



Outcome of hypotensive ward patients who re-deteriorate after initial stabilization by the Medical Emergency Team^{☆,☆☆}

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ABSTRACT

Purpose: We evaluated the outcome of hypotensive ward patients who re-deteriorated after initial stabilization by the Medical Emergency Team (MET) in our hospital, due to limited data in this regard.

Methods: One thousand one hundred seventy-nine MET calls in 32184 ward patients from January 2009 to August 2011 were evaluated. Four hundred ten hypotensive patients met study criteria and were divided into: (1) "Immediate Transfers (IT), n = 136": admitted by MET to intensive care unit (ICU) immediately; (2) "Re-deteriorated Transfers (RDT) n = 72": initially stabilized and signed off by MET, but later re-deteriorated within 48-hours and admitted to ICU; (3) "Ward Patients (WP) n = 202": remained stable on ward after treatment.

Results: The RDT and IT had similar APACHE II scores (20.2 ± 5.1 vs. 19.8 ± 4.8 ; $P = .57$), but RDT showed hemodynamic stabilization with initial MET resuscitation. Patients who re-deteriorated were younger, took longer for eventual ICU transfer, had higher initial lactic acid and delayed normalization as compared to IT ($P < .04$). The re-deterioration predominantly occurred within 8-hours of MET evaluation. RDT had higher 28-day mortality than IT and WP; 42% vs. 27% vs. 7% respectively ($P < .03$). RDT also had a higher rate of endotracheal intubation and worse ICU mortality ($P < .01$).

Conclusion: Hypotensive ward patients who re-deteriorate after initial stabilization have higher mortality. METs should consider implementing at least an 8-hour follow-up in patients who are deemed stable to remain on the wards after hypotensive episodes.

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1. Introduction

The timing of intensive care unit (ICU) transfer may impact outcome when a patient's condition is rapidly deteriorating on the general ward [1]. Delayed transfer from the ward to the ICU results in increased morbidity, increase in requirement for advanced respiratory support and duration of ventilation [2]. Similar data exists in patients who are admitted late from the emergency room. Critically ill emergency department patients with 6 hour or more delay in ICU transfer are shown to have increased hospital length of stay and higher ICU and hospital mortality [3]. Usually this delay is multifactorial, but the most important limiting factor in delayed admissions is the lack of available ICU beds [4]. Other factors like patient age,

underlying diseases and insufficient available information regarding patient's condition can also cause delay in the transfer to the ICU [5,6].

Medical emergency teams (MET) have been introduced to assist in the care of similar patients with unexpected sudden clinical deterioration on the wards [7]. Several studies show that abnormal vital signs can help identify clinical deterioration in patients, minutes to hours before a serious adverse event occurs [8,9]. Through MET these patients at risk are identified so they can have early initiation of diagnostic and therapeutic interventions on the wards. After MET evaluation, usually either these patients are kept on the ward or transferred to the ICU or other appropriate units based on the clinical judgment of the MET and response to treatment.

MET in our hospital runs independently from the ICU consultation service. We have observed in our practice that there is a subgroup of patients for whom MET is activated and they are deemed stable enough to stay on the ward after MET evaluation and treatment, only to deteriorate later again and get admitted to the ICU. It has been suggested that in borderline patients in whom an ICU consultation is obtained (without involving MET) and they are denied ICU admission and on subsequent referral get admitted to the ICU, have higher mortality [4]. It has also been shown that in situations where there is

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shortage of ICU beds, the decision of the MET is influenced and can result in changed goals of care for the patients [10]. But data is lacking regarding outcome of patients after MET intervention and treatment, which show initial stabilization but later on have clinical re-deterioration to the point that ICU admission is inevitable.

In this study we wanted to evaluate the impact of this patient re-deterioration after initial stabilization on the wards and identify the characteristics that would help differentiate these patients. We limited our interest in this cohort to the subgroup of patients in which MET was called for episodes of acute hypotension.

2. Methods

The research protocol was approved by the institutional review board of our hospital. The hospital is a 429 bed, Joint Commission accredited, teaching tertiary care facility with comprehensive bone marrow and limited solid organ transplant services, along with expert medical and surgical subspecialties. The ICU comprises of an 18 bed combined medical-surgical unit.

Data were obtained regarding all the patients who had an episode of acute hypotension on the general ward in our hospital between January 2009 and August 2011. The hospital has a “Rapid Response” alert system for patients in non-critical areas showing any signs of hemodynamic instability since 2007. Palliative patients with “Do Not Attempt Resuscitation” orders are excluded from this service as per institution policy. The system is usually initiated by the ward nurse or sometimes by the physicians taking care of the patient by an overhead announcement system. In response to the alert, a “Medical Emergency Team” (MET) is activated that responds within five minutes and attends to the patient. MET in our hospital comprises of an Internal Medicine physician (either a junior staff or a senior medical resident), a designated critical care nurse that carries an emergency medication box, a respiratory therapist and a standby pharmacist for prompt delivery of any extra medications. The MET manages the patient along with the primary team until the patient is stabilized on the ward or it is felt that an ICU transfer is warranted. In patients with shock, the MET can also initiate low dose dopamine (up to 5 mcg/kg/min) on the ward to reduce deleterious effects of persistent hypotension that is not responding to intravenous fluid boluses alone. This is based on hospital policy as majority of the ward patients do not have central venous access to allow administration of other vasopressor agents, and any higher requirement of vasopressors would warrant immediate ICU admission. An ICU consultation is obtained if deemed necessary. If the patient is felt to be stabilized on the ward, then the MET would officially sign off and the patient is managed by the primary physician as appropriate. However, in case it is assessed that the patient needs an ICU transfer, the intensivist would be involved for patient evaluation and to facilitate the transfer as soon as possible. MET would sign off once the ICU transfer is complete.

2.1. Patients and study variables

All adult patients 18 years or older during the study period, who had an episode of acute hypotension on the ward for which MET was activated, were evaluated. Acute hypotension was defined as sudden drop in systolic blood pressure <90 mm Hg or symptomatic drop of >30 mm Hg from baseline, as per hospital MET activation criteria. The patients were identified from the MET comprehensive database. The encounters were maintained prospectively and patient information regarding those encounters was completed in real time by the MET team. The missing information not recorded in the MET encounter sheets was collected retrospectively from the electronic medical records and patient files. Patients admitted to the ICU from the other critical care units (eg, Cardiothoracic ICU, operating room) were excluded as MET in our hospital does not serve those areas.

Hypotensive patients in whom the MET was not activated, in whom the MET was called for an erroneous low blood pressure, patients admitted to the wards from emergency department 24 hours prior to MET, and palliative care patients were excluded. Rests of the patients were divided into three groups. Those patients who were treated and were transferred to the ICU during the initial evaluation within 2 hours of the MET activation were labeled as “Immediate Transfers (IT)”. The patients who were treated by the MET team on the ward and were deemed stable to stay on the ward and were signed off by the MET team (with or without ICU consultation), only to become hypotensive again and ultimately requiring an ICU transfer within 48 hours of the initial MET call were classified as “Re-deteriorated Transfers (RDT)”. The last group comprised of patients who were treated and stabilized by the MET and remained stable on the ward for more than 48 hours, and were identified as “Ward Patients (WP)”.

Study variables recorded included age, gender, underlying chronic diseases, presence of systemic inflammatory response syndrome (SIRS), sepsis, acute physiology and chronic health evaluation II (APACHE II) scores, time to ICU transfer, available ICU beds at time of MET, lactic acid at time of ICU admission and normalization of lactic acid within 6 hours of ICU admission. Patient was identified as having SIRS, if two or more out of the four diagnostic criteria were met [11]. For APACHE II score, if data were missing then the score on that variable was recorded as normal [12].

2.2. Outcomes and analysis

The primary outcome variable was 28-day mortality from the time of the initial MET evaluation. Secondary outcome measures were ICU mortality, use of vasopressor agents and endotracheal intubation. Patients whose goals of care were changed to “palliative care” during MET encounter and stayed on the wards were excluded from the mortality analysis. We also evaluated the characteristics of the different groups to identify any risk factors. The data was analyzed using Student *t* test, one way analysis of variance and Pearson's χ^2 test, as appropriate. The results of the analysis were considered significant at $\alpha < .05$.

3. Results

There were a total of 1179 MET calls in 32 184 ward patient during the study period. Out of these, 447 were activated as a result of acute hypotension. Thirty-seven patients did not meet the study criteria and were excluded. Remaining 410 patients were included in analysis and divided into IT, RDT, and WP (Fig. 1). Their baseline demographics are shown in Table 1. There was no statistical difference between the groups in regards to gender and presence of SIRS criteria at the time of initial MET encounter. The WP had lower APACHE II scores than both ICU groups (Fig. 2). However, we did identify 76 patients in the WP group that had similar characteristics and level of disease severity compared to RDT. Out of these 76 ward patients, 69 patients (91%) were started on dopamine by the MET. The mean time to wean dopamine off in these patients was 3.9 (± 2.7). hours. MET signed off in these patients when there was hemodynamic stability with dopamine and dopamine dose was being started to be tapered down.

There was no difference in the amount of resuscitative intravenous fluids received between the three groups (Table 2). At the time of evaluation, there were slightly more ICU beds available for the WP, even though the overall bed availability was low for all 3 groups.

Looking at the factors associated with ICU transfer, elderly patients were more likely to be admitted to the ICU immediately. Furthermore, patients with sepsis, on chronic dialysis and patients with hematological-oncological diseases were more likely to eventually get admitted to the ICU. Patients in the RDT group were relatively younger, had less ICU consultation at the time of initial evaluation, a long interval to eventual ICU transfer, worse lactic acid at time of ICU

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