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RESEARCH

Deaths among the elderly with ICU infections

Óbitos em idosos com infecção adquirida em Unidades de Terapia Intensiva

Muertes en ancianos con infecciones adquiridas en Unidades de Terapia Intensiva

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ABSTRACT

Objective: to evaluate the clinical outcome of elderly patients admitted to intensive care units who had nosocomial infection, correlating the findings with sociodemographic and clinical variables. **Method**: descriptive research, performed with 308 elderly patients. The collection was made from medical records and covers the years 2012 to 2015. Uni-/bivariate analyses were performed. **Results**: a statistical association was found between the clinical outcome types and the variables age, length of stay, presence of previous comorbidities, main diagnosis, respiratory and urinary tract infections, use of central venous and indwelling urinary catheters, mechanical ventilation, and tracheostomy. The survival curve showed higher mortality among the elderly from the age of 80 on. **Conclusion**: the clinical outcome of the elderly who acquire infection in the intensive care unit is influenced by sociodemographic and clinical variables that increase mortality rates.

Descriptors: Infection; Elderly; Clinical Outcome; Death; Intensive Care Units.

RESUMO

Objetivo: avaliar o desfecho clínico de idosos que adquiriram infecção hospitalar hospitalizados em Unidades de Terapia Intensiva, correlacionando os achados com variáveis sociodemográficas e clínicas. **Método**: pesquisa descritiva, realizada com 308 pacientes idosos. A coleta deu-se em prontuários e contempla os anos de 2012 a 2015. Realizaram-se análises uni-/bivariadas. **Resultados:** registrou-se associação estatística entre os tipos de desfechos clínicos e as variáveis: faixa etária, tempo de internação, presença de comorbidades prévias, diagnóstico principal, infecção do trato respiratório e urinário, uso de cateteres vesical de demora e venoso central, ventilação mecânica e traqueostomia. A curva de sobrevivência evidenciou maior mortalidade entre idosos a partir de 80 anos. **Conclusão**: o desfecho clínico de idosos que adquirem infecção na Unidade de Terapia Intensiva é influenciado por variáveis sociodemográficas e clínicas, que incrementam as taxas de mortalidade.

Descritores: Infecção; Idoso; Desfecho clínico; Óbito; Unidades de Terapia Intensiva.

RESUMEN

Objetivo: evaluar el desenlace clínico de ancianos que adquirieron infección intrahospitalaria durante internación en Unidades de Terapia Intensiva, correlacionando los hallazgos con variables sociodemográficas y clínicas. **Método**: investigación descriptiva, realizada con 308 pacientes ancianos. Datos recolectados de historias clínicas, considerando los años de 2012 a 2015. Se realizaron análisis uni/bivariados. **Resultados**: se registró asociación estadística entre los tipos de desenlace clínico y las variables: faja etaria, tiempo de internación, presencia de comorbilidades previas, diagnóstico principal, infección del tracto respiratorio y urinario, uso de catéteres vesicales de demora y venoso central, ventilación mecánica y traqueotomía. La curva de supervivencia evidenció mayor mortalidad entre ancianos a partir de los 80 años. **Conclusión**: el desenlace clínico de ancianos que adquieren infecciones en Unidades de Terapia Intensiva es influenciado por variables sociodemográficas y clínicas, que incrementan las tasas de mortalidad.

Descriptores: Infección; Anciano; Desenlace Clínico; Muerte; Unidades de Cuidados Intensivos.

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INTRODUCTION

Hospital infections are an important public health problem, especially when they involve the elderly, the group with the highest rates of population growth in most countries[1-3]. The hospitalization of the elderly has higher importance when these patients' clinical condition is critical, requiring greater demand for care.

In intensive care units (ICUs), hospitalizations have increased annually, and are related to diagnoses ranging from exacerbations of chronic diseases to trauma of greater impact and/or accidents[2,4].

Hospital infection is one of the most serious health risks to the elderly in the ICU. It is predominant in extremes of age, and related to intrinsic and exogenous factors, such as medical diagnosis, environment, and length of stay, among other variables[4-5]. Research on this topic is still sparse in Latin American literature, which makes it difficult to establish the real situation in terms of prevalence and main sites affected. Thus, the combination of these factors influences the patient's stay in the ICU, being determinant for the outcome of hospitalization or the clinical outcome (discharge)[6-7].

This study aimed to evaluate the clinical outcome of the elderly who had nosocomial infection in intensive care units, correlating the findings with sociodemographic and clinical variables.

METHOD

Ethical aspects

The research development complied with national and international standards of research ethics involving human subjects and was approved by the Research Ethics Committee.

Study design, setting, and period

This is a cross-sectional survey, with retrospective data collection, performed in exclusively adult intensive care units of a large public reference hospital in the Northeastern region of Brazil. The hospital experiences about 200,000 (clinical and surgical) annual visits in several specialties. The collection included the two ICUs of the service, which have a total of 15 beds and an average hospitalization of 80 patients per month. Most patients are admitted postoperatively following major surgeries.

The study population consisted of elderly patients (60 years old or over) hospitalized in the ICUs of the health service investigated, from January 2012 to June 2015, who developed hospital infection, according to the criteria of the Centers for Disease Control and Prevention (CDC)[8] and the Brazilian Health Regulatory Agency (ANVISA)[9].

Sampling and inclusion and exclusion criteria

A total of 308 elderly patients were included in the sample because they met the inclusion criteria: age equal to or over 60 years; with diagnosis of hospital infection after admission to the ICU. Exclusion criteria were: lack of accuracy in records regarding socioeconomic information; infection topography; invasive procedures; antibiotics; and clinical outcome in the ICU.

Study protocol

The collection was done using medical records and the database of the Hospital Infection Control Commission (CCIH) of the hospital. A structured formulary was used, with information on sociodemographic variables (gender, age, place of birth, and occupation), topographic site of infections, preexisting diseases, main diagnosis for admission, use of invasive procedures, and hospitalization clinical outcome (type of discharge). The criteria for discharge from the ICU of the investigated service were considered, classified into: 1) Improved: discharge due to recovery of the clinical condition; 2) Death; and 3) Transferred: discharged from the ICU through transfer to another medical service.

The instrument used was previously validated by five experts in the area, using a Likert scale[10] as consensus. A consensus criterion was established that the item had to achieve a minimal percentage of 75% of record in "important" or "very important" scores in order to remain in the questionnaire.

Analysis of results and statistics

Data were entered using Excel software, double typing, and later validation; they were analyzed using the Statistical Package for Social Sciences (SPSS) application, version 20.0. The Kolmogorov-Smirnov test was used to evaluate the normality of the distribution of variables. To check the association between the clinical outcome and the variables of the research, descriptive univariate and bivariate analyses were performed. For categorical variables, the chi-square test was used and the level of significance was set at $p \leq 0.05$ with a 95% confidence interval. We also used the Kaplan-Meier method to analyze survival.

RESULTS

This study registered a prevalence of women (181/58.8%) and a mean age of 71 years ($\pm$ 8.5 years), with a maximum age of 97 years. Among the previous comorbidities, hypertension prevailed (99/32.1%). The main reason for the ICU stay was related to the postoperative period of fracture(s) (126/40.9%).

There was a statistical association between the clinical outcome and the variables: age group ($p = 0.045$); time or period of ICU stay ($p < 0.01$); presence of prior comorbidities ($p = 0.03$); and main diagnosis for the current hospitalization ($p = 0.01$) (Table 1).

Table 2 shows the distribution of different types of clinical outcome, relating them to topographies: Respiratory infection ($p = 0.002$), Urinary tract infection ($p = 0.045$), Bloodstream infection ($p = 0.298$), and Infection of surgical site ($p = 1.000$). All patients developed infection on at least one of the topographic sites.

All patients underwent at least one invasive procedure. Regarding the types, the indwelling vesical catheter ($p < 0.001$), the endotracheal tube ($p = 0.001$), tracheostomy ($p = 0.001$) and central venous access prevailed ($p = 0.007$) (Table 3).

Table 1 – Distribution of types of clinical outcomes in the elderly with diagnosis of infection hospitalized in Intensive Care Units according to sociodemographic variables, Teresina, Piauí, Brazil, 2012-2015

	Clinical outcome								*p* value*
	Improved		Transference		Death		Total		
	n	%	n	%	n	%	n	%	
Total	120	39.0	31	10.1	157	50.9	308	100.0	
Gender									0.233
Male	55	43.3	11	8.7	61	48.0	127	41.2	
Female	65	36.0	20	11.0	96	53.0	181	58.8	
Age range									0.045
60 to 69 years	67	43.0	16	10.2	73	46.8	156	50.6	
70 to 79 years	39	41.0	9	9.5	47	49.5	95	30.9	
80 years on	14	24.6	6	10.5	37	64.9	57	18.5	
Time of stay									**< 0.001**
1-10 days	62	44.6	4	2.9	73	52.5	139	45.2	
11-20 days	20	26.7	18	24	37	49.3	75	24.3	
21-30 days	18	40.9	6	13.6	20	45.5	44	14.3	
31-40 days	5	16.7	3	10.0	22	73.3	30	9.7	
41 or more days	15	75.0	0	0	5.0	25.0	20	6.5	
Associated comorbidities **									0.003
Hypertension	42	40.8	8	7.8	53	51.4	103	33.4	
Diabetes	14	32.5	11	25.6	18	41.9	43	14.0	
Chronic renal insufficiency	24	34.3	13	18.6	33	47.1	70	22.7	
Cardiopathies	13	35.1	7	18.9	17	46.0	37	12.0	
Obesity	12	46.1	6	23.1	8	30.8	26	8.4	
Others	25	44.6	4	7.1	27	48.3	56	18.1	
Main diagnosis									0.001
Limb fracture	41	32.6	12	9.5	73	57.9	126	40.9	
Neoplasias	22	50.0	7	15.9	15	34.0	44	14.3	
Treatment of liver diseases	19	41.3	10	21.7	17	37.0	46	14.9	
Treatment of cardiovascular diseases	14	30.4	3	6.5	29	63.1	46	14.9	
Treatment of neurological diseases	7	33.3	2	9.5	12	57.2	21	6.8	
Treatment of respiratory diseases	14	56.0	1	4.0	10	40.0	25	8.2	

*Note: *Statistical significance was set at p ≤ 0.05; **It does not sum 100%, because patients could have more than one associated comorbidity.*

Table 2 – Distribution of types of clinical outcome in the elderly with a diagnosis of infection in intensive care units, according to the topographic site of infection, Teresina, Piauí, Brazil, 2012-2015

Topography	Clinical outcome								*p* value*
	Improved		Transference		Death		Total		
	n	%	n	%	n	%	n	%	
Total	120	39.0	31	10.0	157	51.0	308	100	
Respiratory tract infection									0.002
Yes	49	32.0	16	10.5	88	57.5	153	49.7	
No	71	45.8	15	9.7	69	44.5	155	50.3	
Urinary tract infection									0.045
Yes	48	46.1	6	5.8	50	48.1	104	33.8	
No	72	35.3	25	12.3	107	52.4	204	66.2	
Bloodstream Infection									0.298
Yes	30	32.3	12	10.7	47	57.0	89	21.1	
No	90	40.7	19	9.9	110	49.4	219	78.9	
Surgical site infection									1.000**
Yes	6	40.0	1	6.7	8	53.3	15	4.9	
No	114	38.9	30	10.2	149	50.9	293	95.1	

*Note: *Statistical significance was set at p ≤ 0.05; **Fischer's exact test.*

Table 3 – Distribution of types of clinical outcome in the elderly with a diagnosis of infection admitted to intensive care units, according to the use of invasive procedures, Teresina, Piauí, Brazil, 2012-2015

Use of invasive procedures	Clinical outcome								*p* value*
	Improved		Transference		Death		Total		
	n	%	n	%	n	%	n	%	
Total	120	39.0	31	10.0	157	51.0	308	100	
Nasogastric/nasoenteral tube									0.290
Yes	70	38.0	15	8.2	99	53.8	184	59.7	
No	50	40.3	16	12.9	58	46.8	124	40.3	
Indwelling vesical catheter									**< 0.001**
Yes	83	32.8	23	9.1	147	58.1	253	82.1	
No	37	67.3	8	14.5	10	18.2	55	17.9	
Endotracheal tube									0.001
Yes	80	52.3	14	9.1	59	38.6	153	49.7	
No	68	43.9	17	11.0	70	45.1	155	50.3	
Tracheostomy									0.001
Yes	33	27.3	18	14.9	70	57.8	121	39.3	
No	87	46.5	13	7.0	87	46.5	187	60.7	
Ventral venous access									0.007
Yes	43	53.7	7	8.8	30	37.5	80	26.0	
No	77	33.8	25	11.0	126	55.2	228	74.0	

*Note: *Statistical significance was set at p ≤0.05.*

According to the Kaplan-Meier survival curve, hospital mortality in the elderly who developed ICU infection does not have large variations among either the delimited age groups or the discharge types. However, it should be taken into account that the elderly aged 80 years and over presented death as a clinical outcome, mainly due to the prolonged hospitalization time (Figure 1).

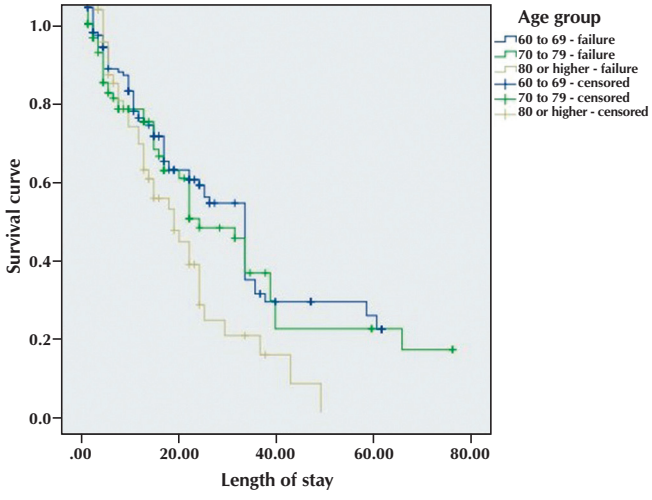

Figure 1 – Kaplan-Meier curve, indicating hospital mortality according to age, Teresina, Piauí, Brazil, 2012-2015

DISCUSSION

In this research, sociodemographic and clinical characteristics influenced the clinical outcome of the elderly with infection in the ICU, contributing to a high death rate. These findings corroborate that factors associated with hospitalization should be identified and treated early, especially in patients with advanced age, because complications can lead to generalized infection with a consequent increase in mortality.

Among the sociodemographic variables related to the elderly in this study, the higher proportion of women is highlighted. Because they have a higher prevalence of chronic diseases, women seek care in health institutions more spontaneously than men. In addition, males are associated with high mortality in adulthood (20 to 29 years), which contributes to greater gender difference among the elderly[4].

With regard to hospital infection in the elderly in Brazil, there is a research gap, especially when it involves the age range over 80 years. Researches that study the profile of patients who develop infection tend to generalize the findings by extrapolating them, disregarding the intrinsic characteristics of this population, while international research tends to study long-term care facilities, with less research in hospitals, especially in intensive care units[11].

Old age alone is an independent risk factor for in-hospital mortality[12]. In Brazil, similarly to other developing countries, people aged 60 years or older represent the segment of the

population with the greatest growth, reflecting the demographic transition that has an impact on the epidemiological profile, with the reduction of infectious, transmissible, and parasitic diseases, and an increase of chronic and degenerative diseases, such as hypertension, renal failure, diabetes mellitus, obesity, and neurological and cardiovascular diseases, among others. The progress or exacerbation of these diseases is usually accompanied by frequent hospitalizations requiring more serious interventions and long periods in a hospital setting[13].

It is estimated that the number of hospitalized elderly patients will double in the coming decades around the world, especially among those of a more advanced age[6]. Due to this increase, elderly patients are frequently admitted to the most critical services with varied and often severe diagnoses[4,14-16].

In elderly patients admitted to the ICU, changes in morphological and physiological variables should be considered, because they affect various organic functions, especially immunity, which makes patients even more vulnerable to infections, and may cause an extension of hospitalization under the use of invasive procedures, an increase in expenses with the treatment, and a rise in chances of death[16-17].

Because it is considered a critical area, length of stay in the ICU influences the stay and the clinical outcome of the elderly. In this study, the highest number of deaths, when compared to hospitalization time, occurred exactly in the period longer than 30 days, which corroborates findings from another multicenter study[18].

Longer hospitalization time will be reflected in prolonged use of invasive procedures, as well as increased stay in a critical environment. These procedures are known to be vital in the prolongation of life; however, they are commonly related to an increased risk of clinical complications[19-20].

Elderly patients are more likely to present atypical manifestations and symptoms resulting from the onset of the infectious process, ranging from malaise and febrile peaks to delirium, disorientation, weakness, anorexia, or urinary incontinence, which may mask and delay the correct diagnosis[21-22]. In these cases, it is common to consider these clinical signs and symptoms as "arising from the aging process," which leads to the use of invasive procedures, especially indwelling urinary catheters and nasogastric tubes, in order to maintain organic function, obscuring the correct diagnosis even more[22-23].

Among the different topographies, respiratory tract infections (RTIs) were the most frequent occurrence in this study. Pneumonia stands out among the RTIs, having a topography of higher prevalence in critical patients. The use of mechanical ventilation in the elderly causes a greater degree of dependence and an index of associated comorbidities in the post-hospitalization period, with emphasis on cardiovascular and neurological pathologies associated with higher severity scores[23].

The elderly in intensive care units commonly present alterations in genitourinary function, especially among women over 80 years, which justifies the high use of indwelling urinary catheters, and explains the high rates of urinary tract infection. The diagnosis of urinary infection in the elderly depends to a great extent on the presence of clinical signs and symptoms; however, it should be confirmed through urine culture for treatment to be initiated[24-26].

There are few comprehensive studies that investigate bloodstream infections among the elderly in the ICU, especially in Latin America. It is believed that the prevalence of bloodstream infection increases significantly over time among older people, leading to an increase in mortality rates, mainly due to late diagnosis or even underreporting. The use of catheters, especially central venous catheters, constitutes a considerable risk factor for infection because it provides direct access to the bloodstream, as it breaks the body's natural barriers[18,27-28].

The highest number of deaths occurred in patients who had treatment of cardiovascular disease as the main diagnosis for admission. The occurrence of nosocomial infection in the postoperative period of cardiac surgeries presents a variable incidence (between 5% and 25%), and there is no consensus on the actual death rates[29-30].

In general terms, factors associated with hospital infection in the elderly in the ICU should be identified and treated early, as they may influence not only patients' stay in this environment, but also their clinical outcome (discharge). In spite of this, systematized perioperative attention focused on the identification of risk factors, such as age and preexisting diseases, as well as clinical variables, can directly interfere in the reduction of invasive procedures and the epidemiology of infection in ICUs.

Limitations and contributions to public health

This research has some limitations, mainly caused by the methodological design used (cross-sectional), which does not allow a follow-up of the elderly from the ICU to post-discharge care. In addition, data show the ICU of a single health facility, which may limit generalization of the findings. Data analysis was limited to the variables presented, because they were consolidated in the evaluation of risk factors for nosocomial infection, even though there are other covariables that may be of interest. Due to possible inaccuracies in information, we opted to cross-check the results of the different registry services, minimizing bias. Research that addresses hospital infection is necessary and feasible because, as demonstrated, more elderly people are being admitted to the ICU.

CONCLUSION

The clinical outcome of the elderly who acquire an infection in the intensive care unit is influenced by sociodemographic (age, length of stay, presence of preexisting comorbidities) and clinical (main diagnosis for hospitalization, topography of hospital infection, and use of invasive procedures) variables, with a greater impact on those aged 80 years or older who, consequently, have a higher death rate.

Thus, individualization of the service provided to the elderly in critical condition, observing the specific signs and symptoms and correlating them with the presence of infection, is essential.

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