Feasibility and Limitations of Proning Protocol for Nonintubated Patients With COVID-19

Benjamin Shoults, BA[1] [iD], Mary Barber, BS[2], Lucia Millham, BA[2], Maaz Mulla, BS[2], Natasha Nanji, BS[3], Grant Steele, BA[2], Tyler Peck, MD[1], Patrick Smithedajkul, MD[4], Christopher Worsham, MD[1], Paul Currier, MD, MPH[1], and Rebecca A Raphaely, MD[1]

Abstract

Proning awake patients with COVID-19 is associated with lower mortality and intubation rates. However, these studies also demonstrate low participation rates and tolerance of awake proning. In this study, we attempt to understand barriers to proning. Medical and dental students surveyed nonintubated patients to understand factors affecting adherence to a proning protocol. Only patients who discussed proning with their medical team attempted the practice. Eight of nine patients who were informed about benefits of proning attempted the maneuver. Discomfort was the primary reason patients stopped proning. Addressing discomfort and implementing systematic patient education may increase adherence to proning.

Keywords

COVID-19, proning, communication, quality improvement

Introduction

Patients infected with the novel coronavirus 2019 (COVID-19) are at risk of developing acute respiratory distress syndrome. Multiple small studies, both retrospective and prospective, have attempted to assess the efficacy of awake proning in COVID-19 (1–7). One retrospective study of 10 patients found that 1 hour of awake proning led to improved oxygen saturation and a decreased respiratory rate (3). Caputo et al found that 5 minutes of awake proning in 50 patients who visited the emergency department improved median SpO_2 from 84% to 94% (8). Another study found that awake proning improved oxygenation as measured by PaO_2/FIO_2 (5). These studies either do not assess barriers to proning or note poor tolerance of awake proning in a significant proportion of the population. One such study states that only 40 of 105 patients tolerated awake proning, while another found that only 11 out of 48 patients tolerated regular proning (1,9). In this mixed-methods quality improvement study, we aim to evaluate the patient experience of awake proning and understand the reasoning behind poor tolerance through phone interviews conducted by medical and dental school students. By understanding patient perspectives on proning and implementation of proning protocols, we hope to facilitate future research and implementation efforts related to improving the patient experience of prone positioning in nonintubated patients.

Methods

This study was performed at Massachusetts General Hospital from April 27, 2020, to May 20, 2020. Interviews were conducted over the phone. Inclusion criteria were age >18 years, tested positive for COVID-19 (reverse transcription polymerase chain reaction), and diagnosis of viral

[1] Pulmonary and Critical Care, Massachusetts General Hospital, Boston, MA, USA
[2] Harvard Medical School, Boston, MA, USA
[3] Harvard School of Dental Medicine, Boston, MA, USA
[4] Internal Medicine, Massachusetts General Hospital, Boston, MA, USA

Corresponding Author:
Benjamin Shoults, Pulmonary and Critical Care, Massachusetts General Hospital, Bulfinch 148, 55 Fruit Street, Boston, MA 02114, USA.
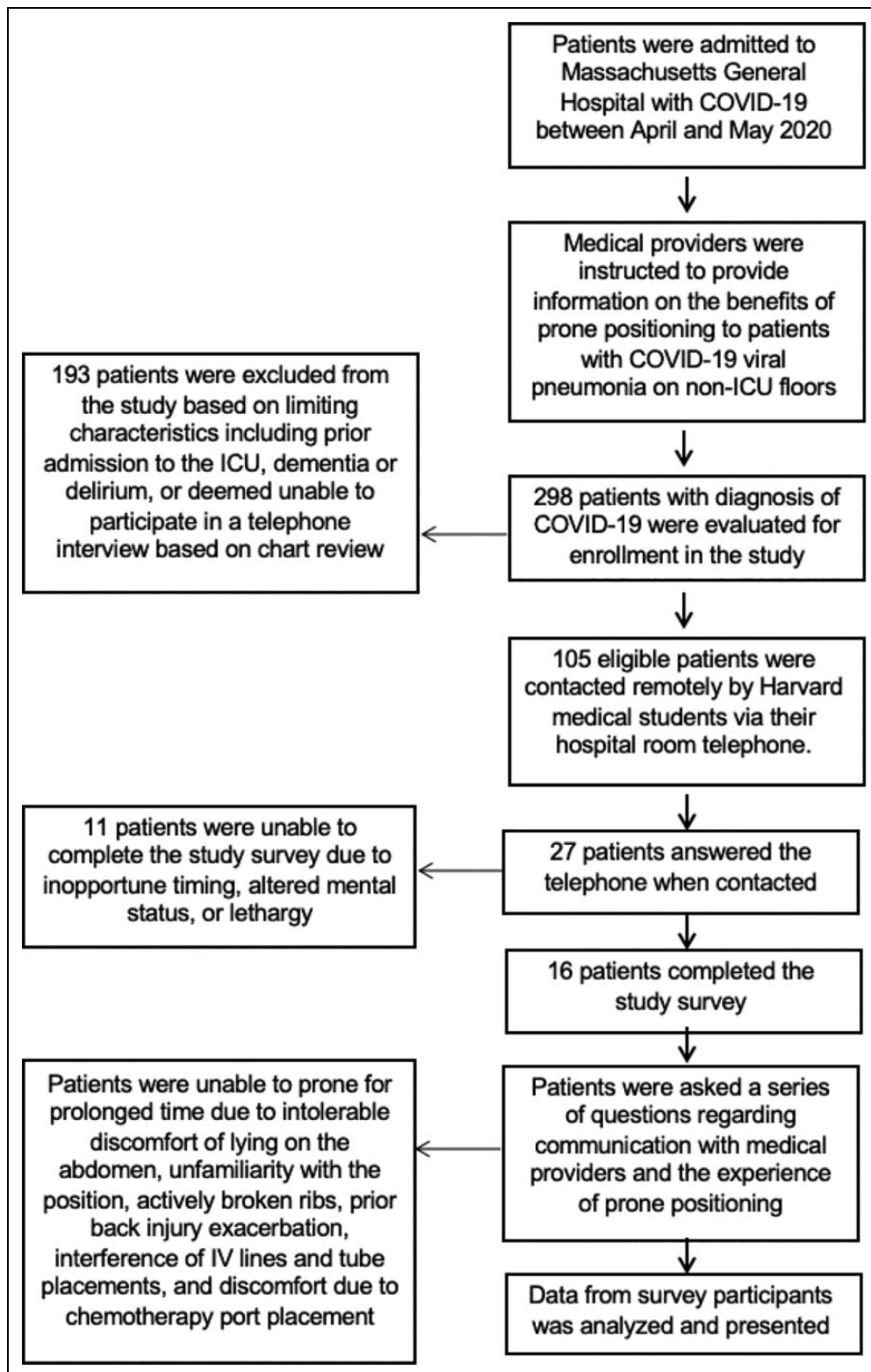Email: bshoults@partners.org

Patients were admitted to Massachusetts General Hospital with COVID-19 between April and May 2020

↓

Medical providers were instructed to provide information on the benefits of prone positioning to patients with COVID-19 viral pneumonia on non-ICU floors

↓

193 patients were excluded from the study based on limiting characteristics including prior admission to the ICU, dementia or delirium, or deemed unable to participate in a telephone interview based on chart review ← **298 patients with diagnosis of COVID-19 were evaluated for enrollment in the study**

↓

105 eligible patients were contacted remotely by Harvard medical students via their hospital room telephone.

↓

11 patients were unable to complete the study survey due to inopportune timing, altered mental status, or lethargy ← **27 patients answered the telephone when contacted**

↓

16 patients completed the study survey

↓

Patients were unable to prone for prolonged time due to intolerable discomfort of lying on the abdomen, unfamiliarity with the position, actively broken ribs, prior back injury exacerbation, interference of IV lines and tube placements, and discomfort due to chemotherapy port placement ← **Patients were asked a series of questions regarding communication with medical providers and the experience of prone positioning**

↓

Data from survey participants was analyzed and presented

Figure 1. Workflow of study protocol.

pneumonia defined by oxygen requirement and/or chest imaging with bilateral pulmonary opacities. Patients were excluded based on need for intensive care unit (ICU) admission, hospitalization >14 days, delirium or dementia indicated by clinical notes in the medical record, or if they were deemed inappropriate for interview by bedside nursing staff.

Patient demographics were collected by electronic medical record review. Physiological measurements were

Table 1. Patient Demographics and Characteristics on Day of Phone Call.

				Patient Characteristics					Day of Survey Evaluation						
Patient No.	Age (years)	Sex	Preferred Language	BMI (kg/m²)	Comorbidities[a]	Orthopedic Concerns	Day of Admission	Days of Symptom Onset to Presentation	O₂ Delivery (L)	Respiratory Rate (breaths/min)	SpO₂ (%)	SOFA Score	Patient Informed of Proning Benefits	Patient Proned in the Past 24 Hours	Average Time in Prone Position per Day (hours)
1	67	F	English	26.2	HTN, PD	Low-back pain	3	60	RA	18	98	0	N	N	0
2	42	M	English	26.6	DM	N	8	7	—	18	96	0	N/A	N	0
3	45	M	Spanish	26.3	HTN	N	8	7	RA	20	93	0	Y	Y	2-5
4	29	F	English	29.3	PD	N	8	10	—	22	94	—	Y	Y	1-2
5	59	M	Portuguese	29.9	None	N	9	7	0.5	18	96	0	Y	Y	2-5
6	42	M	Spanish	27.3	None	N	2	0	—	18	95	—	N	N	0
7	59	M	English	39.0	HTN	Hip replacement	7	12	2	18	95	—	N/A	N	0
8	61	M	Spanish	25.1	DM	N	2	14	RA	20	96	0	N	N	0
9	43	M	Spanish	29.1	HTN, DM	N	4	41	RA	16	94	0	Y	Y	<1
10	34	M	English	26.6	HTN	Chronic back pain	2	6	1-2	20	100	6	Y	Y	1-2
11	60	F	English	27.3	HTN, DM, PD	Chronic back pain	3	14	RA	20	97	0	N	N	0
12	49	M	Spanish	35.2	HTN, PD	Low-back pain	12	4	2	20	91	—	Y	Y	1-2
13[b]	31	F	English	39.2	PD	N	4	1	RA	20	96	0	Y	N	0
14	29	F	English	28.2	None	N	6	13	—	18	96	0	Y	N	1-2
15	52	M	English	28.8	HTN	Rib pain	2	0	RA	18	97	0	N	N	0
16	42	M	English	37.7	PD	Hip pain	3	9	RA	18	97	0	Y	Y	5-10
Median (IQR)	44 (40-49)			28.5 (26.6-31.225)			4 (2.75-8)	8 (5.5-13.25)		18 (18-20)	96 (94.75-97)				

[a]Comorbidities included hypertension (HTN), pulmonary disease (PD), and diabetes mellitus type II (DM).
[b]Patient was pregnant during hospital stay.
Abbreviations: BMI, body mass index; F, female; IQR, interquartile range; M, male; N/A, not available; RA, room air; SOFA, sequential organ failure assessment.

recorded at time closest to the interview. Medical interpreter services were used for patients with limited English proficiency. This study was deemed exempt from full review by the Partners Healthcare Institutional Review Board. All participating subjects provided verbal consent to participate.

Results

Two hundred and thirty-eight patients were screened for enrollment, and of those, 105 (36%) were eligible and were called. Of those called, 26 (25%) answered the call and 16 of those (59%) completed the survey and qualitative interview (Figure 1). The reasons patients declined included fatigue/malaise (n = 3), confusion (n = 3), inconvenient timing (n = 3), hearing difficulties (n = 1), and lack of interest (n = 1; Table 1).

Seven patients (44%) did not receive information about proning from their medical team, and none of those patients reported proning in the 24 hours before completing the survey. Nine patients (56.3%) received information about proning. Eight of these nine patients (89%) attempted proning. The 1 patient who did not attempt the maneuver was pregnant. Seven (77%) had used the prone positioning in the last 24 hours before the survey. All 8 patients who indicated they spent time in the prone position cited discomfort as the primary reason for being unable to continue. Factors contributing to discomfort included preference for a different position, orthopedic concerns, and obtrusive medical equipment. Orthopedic concerns listed in Table 1 had no effect on the likelihood of a patient to attempt proning (P = 1.0).

Discussion

Previous studies have shown the benefits of awake proning on physiologic measures and clinical outcomes but have provided little information on patient barriers to proning (2,5,6). Our study adds to the literature by evaluating the subjective patient experience. In this mixed-methods study, not being informed about the practice and discomfort were the major barriers to proning. Pregnancy also served as a barrier. While per hospital policy patients with COVID-19 were to be encouraged to use prone positioning as much as they could tolerate by their inpatient medical teams, many stated that they had not been informed of this protocol. As expected, we observed that patients who did not discuss proning with their medical team did not participate in proning. Although the sample size is small, this observation highlights the importance of systematic patient education in promoting the practice. Supplying information on potential proning benefits to patients in their native language before attempting the maneuver is also recommended for future studies.

Among those who attempted proning, discomfort was the primary reason patients limited their time in the prone position. This is a novel observation as previous proning studies either only included critically ill patients on sedating medications or did not solicit patient insights on barriers to awake proning. This finding is supported by the current literature which suggests poor adherence to proning for non-ICU patients (1,9). More information is needed regarding the types of discomfort patients experience in order to design interventions to address these issues. Current proning protocols, in our institutions and others, do not include assessments of pain or discomfort with proning. We recommended that future studies implement initial and repeat assessments of pain accompanied by recommendations on possible pain-relieving measures (eg, positioning, pain medication) to increase proning adherence. The authors believe that by improving educational efforts and addressing comfort-related issues, we will be able to improve proning compliance and therefore patient outcomes.

The strengths of our approach include a generalizable population as exclusion criteria were based solely on ability to participate in an interview. Additionally, our study allowed for open-ended patient responses.

This study also highlights the ability of medical and dental school students to leverage their skills virtually via telephone interviews with patients. The efficacy of these interviews is relatively unknown, but they are useful in employing the effective communication skills of physicians in training which allows for a wider range of contribution from different levels of healthcare providers. These telephone interviews allowed for new ways to conduct qualitative research in a population of quarantined patients and provided a sense of companionship between patient and interviewer. Utilizing the talents of these groups in novel ways can be of great benefit during the pandemic.

Limitations

Weaknesses of this study are the small samples and low completion rate. The low completion rate was largely due to patients not answering the phone in their hospital room when called. This highlights a challenge in conducting phone-based quality improvement studies dealing with hospitalized patients.

Clinical Innovation Grant and the Harvard Catalyst Program which supported the statistical analysis.

ORCID iD

Benjamin Shoults 🔾 https://orcid.org/0000-0001-6301-7385

References

1. Jagan N, Morrow LE, Walters RW, Klein LP, Wallen TJ, Chung J, et al. The POSITIONED study: prone positioning in nonventilated coronavirus disease 2019 patients—a retrospective analysis. Crit care Explor. 2020;2:e0229.
2. Elharrar X, Trigui Y, Dols AM, Touchon F, Martinez S, Prud'homme E, et al. Use of prone positioning in nonintubated patients with COVID-19 and hypoxemic acute respiratory failure. Jama. 2020;323:2336-8.
3. Damarla M, Zaeh S, Niedermeyer S, Merck S, Niranjan-Azadi A, Broderick B, et al. Prone positioning of non-intubated patients with COVID-19. Am J Respir Crit Care Med. 2020;202:604-6.
4. Sun Q, Qiu H, Huang M, Yang Y. Lower mortality of COVID-19 by early recognition and intervention: experience from Jiangsu Province. Ann Intensive Care. 2020;10:1-4.
5. Scaravilli V, Grasselli G, Castagna L, Zanella A, Isgrò S, Lucchini A, et al. Prone positioning improves oxygenation in spontaneously breathing nonintubated patients with hypoxemic acute respiratory failure: a retrospective study. J Crit Care. 2015;30:1390-4.
6. Ding L, Wang L, Ma W, He H. Efficacy and safety of early prone positioning combined with HFNC or NIV in moderate to severe ARDS: a multi-center prospective cohort study. Crit Care. 2020;24:28.
7. Sztajnbok J, Maselli-Schoueri JH, de Resende Brasil LM, de Sousa LF, Cordeiro CM, Borges LM, et al. Prone positioning to improve oxygenation and relieve respiratory symptoms in awake, spontaneously breathing non-intubated patients with COVID-19 pneumonia. Respir Med Case Rep. 2020;30:101096.
8. Caputo ND, Strayer RJ, Levitan R. Early self-proning in awake, non-intubated patients in the emergency department: a single ED's experience during the COVID-19 pandemic. Acad Emerg Med. 2020;27:375-8.
9. Hallifax RJ, Porter BM, Elder PJ, Evans SB, Turnbull CD, Hynes G, et al. Successful awake proning is associated with improved clinical outcomes in patients with COVID-19: single-centre high-dependency unit experience. BMJ Open Respir Res. 2020;7:e000678.

Author Biographies

Benjamin Shoults is a clinical research coordinator and pulmonary function technician at Massachusetts General Hospital. He will be attending Medical School this upcoming Fall. His research interests include patient communication and simulation.

Mary Barber is a second year MD candidate at Harvard Medical School, currently completing clinical rotations at Massachusetts General Hospital. Mary grew up in middle Tennessee and received a bachelor's degree in Chemistry and minor in English Literature from Belmont University in Nashville, TN. Mary hopes to focus her career on translational research, narrative medicine, and patient education.

Lucia Millham is a current second-year medical student at Harvard Medical School. She graduated from Harvard College in 2016 and subsequently worked for two years and the Medical Practice Evaluation Center at Massachusetts General Hospital researching public health interventions for HIV and, subsequently, COVID-19.

Maaz Mulla is a medical student at Havard Medical School. He has a background in computer science from Duke University and has worked at several health startups within the mHealth and clinical informatics / big data field.

Natasha Nanji is second year student at Harvard School of Dental Medicine. She graduated from Cornell University with a Bachelor of Science. She is passionate about the oral systemic link and improving the quality and delivery of healthcare to underserved populations.

Grant Steele is a second year medical student at Harvard Medical School. He is interested in pursuing a career that allows for a mix of patient care, teaching, and quality improvement/health outcomes research.

Tyler Peck is a pulmonary and critical care medicine fellow at Massachusetts General Hospital and Beth Israel Deaconess Medical Center in Boston, MA. His clinical and research area of focus is pulmonary vascular disease/pulmonary hypertension.

Patrick Smithedajkul is a hospital medicine attending physician at the Massachusetts General Hospital and Instructor of Medicine at Harvard Medical School. His academic interests include medical simulation and integration of point of care ultrasound in the care of medical patients.

Christopher Worsham is a pulmonologist and critical care physician at Massachusetts General Hospital and a research fellow at the Harvard Medical School Department of Health Care Policy. He is a health services researcher focusing on physician behavior, resource utilization, and health care policy, with special interest in critical care medicine.

Paul Currier is a pulmonary and critical care doctor at Massachusetts General Hospital (MGH). He is the director of the Respiratory Acute Care Unit and Quality and Safety for the division of pulmonary and critical care at MGH. He also serves as Director of Simulation and Experiential Learning for the Department of Medicine and is an assistant professor of medicine at Harvard Medical School.

Rebecca A Raphaely is a pulmonary and critical care fellow at Massachusetts General Hospital and Beth Israel Deaconess Medical Center. She is interested in patient-centered care and medical education.