ORIGINAL ARTICLE

Early mortality in a tertiary care hospital: analysis of quality of care

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Objective: To describe and analyze the clinical and epidemiologic characteristics of the care process of patients who died within 24 hours of arriving at emergency department.
Methods: Descriptive single-centre study of patients who died in the first 24 hours of arrival at our emergency department in 2009.
Results: A total of 164 deaths occurred; 84 patients died after admission to a ward and 83 were in the emergency department (mortality rate, 0.091%). The mean (SD) age of these patients was 78.4 (14.7) years; 54.9% were women and 85% had a significant comorbid condition. The mean Karnofsky index was 66.1 (23.7). The terminal stage of a disease had been reached by 24.7% of the patients, and death was foreseen on the patient's arrival in the emergency department in 82.2%. The most frequent cause of death was cerebrovascular disease (17.3%), followed by pneumonia (16.7%) and septicemia (13.6%). Patients were admitted to an appropriate place in 98.8% of the cases. Treatment with opioid analgesics or sedation was most often provided for patients in a terminal phase (64.1% vs 34.2%, $P<.05$). Families were informed about the patient's prognosis in 97.1% of the cases; 87% of the patients were accompanied by a relative.
Conclusions: Given that the demand for care of patients in terminal phases of disease is growing, analysis of the care process will allow us to ensure that measures are implemented to make them and their families as comfortable as possible. [Emergencias 2011;23:430-436]

Key words: Mortality. Hospital emergency health services. Palliative treatment. Terminal care.

Introduction

Hospital mortality has traditionally been one of the most frequently used indicators of quality care. It is the oldest known healthcare indicator, and a valuable tool for planning and managing a hospital[1]. There are two important indicators of mortality in relation to the emergency department (ED)[2]. First, there is ED mortality rate representing the number of deaths in the first 24 hours of ED attention, an indirect measure of the resolution capacity of the ED of an institution. Currently, there are certain pathological conditions that require the study of their specific mortality rates, such as acute myocardial infarction, stroke, multiple trauma and witnessed cardiorespiratory arrest, with their own standards and severity scales, instruments to establish comparisons and identify areas for improvement in health care[3]. Second, there is mortality assessment, which relates the number of deaths evaluated in an ED with the number of deaths occurring in that ED.

Mortality indicators are most frequently used in public health, given the ease of data collection and systematic registration. They allow monitoring of major health problems in a particular population and analysis of the main causes of death and trends[4]. More and more hospitals have ED death records, which allow one to identify the characteristics of patients who die, and thus adopt measures of improvement for the most prevalent pathologies and usual circumstances surrounding their death[5].

The analysis of the quality of care is an established key practice of health professionals and institutions. It includes the scientific and technical aspects of institutional performance, care received, patient safety and the effectiveness of

care measures, in order to identify areas for improvement[6]. The literature contains few references to overall mortality in the ED (not associated with pathology or specific patient groups), and the quality of health care provided to patients who die during the first 24 hours of arrival at the ED[7,8].

The objectives of this study were to evaluate mortality and mortality rate in the ED of Hospital Universitario de La Princesa (HULP), to compare the characteristics of patients who died within 24 hours of ED arrival according to site of death (ED itself or hospital ward) and patient type (terminal or not) and, finally, to analyze the quality of care in patients who should be prioritized to receive measures designed to maximize the quality of death[9-14].

Method

We performed a retrospective study of all patients who died within 24 hours of arrival at the ED between 1 January and 31 December, 2009. HULP is a tertiary hospital of Madrid serving the districts of Salamanca and Chamartín (health area 2), with an estimated population of 500,000 people. Its range of services covers all medical and surgical specialties except obstetrics, gynecology and pediatrics. It also serves as a reference hospital for certain cases referred by other centers, primarily the hospitals of Henares and Prince of Asturias (Alcalá de Henares). The ED attends about 100,000 emergency patients per year.

We reviewed reports of care in the ED and reports of deaths of all patients who died in our hospital within 24 hours of ED arrival. 24-hour ED mortality rate was calculated as the ratio between the number of deaths occurring within 24 hours and the total number of patients attending the ED. All data were recorded on a data collection sheet.

Epidemiological and demographic variables: age and sex.

Clinical variables: previous quality of life [Karnofsky index, (KI)[15]], comorbidity index (Modified Charlson[16]), the underlying cause of death [according to the International Classification of Diseases 9th edition, Clinical Modification (ICD-9-CM)[17]], terminally ill or not (patient with disseminated or advanced neoplasia, advanced dementia, advanced neuropathy or heart disease with very poor baseline KI $\leq$ 50), presence of cognitive impairment and advanced dementia, and the number of ED visits made in the last month.

Care variables: hours of ED stay and deaths, total stay time, diagnostic procedures performed (blood or urine test, electrocardiogram, plain x-ray, arterial blood gases -ABG), treatments indicated (curative and/or palliative, sedation and analgesia), place of death (in hospital wards, specific place within the ED or death on arrival) and request for post-mortem examination.

Variables related to the quality of death: expected death (occurring in a patient with advanced neoplasia or in a patient who, on ED arrival, had: heart rate < 50 or > 150 beats per minute, systolic blood pressure < 90 mmHg, respiratory frequency < 10 or 30 breaths per minute and/or decreased level of consciousness (Glasgow Coma Scale < 10) without response to appropriate initial treatment)[18], non-palliative diagnostic tests and therapies without foreseeable benefit, palliative treatment when indicated, initiation and implementation of cardiopulmonary resuscitation (CPR), information for relatives, type of room, presence of relatives at the time of death and adequacy of the patient's location at the time of death (the patient's location at the time of death was considered adequate if it occurred in a hospital ward or ED observation area, or it occurred in the ED area of physical examination within 12 hours of hospital arrival.

Data collection was performed using individual files, collected on a database, and analyzed using SPSS version 17.0. Dichotomous qualitative variables are presented as percentages and compared with chi-square test; quantitative variables are presented as means and compared using Student's t test or ANOVA as appropriate. We used Pearson's correlation and logistic regression for quantitative variables associated each other. Differences with a p value < 0.05 were considered statistically significant. The study protocol was approved by the HULP Commission on Quality of Mortality.

Results

During 2009, our ED attended 90,712 emergency patients; 164 patients died within 24 hours of admission to the ED (0.18%). Eighty-one deaths occurred in a ward, and 83 in the area of the ED, with an ED mortality rate of 0.091%.

The clinical and demographic characteristics of the patients who died during the first 24 hours, considering terminal status and place of death, are reflected in Tables 1 and 2. Forty patients (24.4%) were in the terminal phase of their disease, and 23.5% of patients had previously visited

Table 1. Clinical and demographic characteristics of patients who died within 24 hours of ED arrival, clinical and care variables, according to terminal or non-terminal disease status

	All patients (n = 164)	Terminally ill patients (n = 40)	Non-terminally ill patients (n = 124)	*p*
Epidemiological and demographic variables				
Sex (% male)	45.1	50	43.4	ns
Age, years (mean ± SD)	78.4 ± 14.7	73.5 ± 16.1	79.9 ± 13.9	< 0.05
Clinical Variables				
Karnofsky Index, score (mean ± SD)	66.1 ± 23.7	49.2 ± 21.9	72.3 ± 21.2	< 0.01
Charlson index, score (mean ± SD)	1.8 ± 1.3	2.5 ± 1.1	1.6 ± 1.2	< 0.01
Cognitive impairment (%)	32.1	25.6	34.2	< 0.01
Advanced dementia (%)	18.1	15.4	19	ns
Care variables				
Time to death, minutes (mean ± SD)	607.5 ± 402.1	666.7 ± 448.5	597.5 ± 382.3	ns
No diagnostic procedures (mean ± SD)	2.3 ± 1.2	1.9 ± 1.2	2.4 ± 1.2	< 0.05
Variables related to the quality of death				
Expected death (%)	82.2	100	77.9	< 0.01
Indication for palliative treatment (%)	41.5	64.1	34.2	< 0.01
CPR performed (%)	19.4	5	24.2	< 0.01
Relatives informed (%)	97.1	100	96	ns
Presence of relatives (%)	87	95.4	83.6	ns

ED: Emergency department; CPR: cardiopulmonary resuscitation; SD: standard deviation, ns: not significant.

our ED during the previous month. The leading causes of death were cerebrovascular diseases and pneumonic processes (Table 3).

All patients treated in the area of the ED were medically attended immediately on arrival at the hospital. Twelve patients died during the first hour after admission (7.3%). Two post mortems were requested, both clinical. Of the patients who died in the ED, 40.7% were located in the examination area, 38.3% in the observation area and 21% in the emergency room; of these latter patients[17], 70.6% arrived at the hospital with cardiac arrest, and in all these cases CPR was re-initiated. Patients who were transferred to the intensive care unit (ICU) were younger, had less morbidity and better functional status than those admitted to other medical and surgical departments (Table 4). One terminal patient who was intubated on hospital arrival, before his comorbidity and functional status was known, died in the ICU. Just over half of the terminally ill patients died in a hospital ward. Two patients died in the ED examination area 12 hours after hospital arrival, and most (98.8%) who died there did so within 12 hours and were considered to have died in a suitable location (Figure 1).

In 7 patients no diagnostic test was performed. Of the remaining 154 patients, 30 underwent four diagnostic tests (blood, arterial blood gases, electrocardiogram and an imaging test) and 47 patients underwent three tests. ABG was performed in just under half of the subjects.

In 82.2% of cases, death was expected at the time of ED arrival; of these, 73.9% arrived at hospital in a terminal/dying condition and 40% were terminally ill. There were no significant differences in the predictability of the outcome between patients who died in the ED or a hospital ward, and death was expected more frequently in terminal than in non-terminal patients (95 versus 77.9%, $p < 0.05$).

Regarding patients in the terminal phase of disease, 64.1% were treated with opioid analgesics or sedatives, which were prescribed in 34.2% of non-terminals ($p < 0.05$). This treatment was most commonly prescribed for patients admitted for vascular surgery, oncology and general surgery (Figure 2). Fewer ABG were performed in terminal patients (30 vs 42.2%, $p = 0.01$).

CPR was initiated in almost one fifth of patients, half of whom were younger (74.5 versus 79.4 years, p = ns) and had better baseline quality of life (63.2 versus 77.6 KI, $p < 0.01$); 80% of CPR were performed in patients with a KI $\geq$ 50.

From the reports of deaths specifying information to family members or their presence at the time of death (63%), 97.1% of cases' family members were informed about the prognosis of the patient and 87% of cases were accompanied; in terminally ill patients, these percentages were 100% and 95% respectively ($p < 0.01$).

Discussion

The mortality rate was lower in our center than the rates reported in similar studies. Analyzing data from the first studies published in 1993[10] in this respect, it seems there is a trend towards reduced ED mortality in recent years.

The usual profile of the ED patient who dies within 24 hours was that of a patient with advanced age, poor functional status and important

Table 2. Clinical and demographic characteristics of patients who died within 24 hours of ED arrival. clinical and care variables. according to place of death

	All patients (n = 164)	ED patients (n = 83)	Hospitalized (except ICU) (n = 63)	*p*
Epidemiological and demographic variables				
Sex (% male)	45.1	43.2	47.6	ns
Age, years (mean ± SD)	78.4 ± 14.7	81.7 ± 10.8	79.4 ± 14.5	ns
Clinical Variables				
Karnofsky Index, score (mean ± SD)	66.1 ± 23.7	67.7 ± 20.1	58.5 ± 24.9	< 0.05
Charlson Index, score (mean ± SD)	1.8 ± 1.3	1.8 ± 1.3	2 ± 1.2	ns
Cognitive impairment (%)	32.1	32.9	36.5	ns
Advanced dementia (%)	18.1	20.5	18.7	ns
Care variables				
Time to death, minutes (mean ± SD)	607.5 ± 402.1	442.5 ± 349.9	815.8 ± 378.5	< 0.01
Nº diagnostic procedures (mean ± SD)	2.3 ± 1.2	2.1 ± 1.2	2.4 ± 1.1	ns
Variables related to the quality of death				
Expected death (%)	82.2	83.9	76.6	ns
Indication for palliative treatment (%)	41.5	47.5	40.6	ns
CPR performed (%)	19.4	18.7	11.1	ns
Relatives informed (%)	97.1	96.9	100	ns
Presence of relatives (%)	87	85.5	100	ns

ED: Emergency department; CPR: cardiopulmonary resuscitation; SD: standard deviation; ns: not significant.

comorbidity, as in similar studies[19-24]. A quarter of the patients were terminally ill; they were significantly younger and had higher comorbidity and functional impairment than non-terminal patients, less cognitive impairment, which reflects the high percentage of cancer patients. Such patients underwent fewer diagnostic tests and ABG measurement, and just over half of them received palliative treatment. A single patient with unknown baseline status received CPR on hospital arrival. Somewhat less than half of terminally ill patients died of end-stage malignancy, followed by pneumonia and septicemia. The patients who died in a hospital ward had worse functional status than those who died in the ED. This difference is probably explained by their not being candidates for aggressive measures, which determines a shorter stay in the ED.

Patients referred to the departments of oncology, intermediate coronary care unit and internal medicine had the greatest degree of functional impairment, and nephrology and oncology patients had the most comorbidity. Three out of four terminally ill patients died while in the charge of the ED, oncology and internal medicine.

With regard to our evaluation of the quality of care, imminent death was foreseen on ED arrival in the vast majority of patients, especially for terminal patients and those who died in the ED. Patient location at the time of death was considered adequate in almost 99% of cases, more than that observed in similar studies. Most patients were accompanied and their relatives had been informed about the prognosis.

Therapeutic efforts (CPR and ICU admission) were maximized in younger patients with better functional status. However, there remained a considerable percentage of patients who received aggressive diagnostic and therapeutic measures despite not being eligible for them, given their

Table 3. Leading causes of death in patients who died within 24 hours of ED arrival [total nº of cases (%)]

Leading causes of death	All patients (n = 164)	Type of patient			Place of death		
		Terminal (n = 40)	Non-terminal (n = 124)	*p*	ED (n = 83)	Ward (n = 81)	*p*
Cerebrovascular disease	28 (17.1)	1 (2.5)	27 (21.8)	< 0.01	17 (20.5)	11 (13.6)	ns
Pneumonia	27 (16.5)	10 (25)	17 (13.7)	ns	16 (19.3)	11 (13.6)	ns
Septicemia	22 (13.4)	4 (10)	18 (14.5)	ns	11 (13.3)	11 (13.6)	ns
End-stage malignancy	16 (9.8)	16 (40)	0	< 0.01	11 (13.3)	5 (6.2)	ns
AMI	16 (9.8)	1 (2.5)	15 (12.1)	ns	8 (9.6)	8 (9.9)	ns
Shock/Cardiogenic shock	15 (9.1)	3 (7.5)	12 (9.7)	ns	9 (10.8)	6 (7.4)	ns
Digestive tract disease	15 (9.1)	1 (2.5)	14 (11.2)	ns	6 (7.2)	9 (11.2)	ns
Heart failure	5 (3.0)	3 (7.5)	2 (1.6)	ns	2 (2.4)	3 (3.7)	ns
Other	20 (12.2)	1 (2.5)	19 (15.3)	< 0.05	3 (3.6)	17 (20.9)	ns

ED: Emergency department; AMI: Acute myocardial infarction; ns: not significant.

Table 4. Characteristics of patients who died within 24 hours of ED arrival according to hospital department referral

Hospital Department	Nº patients	Age (mean, years)	Karnofsky Index (mean score)	Charlson Index (mean score)	% Terminal patients	% patients on palliative medication
Cardiology	2	90	70	1.5	0	0
Vascular Surgery	4	92	67.5	1.25	25	100
General Surgery	8	75.7	70	1.88	0	75
Digestive system	9	81.4	72.5	1.67	11.1	44.4
Hematology	3	81.7	63.3	2.33	100	33.3
Internal Medicine	20	87.3	54	2.3	30	25
Neurosurgery	5	84.6	65	1.25	0	20
Nephrology	5	77.4	67.5	3.6	20	40
Pneumology	2	85	60	1.5	0	50
Neurology	15	82.7	74	1.4	6.7	60
Medical Oncology	9	56.6	47.1	2.4	88.9	88.9
Intermediate coronary care unit	4	81.2	50	2	0	25
Intensive Care Unit	19	61.5	90.7	1.06	5.3	12.5
ED	50	80.6	64.2	2	33.3	37.5
Other	9	80.7	72	2	22.2	44.4

ED: Emergency department.

significant morbidity and/or severely impaired functional status, as well as insufficient palliative support.

There are few data in the literature on quality of care analysis for early hospital mortality beyond isolated mortality rate. Mortality indicators should be interpreted with caution, as ED attention also depends on the severity of the patients treated, the most prevalent diseases, population structure, baseline characteristics of patients, the economic regimen of the center, previous care received by extra-hospital emergency services and the availability of a reference system, hence, mortality indicators do not provide a comprehensive assessment of the quality of health care provided[25-27].

The progressive increase of life expectancy in our society leads to an increase in the prevalence of chronic terminal disease which are accompanied by progressive functional impairment[28], which leads to patients, mostly elderly, with severely impaired health status who require frequent medical attention[29]. The poor infrastructure for these chronic patients to receive ambulatory or home care[30,31] coupled with a growing tendency of attending a hospital center in order to die there[32] has led to greater demand for care that prioritizes palliative rather than curative measures. The analysis of the quality of ED care, particularly of those patients who die within 24 hours of hospital arrival, allows us to detect preventable death and identify areas for improvement, as well as improving the perceived quality of care by patients and their family members[33].

The main limitation of our study is that it was retrospective, and it depended on medical care data obtained from hospital and ED reports on deaths.

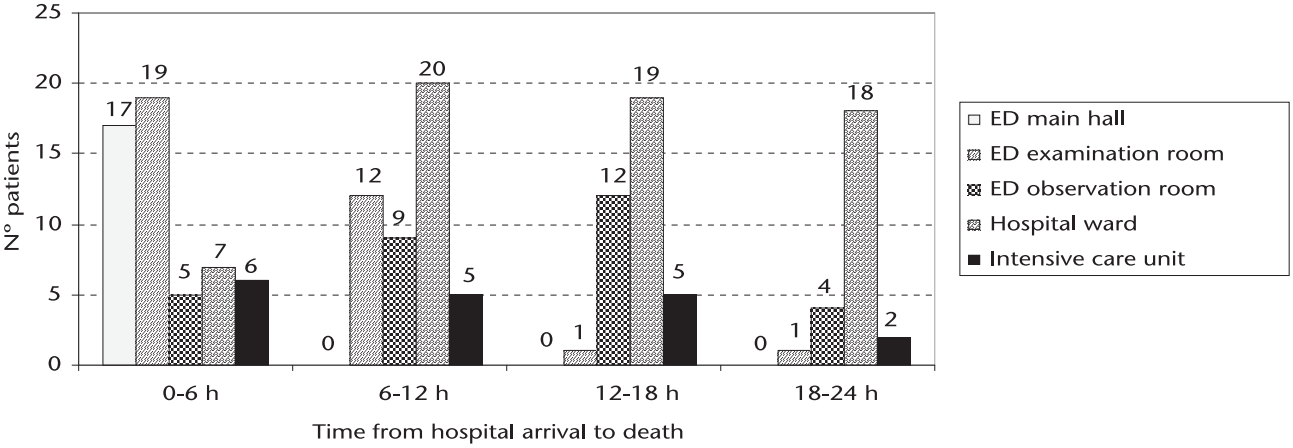

Figure 1. Location of patients who died in the emergency department or a hospital ward, according to time from hospital arrival to death. ICU: intensive care unit.

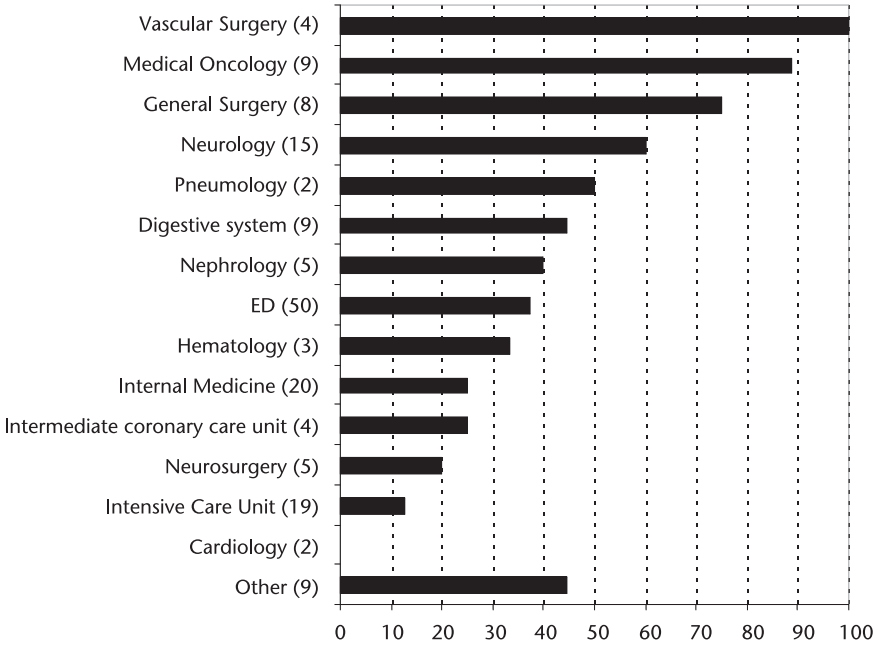

Figure 2. Percentage of patients receiving palliative medication prior to death.

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Mortalidad precoz en un hospital terciario: análisis de la calidad asistencial

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Objetivos: Describir y analizar las características clínico-epidemiológicas y el proceso asistencial de los pacientes que fallecen durante las primeras 24 horas tras su llegada a urgencias.
Método: Estudio unicéntrico descriptivo de todos los pacientes fallecidos durante las primeras 24 horas tras su llegada a urgencias durante el año 2009. Se compararon según el lugar del fallecimiento (urgencias o planta) el tipo de paciente (terminal o no) y se analizó la calidad asistencial prestada.
Resultados: Se produjeron 164 fallecimientos, 81 de ellos en hospitalización y 83 en urgencias (tasa de mortalidad 0,091%). La edad media de los pacientes fue de 78,4 ± 14,7 años, el 54,9% fueron mujeres, el 85% tenía alguna comorbilidad importante y el índice de Karnofsky medio fue de 66,1 ± 23,7. El 24,7% de sujetos se encontraba en fase terminal de su enfermedad. En el 82,2% de los casos el fallecimiento fue previsible a la llegada del paciente a urgencias. Las principales causas de muerte fueron las enfermedades cerebrovasculares (17,3%), seguidas de las neumonías (16,7%) y las septicemias (13,6%). La ubicación de los pacientes se consideró adecuada en el 98,8% de casos. Recibieron tratamiento con analgésicos opiáceos o sedación con mayor frecuencia los pacientes en fase terminal (64,1 frente a 34,2%, $p < 0,05$). En el 97,1% de casos se informó a los familiares acerca del pronóstico del paciente, y en el 87% éste se encontraba acompañado.
Conclusiones: Dada la creciente demanda asistencial de pacientes afectados de patologías terminales, el análisis de su proceso asistencial permite garantizar las medidas de confort para ellos, con el fin de maximizar la calidad percibida por los enfermos y sus familiares. [Emergencias 2011;23:430-436]

Palabras clave: Mortalidad. Urgencias hospitalarias. Tratamiento paliativo. Paciente terminal.