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Clinical paper

Palliative care utilization following out-of-hospital cardiac arrest in the United States☆

Aiham Albaeni[a,*], Nisha Chandra-Strobos[b], Shaker M. Eid[b]

[a] Department of Medicine, University of Texas Medical Branch, 301 University Boulevard, Galveston, TX, 77555-0570, USA
[b] Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, USA

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ABSTRACT

Aims: Palliative care (PC) has become an integral component of comprehensive care provided to critically ill patients. Little is known about the utilization of palliative care following Out-of-Hospital Cardiac Arrest (OHCA) in the United States.

Methods: We used the 2002–2013 National Inpatient Sample database to identify adults ≥18 years old with an ICD-9-CM principal diagnosis code of cardio-respiratory arrest or ventricular fibrillation (VF). Patients were categorized into two groups based on the presence of PC, then compared using Pearson χ^2 test for categorical variables and linear regression for continuous variables. Multiple linear and logistic regression models were conducted to identify factors associated with PC, and temporal trends in PC utilization.

Results: Of the 154,177 patients hospitalized with OHCA in the U.S, 11,260 (7.3%) had PC consultations during hospitalization. PC Utilization increased from 1.5% in 2002 to 16.7% in 2013 (P-trend < 0.001). Patients who received Palliative care were older (mean age 70.7 ± 0.3 vs 65.9 ± 0.1), more likely to be female (45.8% vs 40.5%), and had higher Charlson comorbidity index ≥2 (55.8% vs 46.8%). In adjusted analyses, older age, female gender, Caucasian race, higher Charlson comorbidity index, multiorgan failure, metastatic cancer, non-shockable rhythm, admission to larger, urban and teaching hospitals were all associated with higher PC utilization.

Conclusion: We observed significant increase in the utilization of palliative care consultations following OHCA over the study period. This was influenced by multiple patient and hospital factors. Further investigations are needed to identify the appropriate cost-effective use of palliative care following cardiac arrest.

Introduction

Out of hospital cardiac arrest affects more than 300,000 patients annually in the United States with a mortality rate of around 90% [1]. The complexity and sensitivity of cardiac arrest and its treatment decisions usually require the involvement of multiple treatment teams, utilization of hospital resources, and multiple meetings to address patient's wishes, family's needs and concerns. Palliative care has emerged as an essential part of comprehensive care provided to critically ill patients. However, its use following cardiac arrest has not been fully addressed or integrated into routine practice. The importance of palliative care extends beyond improving quality of care, to alleviate emotional distress, assist in transition of care and prepare patients and families for various challenges following an intensive care unit stay [2]. Furthermore, palliative care utilization has been shown to decrease hospital length of stay, resources utilization and hospitalizations cost [3–5].

One single center study demonstrated an increase in the utilization of palliative care in patients who received therapeutic hypothermia and attributed such increase to multiple factors including increase physician awareness of the presence and importance of palliative care services through educational initiatives, findings of reported literature, and expanding available palliative care services [6]. However, utilization of palliative care in U.S. hospitals following cardiac arrest, temporal trends and factors that might impact its use have not been studied at the national level and were the focus of this investigation.

Methods

Database

We used the data files from the Nationwide Inpatient Sample (NIS)

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* Corresponding author.
E-mail address: aialbaen@utmb.edu (A. Albaeni).

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2002–2013. Annually, the NIS collects data covering 7–8 million hospital stays, reflecting all discharges from ~1000 hospitals and covering 44 states in 2013. Using a sampling probability of ~20%, the design of NIS is stratified and includes U.S. non-rehabilitation, community hospitals, with the target universe being all acute care hospital discharges in the United States [7,8].

Study population

We used the International Classification of Diseases, Ninth Edition Clinical Modification (ICD-9-CM) codes of cardio-respiratory arrest (427.5) and ventricular fibrillation (VF) (427.41) to identify adults ≥18 years of age with a principal diagnosis of out-of-hospital cardiac arrest (OHCA). Previous studies have used similar methodology to identify patients with OHCA [9,10].

In addition, studies of state-wide databases as well as Medicare/Medicaid claims data have demonstrated the reliability of using ICD-9-CM codes, at the principle diagnosis position, in identifying patients with OHCA [11–13]. All patients with concomitant diagnosis of injury/trauma were excluded. This selection process yielded a final sample of 154,177 OHCA patients.

We used the ICD-9-CM code V66.7 to identify palliative care consultation. This code stands for hospice care, terminal care and end of life care and has been used in prior studies to identify palliative care team involvement [5,14]. Patients were thus categorized based on the presence or absence of palliative care (PC) involvement into two groups (PC and No-PC, respectively).

Outcomes measured

The primary outcomes were temporal trend in the use of PC following OHCA, and factors associated with PC utilization. Secondary outcomes included: resource utilization (cardiac catheterization, percutaneous coronary intervention (PCI), automatic implantable cardioverter-defibrillator (AICD) implantation), length of hospital stay (days), discharge disposition, total hospital charges (US $), and total hospitalization costs (US $). Charges and Costs were adjusted for inflation using the year-specific Consumer Price Index provided by the US Bureau of Labor Statistics, with 2015 as the index base [15].

Patient and hospital characteristics

Patients' characteristics were studied in both groups including patient age, gender, race, primary payer, house hold income, co morbidities (hypertension, diabetes, coronary artery disease, congestive heart failure, chronic pulmonary disease, metastatic cancer, chronic renal failure, and dementia), clinical presentation (acute myocardial infarction, intracranial hemorrhage, myoclonus epilepticus, and multiorgan failure) and the Charlson co-morbidity index. Hospital-level characteristics were similarly studied and included region, size and location/teaching status. Relevant co morbidities that were not readily available in NIS were obtained using the appropriate ICD-9-CM codes (Supplemental-eTable 1).

Statistical analyses

Statistical analyses were performed using Stata 13.0, accounting for survey design complexity, sampling weights, primary sampling units and strata. First, patient demographics, co-morbidities and hospital characteristics were compared between both groups using Pearson χ^2 test for categorical variables and linear regression (1-way ANOVA) for continuous variables. Second, means and proportions of outcomes of interest were similarly compared. Third, multiple logistic regression models were conducted to identify factors associated with PC utilization. Fourth, temporal trends in the use of PC were performed by adding calendar year as a continuous variable to the regression model. Standard errors were estimated using Taylor series linearization, all P values were 2 sided and type I error was set at 0.05.

Data were largely complete with few exceptions, particularly race (23.0% missing). Assuming missing at random (MAR), we therefore performed multivariate imputation by chained equations methods (MICE) estimated from sequential multivariable models with fully conditional specifications [16,17]. Overall, 25 imputed data sets were constructed using complete information from regression covariates and other variables without missing data. Results with and without imputation did not differ meaningfully. Thus, the former is reported.

Results

Patients and hospital characteristics

Our study included 154,177 OHCA patients who survived to hospital admission. Of those patients, 11,260 (7.3%) had palliative care consultation. Compared to those who did not receive PC, patients who had PC were older (mean age 70.7 ± 0.3 vs 65.9 ± 0.1, P < 0.001), more likely to be female (45.8% vs 40.5%, P < 0.001), more likely to have metastatic cancer (3.7% vs 1.9% P < 0.001), multiorgan failure (30.2% vs 16%, P < 0.001) and a higher (≥2) Charlson co morbidity index (55.8% vs 46.8%, P < 0.001) (Table 1).

Utilization of resources, total hospital charges and cost, length of stay and survival

Compared to patients who did not receive PC, patients in the PC group were less likely to have cardiac catheterization, PCI and AICD implantation following cardiac arrest. They were also less likely to have tracheostomy and gastrostomy (Table 2). In addition, length of hospital stay was lower in the PC group (3.61 vs 4.55 days, P < 0.001), with significantly lower cost and hospital charges. PC group patients also had lower rates of survival to discharge (10.3% vs 47.3%, P < 0.001) (Table 2).

Factors associated with palliative care

In multivariate analyses, factors associated with increased use of PC consultation included: older age, female gender, Caucasian race, non-VF as an initial rhythm, the presence of multiorgan failure, the presence of metastatic cancer, higher Charlson co-morbidity index, and admission to large, urban and teaching hospitals. In addition, there were regional variability in PC utilization with increase use in the West and decrease use in the South compared to the Northeast (Table 3).

Temporal trend in palliative care, discharge disposition

The overall rate of palliative care utilization increased from 1.5% (95% CI, 0.7%–2.3%) in 2002 to 16.7% (95% CI, 15.2%–18.2%) in 2013 (unadjusted OR 1.33; 95% CI 1.30–1.37, P trend < 0.001) (Fig. 1). Disposition of patients who survived to hospital discharge in both the PC and No-PC group is shown in (Fig. 2). Out of 1160 patients who survived to discharge in the PC group, 10.8% were discharged home, 4.7% were discharge to a short-term hospital, 68.4% were discharged to a skilled nursing facility and 12.8% were discharged with home health care. On the other hand, 67,638 patients survived to discharge in the No-PC group with 53.9% discharged home, 17.6% transitioned to a short-term hospital, 19.2% transferred to a skilled nursing facility and 8.2% provided with home health care.

Discussion

We observed a significant increase in palliative care (PC) utilization in U.S. hospitals following out-of-hospital cardiac arrest over the study period 2002–2013. Such utilization was influenced not only by patient-