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A short-term survival analysis of severe patients with acute vascular event admitted on intensive care unit department

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Abstract

The study evaluated the short-term survival during hospitalization period of the patients admitted on the intensive care unit department with an acute vascular event in comparison with other pathologies. We developed a retrospective cohort study with longitudinal design on 178 subjects admitted in an intensive care unit department. The patients were divided according the presence (33 patients) or absence (145 patients) of an acute vascular event (myocardial infarction or stroke). The survival during the hospitalization period was evaluated also considering the presence of diabetes (58 patients) or diabetes with complications (54 patients). The survival was presented as probability to survive during hospitalization period and median survival time. Logrank test was used to compare the groups. Patients with myocardial infarction had the average age of 60.57±7.97 years old, with 100% mortality during the hospitalisation period and a median survival time of 16 days. The patients with stroke were 66.34±14.12 years old with 46.15% survival probability and median survival time of 26 days; respectively patients without vascular event were 65.52±15.81 years old, had a survival probability of 46.89% and a median survival time of 28 days. Considering all the patients with vascular events, survival probability was 36.36%. Diabetes, the presence of arterial hypertension or diabetic complications does not influence significantly the survival in this sample (Logrank test, $p>0.05$). Survival of patients with acute vascular event is comparable with that of the patients admitted on intensive care unit for other health condition. A poor prognostic was observed for myocardial infarction.

Keywords: intensive care unit; myocardial infarction; stroke; survival; vascular event

Introduction

Type 2 diabetes is a very important metabolic disorder characterized by chronic hyperglycemia, a burden for the healthcare system worldwide (Reed *et al.*, 2021). This disease was mentioned for the first time in a manuscript, about three thousand years ago (Hegazi *et al.*, 2015).

The highest prevalence in the population have type 2 diabetes (90%), followed by type 1 diabetes (less than 10%) and other rare types. The increase in prevalence for type 2 diabetes is related with bad eating habits and increase body weight (Haslam, 2010; Maahs *et al.*, 2010; Ozougwu *et al.*, 2013). The molecular cause for type 2 diabetes seems to be inappropriate insulin production or secretion in the pancreatic beta cells or the resistance to insulin (Thompson and Kanamarlapudi, 2013). Long-term complications are important in this pathology, considering that is the first cause of blindness, end-stage kidney disease, cardiovascular disease and leg amputation worldwide (Thompson and Kanamarlapudi, 2013).

Myocardial infarction is characterized by the death of myocardial cell due to ischemia (Thygesesn *et al.*, 2010). Mortality decreased in the past years (Mozaffarian *et al.*, 2010). Dispensarisation on intensive care unit after an acute myocardial infarction is accepted in the standard practice (Halpern and Pastores, 2013). Stroke is another important acute vascular event caused by hemorrhage or ischemia that can require management in the intensive care unit (Khassawneh *et al.*, 2012). According to Ho *et al.* (2015) the in-hospital mortality after hemorrhagic and ischemic stroke is 20.4% respectively 15%. For patients with myocardial infarction who developed cardiogenic shock a mortality of at least 40% is described in the literature (Saleh and Ambrose, 2010).

The aim of our study was to evaluate the short-term survival of patients with a major vascular event that needed intensive care management considering associated diabetes in comparison with other cases from intensive care unit department.

Materials and Methods

Setting and study design

A cohort study with longitudinal retrospective design was conducted on patients admitted in the intensive care unit from Oradea Regional Emergency Hospital.

Participants

All patients admitted in the intensive care unit department were eligible for the study. Patients who were in the direct care of the main author, with a complete medical history and without missing data were included for analysis. The cohort was divided according the presence and the type of vascular event (myocardial infarction or stroke).

Data source and collection

Patient's information was collected from hospital database and patient observation sheets. Qualitative data (gender and comorbidities), quantitative (age) and survival information (survival time in days) were collected.

Statistical analysis

The statistics were computed on R Commander Version 2.8.0 and for survival graphs the KMggplot2 package was used. Qualitative data were evaluated as relative frequencies, quantitative data were presented as averages and standard deviations respectively median and interquartile range. The survival time was presented

as median and 95% confidence intervals. To compare the survival time, we used the Logrank test and Kaplan Meyer curves. The p value lower than 0.05 was considered statistically significant.

Ethical issues

This study received approval no. 33441/07.10.2022 from the Ethics Committee of the Oradea Regional Emergency Hospital.

Results

One hundred seventy-eight patients admitted in the intensive care unit department were evaluated. The groups were built according to the presence of cardiovascular event: twenty-six patients after a stroke (14.61%), seven patients after myocardial infarction (3.93%) and one hundred forty-five subjects without vascular events (81.46%). The main characteristics of the patients and associated comorbidities are presented in Table 1.

Table 1. The main characteristics of the sample (n=178)

	All subjects (n=178)	Myocardial infarction (n=7)	Stroke (n=26)	No vascular event (n=145)
Characteristics				
Age* (years) mean± SD	65.44±15.32	60.57±7.97	66.34±14.12	65.52±15.81
Gender, male – no. (%)	101 (56.74%)	5 (7.14%)	16 (61.53%)	80 (55.17%)
Diabetes - no. (%)	58 (32.58)	4 (57.14%)	6 (23.07%)	48 (33.1%)
Diabetes with hypertension - no. (%)	13 (7.3%)	0	1 (3.84%)	12 (8.27%)
Diabetes with complications - no. (%)	54 (30.33%)	4 (57.14)	6 (23.07%)	44 (30.34%)
Survival				
Death during hospitalization period - no. (%)	98 (55.05%)	7 (100%)	14 (53.84%)	77 (53.1%)
Death on the intensive care unit - no. (%)	89 (50%)	7 (100%)	14	68 (46.89%)
Death after they were transferred to another department - no. (%)	9 (5.05%)	0	0	9 (6.2%)
Median survival time *	27 (95% CI 24-33)	16 (95% CI 1-NA)	26 (95% CI 20-NA)	28 (95% CI 24-35)

*Presented as median and 95% confidence intervals; NA, not applicable.

No statistically significant difference in survival (p=0.25 –Log-rank test) was observed for diabetic patients that had a survival probability of 48.27% and a median survival time of 27 days (95% CI 19-45) in comparison with the median survival time for those without diabetes with a survival probability of 46.66% and median survival of 27 days (95% CI 24-34). Patients with diabetes and associated hypertension have a survival probability of 46.15% with a median survival time of 28 days (95% CI 5-NA), and the difference was not statistically significant in comparison to those without hypertension (Figure 1). For those with diabetes and specific diabetic complications, the survival probability was 50% and the median survival time on intensive care unit was 28 days (95% CI 18-45). For patients with diabetes and an acute vascular event, the survival probability was 50% with a median survival time of 32.5 days (95% CI 17-NA), but the differences with the other patients admitted on intensive care unit were not statistically significant (Figure 1).
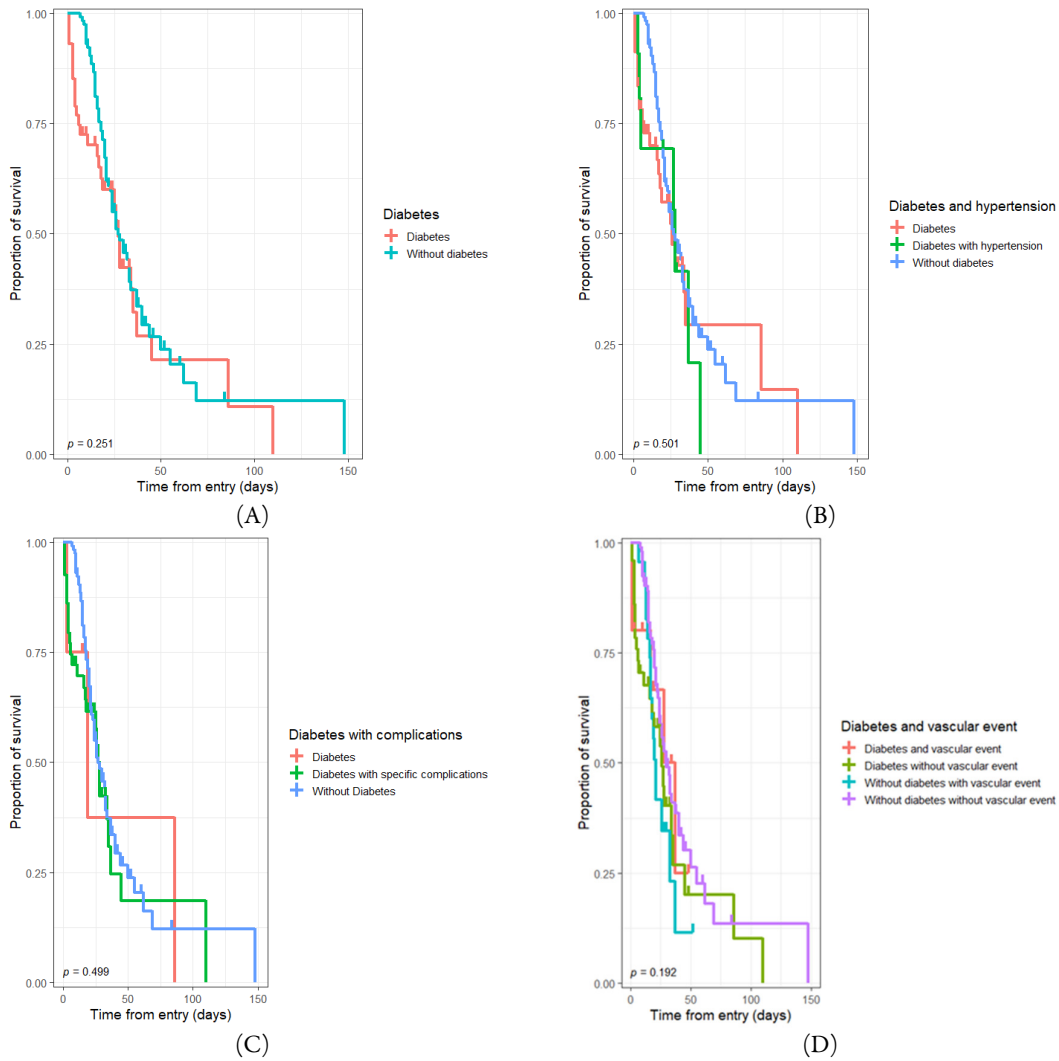
Figure 1. Survival during hospitalization period regarding the presence of diabetes (A), hypertension (B), diabetic complications (C) and vascular events (D)

The survival probability for the subjects with stroke admitted in the intensive care unit was 46.15% with a median survival time of 26 days (95% CI 20-NA) while none of the subjects admitted with myocardial infarction managed to survive. The median survival time for myocardial infarction was 16 days (95% CI 1-NA). The overall survival probability for subjects with vascular events admitted in the intensive care unit was 36.36%. For the subjects without vascular event the survival probability was 46.89% and the median survival time of 28 days (95% CI 24-35) (Figure 2). The survival probability was significantly inferior for the subjects with myocardial infarction.
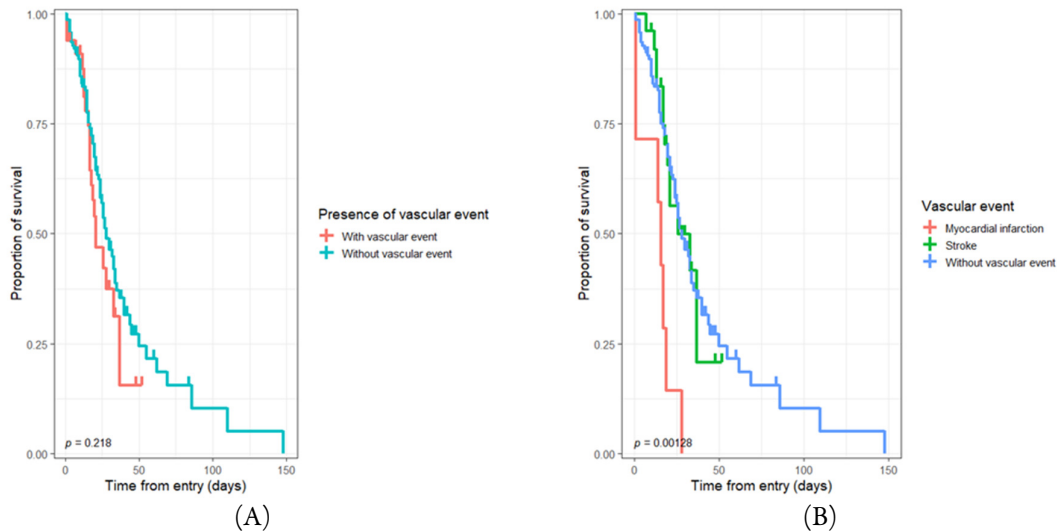
Figure 2. Survival during hospitalization period regarding the presence (A) and the type (B) of vascular event

Discussion

The myocardial infarction and stroke are considered diseases with golden hour (Cho *et al.*, 2019). This study evaluated the short-term survival in case of a major vascular event (myocardial infarction or stroke) in comparison with other subjects admitted in a mixed intensive care unit.

Myocardial infarction that needed intensive care management proved to have a significantly poor prognostic in comparison with the other subjects, despite a slightly lower average age (Table 1 and Figure 2). Kristoffersen *et al.* (2012) described a close overall relative frequency of death among the patients after acute myocardial infarction (19.1%) to those that had an acute stroke event (17.6%) during the first 30 days hospitalization period. The rates were higher in our study, considering also the severity of the cases that needed intensive care management. An important factor for survival was also the time and the distance before the patients firstly arrived in the hospital, as Berlin *et al.* (2016) mentioned. Driving time to the hospital was less important for stroke patients in comparison with myocardial infarction regarding the prognostic (Berlin *et al.*, 2016). Myocardial infarction seems to have a poor short –term survival especially STEMI in comparison with the stroke where mortality is increased later, after the first approach due to secondary sequelae, hemodynamic instability or pulmonary complications (Berlin *et al.*, 2016).

A meta-analysis over 141 studies regarding the mortality in the intensive care unit for subjects with diabetes in comparison to those without diabetes, a significant disadvantage for diabetes was observed only for subjects admitted after surgery (OR= 1.48 [1.04 to 2.11]), but not for those from the medical or mixed intensive care units (Siegelaar *et al.*, 2011). The results were similar with the situation described in our study. The diabetes was not associated with increased mortality (Figure 1). The presence of diabetic complications did not make differences on short-term outcome, and this can be explained by a different treatment approach adapted to their needs, and a good care they receive, to have a similar survival chance. Also, regarding the chronic pathology and complications, they seem to be managed efficiently (Figure 1). Krinsley (2003) suggested that hyperglycemia is a common condition for the critically ill patient, being associated with an increased in-hospital mortality. Patients with high glucose levels due to diabetes seems to be less affected by hyperglycemia in critical situations (Rady *et al.*, 2005; Egi *et al.*, 2008; Falciglia *et al.*, 2009; Graham *et al.*, 2010). This can also explain the similarities for the short-term prognostic (Figure 1).

Our single-center experience can be valuable to assess the short-term prognostic for severe subjects after an acute vascular event admitted for intensive care. Possible drawback for this study is the retrospective design; the small sample size, and the low number of of subjects in the group with vascular event; especially for those with myocardial infarction. A larger sample with prospective follow-up is recommended for further research on this domain.

Conclusions

Survival of patients admitted after an acute stroke on a mixed intensive care unit is comparable with that of the patients admitted for other non-vascular conditions. A poor prognostic was observed for myocardial infarction in comparison with stroke or non-vascular subjects. For patients with diabetes or with diabetic complications no differences in survival were observed during short-term prognostic on a mixed intensive care unit department.

Authors' Contributions

SA was responsible for data collection and manuscript writing. NVI was involved in statistical analysis, interpretation, review and editing of final manuscript. PCI provided conceptualization, supervision, study design, final review and correction.

All authors read and approved the final manuscript.

Ethical approval (for researches involving animals or humans)

This study received approval no. 33441/07.10.2022 from the Ethics Committee of the Oradea Regional Emergency Hospital.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

References

Berlin C, Panczak R, Hasler R, Zwahlen M (2016). Do acute myocardial infarction and stroke mortality vary by distance to hospitals in Switzerland? Results from the Swiss National Cohort Study. British Medical Journal 6(11):e013090. *https://doi.org/10.1136/bmjopen-2016-013090*

Cho KH, Nam CM, Lee SG, Kim TH, Lee SH, Park EC (2019). Measuring of quality of care in patients with stroke and acute myocardial infarction: An application of algebra effectiveness model. Medicine 98(20):e15353. *https://doi.org/10.1097/MD.0000000000015353*

Egi M, Bellomo R, Stachowski E, French CJ, Hart GK, Hegarty C, Bailey M (2008). Blood glucose concentration and outcome of critical illness: the impact of diabetes. Critical Care Medicine 36:2249-2255. *https://doi.org/10.1097/CCM.0b013e318181039a*

Falciglia M, Freyberg RW, Almenoff PL, D'Alessio DA, Render ML (2009). Hyperglycemia-related mortality in critically ill patients varies with admission diagnosis. Critical Care Medicine 37:3001-3009. *https://doi.org/10.1097/CCM.0b013e3181b083f7*

Graham BB, Keniston A, Gajic O, Trillo Alvarez CA, Medvedev S, Douglas IS (2010). Diabetes mellitus does not adversely affect outcomes from a critical illness. Critical Care Medicine 38:16-24. *https://doi.org/10.1097/CCM.0b013e3181b9eaa5*

Halpern NA, Pastores SM (2010). Critical care medicine in the United States 2000-2005: an analysis of bed numbers, occupancy rates, payer mix, and costs. Critical Care Medicine 38:65-71. *https://doi.org/10.1097/CCM.0b013e3181b090d0*

Haslam D (2010). Obesity and diabetes: the links and common approaches. Primary Care Diabetes 4(2):105-112. *https://doi.org/10.1016/j.pcd.2010.04.002*

Hegazi R, El-Gamal M, Abdel-Hady N, Hamdy O (2015). Epidemiology of and risk factors for type 2 diabetes in Egypt. Annals of Global Health 81(6):814-820. *https://doi.org/10.1016/j.aogh.2015.12.011*

Ho WM, Lin JR, Wang HH, Liou CW, Chang KC, Lee JD, ... Lee TH (2016). Prediction of in-hospital stroke mortality in critical care unit. SpringerPlus 5(1):1051. *https://doi.org/10.1186/s40064-016-2687-2*

Khassawneh B, Ibnian A, Yassin A, Al-Mistarehi A, E'Leimat I, Ali M, ... El-Salem K (2019). The outcome of patients with acute stroke requiring intensive care unit admission. European Respiratory Journal *https://doi.org/10.1183/13993003.congress-2019.PA2283*

Krinsley JS (2003). Association between hyperglycemia and increased hospital mortality in a heterogeneous population of critically ill patients. Mayo Clinic Proceedings 78:1471-1478. *https://doi.org/10.4065/78.12.1471*

Kristoffersen DT, Helgeland J, Clench-Aas J, Laake P, Veierød M (2012). Comparing hospital mortality – how to count does matter for patients hospitalized for acute myocardial infarction (AMI), stroke and hip fracture. BMC Health Service Research 12:364. *https://doi.org/10.1186/1472-6963-12-364*

Maahs DM, West NA, Lawrence JM, Mayer-Davis EJ (2010). Chapter 1: epidemiology of type 1 diabetes. Endocrinology & Metabolism Clinics of North America 39(3):481-497. *https://doi.org/10.1016/j.ecl.2010.05.011*

Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, ... Turner MB (2015). Heart disease and stroke statistics – 2015 update: a report from the American Heart Association. Circulation 131:e29-e322

Ozougwu JC, Obimba KC, Belonwu CD, Unakalamba CB (2013). The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus. Journal of Physiology and Pathophysiology 4:46-57. *https://doi.org/10.5897/JPAP2013.0001*

Rady MY, Johnson DJ, Patel BM, Larson JS, Helmers RA (2005). Influence of individual characteristics on outcome of glycemic control in intensive care unit patients with or without diabetes mellitus. Mayo Clinic Proceedings 80:1558-1567. *https://doi.org/10.4065/80.12.1558*

Reed J, Bain S, Kanamarlapudi V (2021). A review of current trends with type 2 diabetes epidemiology, aetiology, pathogenesis, treatments and future perspectives. DMSO. Diabetes, Metabolic Syndrome and Obesity 4:3567-3602. *https://doi.org/10.2147/DMSO.S319895*

Saleh M, Ambrose JA (2018). Understanding myocardial infarction. F1000 Research 7. *https://doi.org/10.12688/f1000research.15096.1*

Siegelaar SE, Hickmann M, Hoekstra JB, Holleman F, DeVries JH (2011). The effect of diabetes on mortality in critically ill patients: a systematic review and meta-analysis. Critical Care 15(5):R205. *https://doi.org/10.1186/cc10440*

Thompson A, Kanamarlapudi V (2013). Type 2 diabetes mellitus and glucagon like peptide-1 receptor signalling. Clinical and Experimental Pharmacology 3:138. *https://doi.org/10.4172/2161-1459.1000138*

Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD (2012). Third universal definition of myocardial infarction. European Heart Journal 33:2551-2567. *https://doi.org/10.1093/eurheartj/ehs184*

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