted of relief of symptoms such as breathing, sleep, alertness, and feeling better overall, mask discomfort/anxiety, and limitations in ADL. Potential predictors included age, gender, race/ethnicity, and code status.

Statistical methods

Descriptive statistics were calculated to characterize the study cohort. The chi-square test or Fisher's exact was used, as appropriate, to compare demographic characteristics, NIPPV characteristics, and disposition status between the defined age groups of interest. Multivariable logistic regression analysis was performed to evaluate the independent effect of age group on ongoing use of NIPPV, after controlling for race, gender, and code status. Adjusted odds ratios and 95% confidence intervals for all variables of interest were estimated from the multivariable model. All p-values are two-sided with statistical significance evaluated at the 0.05 alpha level. Ninety-five percent confidence intervals for all parameters of interest were calculated to assess the precision of the obtained estimates. All analyses were performed in SAS Version 9.4 (SAS Institute, Inc., Cary, NC) and Stata Version 15.0 (Stata Corp, College Station, TX).

Table 1: Baseline characteristics comparing younger adults *vs*. older adults.

Baseline characteristics	Younger adults (64 or younger) N (%)	Older adults (65 or older) N (%)	All, N (%)	P-Value
Number of subjects	41 (23%)	137 (77%)	178	
Mean age (Range)	54 (30-64)	78 (65-100)	72 (30-100)	
Gender (Female/Male)				0.12
Female	18 (44)	79 (58)	97 (55)	
Male	23 (56)	58 (42)	81 (45)	
Race/Ethnicity				0.01
Caucasian	12 (29)	69 (50)	81 (46)	
African American	15 (37)	17 (12)	32 (18)	
Asian	5 (12)	24 (18)	29 (16)	
Hispanic	2 (5)	9 (7)	11 (6)	
Others	7 (17)	18 (13)	25 (14)	
Code status				0.13
Full Code	38 (93)	113 (83)	151 (85)	
DNR/DNI	3 (7)	23 (17)	26 (15)	
Reason for NIPPV				0.07
Acute respiratory failure	9 (22)	53 (39)	62 (35)	
Acute CHF exacerbation	9 (22)	37 (27)	46 (26)	
Acute COPD exacerbation	10 (24)	24 (18)	34 (19)	
Other diagnoses*	13 (32)	23 (17)	36 (20)	

*Other diagnoses include: Sepsis (8 cases), Diabetic complications (4), syncope (3), hematologic conditions (3), gastrointestinal complications (3), neurologic complications (3), hyponatremia (2), ileus (2), advanced renal disease (2), other infections (2), metabolic complications (2), other (2).

Results

General

A total of 178 subjects (out of 511 potential ones) participated, with survey response rate of 35%. Participants had an average age of 72 years (range 30-100). The sample was ethnically diverse, and there was a statistically significant difference in racial and ethnic make-up between the younger and older populations with a greater proportion of African Americans in the younger group (Table 1). In terms of disposition at discharge, most subjects (53%) were discharged home, 20% to nursing home, while 7% died in the hospital.

Comparing younger vs. older subjects

We found that older adults were less willing to continue using NIPPV acutely during the current stay (76% *vs.* 55%, p = 0.02). However, when asked about acute NIPPV use in the future, we found no significant difference (83% *vs.* 70%, p = 0.10) (Table 2).

In terms of symptoms, older subjects reported significantly more mask discomfort (69% *vs.* 41%, p = 0.01). Older subjects also reported a lower rate of feeling better overall (73% *vs.* 90%, p = 0.02), and less improvement in sleep (51% *vs.* 68%, p < 0.05). There was no statistical difference regarding eating, talking, and mobility.

Multivariable logistic regression modeling was used to evaluate the independent effect of age group on ongoing NIPPV use, controlling for gender, ethnicity, and code status. The analysis showed that younger age was independently and significantly predictive of willingness to continue current NIPPV use (OR = 2.5, P = 0.03). Gender, race/ethnicity, and presence of a do not resuscitate/do not intubate (DNR/DNI) order were not significantly predictive.

Discussion

In this study of hospitalized adults with acute respiratory failure with a variety of diagnoses, we found that older adults reported NIPPV to be less comfortable and were less willing to use it in the present compared to younger adults. However, this did not affect their willingness to potentially use NIPPV in the future. Gender, race/ethnicity, and having a DNR/DNI order were not predictive of willingness to continue NIPPV use. Our results confirm prior findings from smaller studies that reported significant mask or device discomfort. These results also suggest potential for palliative care interventions to enhance communication, expectations, and goals of care discussions.

This study has limitations. First, the survey instrument has not been validated. Second, the study design is susceptible to sampling bias. Last, the management and communication with patients regarding NIPPV

Table 2: NIPPV tolerability comparing younger *vs*. older adults.

Primary and Secondary outcomes	Younger adults (64 or younger) N (%)	Older adults (65 or older) N (%)	All, N (%)	P-Value
Number of subjects	41 (23)	137 (77)	178	
Willingness to use NIPPV				
Ongoing NIPPV use	31 (76)	75 (55)	106 (60)	0.02
Future NIPPV use	34 (83)	95 (70)	129 (73)	0.10
Symptom relief				
Improve breathing	37 (90)	114 (83)	151 (85)	0.27
Improve sleep	28 (68)	70 (51)	98 (55)	0.052
Improve alertness	21 (51)	55 (40)	76 (43)	0.21
Felt better overall	37 (90)	100 (73)	137 (77)	0.02
Discomfort and anxiety				
Mask discomfort	17 (41)	94 (69)	111 (62)	0.002
Worsen anxiety	7/9 (78)	34/44 (77)	41/53 (77)	0.99
ADL limitations				
Movement limitations	20 (49)	62 (45)	82 (46)	0.69
Eating limitations	26 (63)	82 (60)	108 (61)	0.68
Talking limitations	26 (63)	94 (69)	120 (67)	0.533

expectations was not standardized.

This study adds to the existing literature in that it is a quantitative study involving a large number of subjects with multiple diagnoses. Our outcomes were centered on the patient's experience. The ethnic and age diversity of our subjects suggest that the findings may be generalizable.

Our findings offer preliminary clinical insights for hospital-based clinicians. First, be aware that older patients may report fewer benefits and express a greater desire to discontinue NIPPV use; clinicians should consider discussing goals of care with such patients, weighing burdens and benefits. Second, older adults may report more device discomfort, requiring more attention to mask/device adjustment and more frequent reassessment. Third, clinicians should offer NIPPV without bias from patient's prior experiences or racial/ethnic background. Fourth, remember that the criteria for offering NIPPV should not be dependent on patient's code status. Fifth, frequent and timely reassessments can help improve care and safety for hospitalized patients with geriatric vulnerabilities. Lastly, patients having difficulty tolerating NIPPV may be good candidates for palliative care consultation.

Conclusion

Clinicians may overlook patient's tolerability to NIPPV because NIPPV is usually thought of as a life-saving intervention. We found significant device discomfort and poor tolerability especially in older adults, which suggests that reassessments should be performed frequently and goals of care should be addressed. Our NIPPV Tolerability Survey tool may be useful for hospital clinicians to assess how patients tolerate NIPPV and promote patient-centered care.

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Conflicts of Interest

The authors have no conflict.

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References

1. Pierson DJ (2009) History and epidemiology of noninvasive ventilation in the acute-care setting. Respir Care 54: 40-52.
2. Khilnani GC, Banga A (2008) Noninvasive ventilation in patients with chronic obstructive airway disease. Int J Chron Obstruct Pulmon Dis 3: 351-357.

3. Yim K, Liu EJ, Fleming RA, Brady T (2005) Outcome and survival in hypercarbic respiratory failure from COPD treated with non-invasive ventilation (NIV). Chest 128: 256S.

4. Antonescu Turcu A, Parthasarathy S (2010) CPAP and bi-level PAP therapy: New and established roles. Respir Care 55: 1216-1229.

5. Smith TA, Agar M, Jenkins CR, Ingham JM, Davidson PM (2019) Experience of acute noninvasive ventilation- insights from 'Behind the Mask': A qualitative study. BMJ Support Palliat Care 9: e11.

6. Ngandu H, Gale N, Hopkinson JB (2016) Experiences of noninvasive ventilation in adults with hypercapnic respiratory failure: A review of evidence. Eur Respir Rev 25: 451-471.

7. Ando H, Williams C, Angus RM, Thornton EW, Chakrabarti B, et al. (2015) Why don't they accept non□invasive ventilation? Insight into the interpersonal perspectives of patients with motor neurone disease. Br J Health Psychol 20: 341-359.

8. Cabrini L, Moizo E, Nicelli E, Licini G, Turi S, et al. (2012) Noninvasive ventilation outside the intensive care unit from the patient point of view: A pilot study. Respir Care 57: 704-709.

9. Christensen HM, Huniche L, Titlestad IL (2018) Involvement of patients perspectives on treatment with noninvasive ventilation in patients with chronic obstructive pulmonary disease-A qualitative study. J Clin Nurs 27: 61-69.

10. Torheim H, Gjengedal E (2010) How to cope with the mask? Experiences of mask treatment in patients with acute chronic obstructive pulmonary disease-exacerbations. Scand J Caring Sci 24: 499-506.

11. Girault C, Briel A, Benichou J, Hellot MF, Dachraoui F, et al. (2009) Interface strategy during noninvasive positive pressure ventilation for hypercapnic acute respiratory failure. Crit Care Med 37: 124-131.

12. Roy B, Cordova FC, Travaline JM, D'Alonzo GE Jr, Criner GJ (2007) Full face mask for noninvasive positive- pressure ventilation in patients with acute respiratory failure. J Am Osteopath Assoc 107: 148-156.

13. Sadeghi S, Fakharian A, Nasri P, Kiani A (2017) Comparison of comfort and effectiveness of total face mask and oronasal mask in noninvasive positive pressure ventilation in patients with acute respiratory failure: A Clinical Trial. Can Respir J 2017: 2048032.

14. Meduri GU, Turner RE, Abou Shala N, Wunderink R, Tolley E (1996) Noninvasive positive pressure ventilation via face mask. First-line intervention in patients with acute hypercapnic and hypoxemic respiratory failure. Chest 109: 179-193.

15. Beckert L, Wiseman R, Pitama S, Landers A (2016) What can we learn from patients to improve their non-invasive ventilation experience? 'It was unpleasant; if I was offered it again, I would do what I was told'. BMJ Support Palliat Care 10: e7.

16. Lubin G (2019) Welcome to the language capital of the world: Queens, New York. World Economic Forum.