Original Article

Variations in Vital Signs in the Last Days of Life in Patients With Advanced Cancer

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Abstract

Context. Few studies have examined variation in vital signs in the last days of life.

Objectives. We determined the variation of vital signs in the final two weeks of life in patients with advanced cancer and examined their association with impending death in three days.

Methods. In this prospective, longitudinal, observational study, we enrolled consecutive patients admitted to two acute palliative care units and documented their vital signs (heart rate, blood pressure, respiratory rate, oxygen saturation, and temperature) twice a day serially from admission to death or discharge.

Results. Of 357 patients, 203 (57%) died in hospital. Systolic blood pressure ($P < 0.001$), diastolic blood pressure ($P < 0.001$), and oxygen saturation ($P < 0.001$) decreased significantly in the final three days of life, and temperature increased slightly ($P < 0.04$). Heart rate ($P = 0.22$) and respiratory rate ($P = 0.24$) remained similar in the last three days. Impending death in three days was significantly associated with increased heart rate (odds ratio [OR] = 2; $P = 0.01$), decreased systolic blood pressure (OR = 2.5; $P = 0.004$), decreased diastolic blood pressure (OR = 2.3; $P = 0.002$), and decreased oxygen saturation (OR = 3.7; $P = 0.003$) from baseline readings on admission. These changes had high specificity (≥80%), low sensitivity (≤35%), and modest positive likelihood ratios (≤5) for impending death within three days. A large proportion of patients had normal vital signs in the last days of life.

Conclusion. Blood pressure and oxygen saturation decreased in the last days of life. Clinicians and families cannot rely on vital sign changes alone to rule in or rule out impending death. Our findings do not support routine vital signs monitoring of patients who are imminently dying. J Pain Symptom Manage 2014;48:510–517.

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Key Words
Blood pressure, diagnosis, death, heart rate, oxygen, physiologic phenomena, respiratory rate, temperature, impending death, neoplasms

Introduction

The last days of life are characterized by a multitude of physiologic changes, such as muscle weakness, dysphagia, and altered level of consciousness. These signs become increasingly common as patients approach death and are highly predictive of a shortened survival.[1–4] In addition to these physiologic changes, vital signs such as heart rate, blood pressure, respiratory rate, oxygen saturation, and temperature also may provide useful information on the patient's health status. Vital signs are regularly measured and recorded in hospitalized patients, even among those who are imminently dying. Abrupt and marked changes in vital signs often signal cardiovascular instability and/or respiratory compromise, which could be related to potentially life-threatening complications.

There is a paucity of studies examining how vital signs vary in the last days of life.[5,6] A better understanding of how vital signs change as patients approach the last days of life and the association between vital sign changes and impending death may improve the clinician's diagnostic accuracy of impending death, thereby facilitating communication with patients and families to plan for the final stages of life.[7] The primary objective of our study was to determine the variation in vital signs in the final two weeks of life among cancer patients who died in our acute palliative care units (APCUs). Our secondary objective was to determine the association between the changes in vital signs and impending death.

Methods

Participants

This was a prospective, longitudinal, observational study. Consecutive patients with advanced cancer who were 18 years or older and admitted to the APCU at either M. D. Anderson Cancer Center between April 5, 2010 and July 6, 2010 or Barretos Cancer Hospital between January 27, 2011 and June 1, 2011 were enrolled into this study.[8] The institutional review boards at both M. D. Anderson Cancer Center and Barretos Cancer Hospital reviewed this protocol and granted waivers of informed consent because this study was purely observational in nature. Furthermore, informed consent may have precluded us from enrolling consecutive patients, which could then have introduced selection bias if patients who were delirious or in distress were not consistently included. It is the policy of both APCUs to monitor vital signs routinely unless otherwise requested.

Data Collection

We collected baseline demographics including age, sex, race, cancer diagnosis, and admission length. Vital signs including heart rate, blood pressure, respiratory rate, oxygen saturation, and temperature were routinely documented at both APCUs, once in the morning and once in the afternoon, by our nurses from admission until death or discharge. Patients who were nonresponsive and/or delirious still had their vital signs taken whenever feasible. Collection of vital signs may increase or decrease in frequency depending on any specific requests from the attending physician, patient, or family members. For patients with multiple documented vital signs throughout the day, the recordings made closest to 8 a.m. and 8 p.m. were used for data analyses. We collected survival data from institutional databases, electronic health records, and the Tumor Registry Vital Statistics Database.

Statistical Analysis

We summarized the baseline demographics using descriptive statistics. To determine the pattern of vital signs in the last two weeks of life, we plotted the average value of each vital sign every 12 hours from death backward for patients who died at the end of the APCU stay. We fit a two-piece model to determine the slope, with the first piece from Day −14 to Day −4 and the second piece from Day −3