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AVC AGUDO NO NORTE DE PORTUGAL: RESULTADOS E CARACTERÍSTICAS DOS DOENTES NUM SERVIÇO DE URGÊNCIA MÉDICO-CIRÚRGICA

ACUTE STROKE IN NORTHERN PORTUGAL: OUTCOMES AND CHARACTERISTICS OF PATIENTS IN A MEDICAL-SURGICAL EMERGENCY DEPARTMENT

ICTUS AGUDO EN EL NORTE DE PORTUGAL: RESULTADOS Y CARACTERÍSTICAS DE LOS PACIENTES EN UN SERVICIO DE URGENCIAS MÉDICO-QUIRÚRGICAS

Sandra Domingues[1] *https://orcid.org/0009-0003-7693-1493*
Tiago Barros[1] *https://orcid.org/0009-0009-6155-7500*
João Correia[1] *https://orcid.org/0009-0007-7260-1605*
Arlindo Cruz[1] *https://orcid.org/0000-0002-5620-3478*
Nuno Araújo[2] *https://orcid.org/0009-0002-4763-4388*
Liliana Silva[1,3,4] *https://orcid.org/0000-0002-0055-8261*

[1] Unidade Local de Saúde de Matosinhos, Matosinhos, Portugal
[2] Cooperativa de Ensino Superior Politécnico e Universitário (CESPU), Gandra, Portugal
[3] Tecnologias para a Educação e Simulação na Saúde (Tech4edusim), Porto, Portugal
[4] Centro de Investigação em Tecnologias e Serviços de Saúde (CINTESIS), Porto, Portugal

Sandra Domingues – sandra.dmgs@gmail.com |Tiago Barros – jtsbarros@gmail.com | João Correia – enf.correia@hotmail.com |
Arlindo Cruz – Arlindo.Cruz@ulsm.min-saude.pt | Nuno Araújo – nuno.araujo@ipsn.cespu.pt | Liliana Silva – enf.lilianasilva@gmail.com

Corresponding Author:
Sandra Domingues
Rua Dr. Eduardo Torres
4464-513– Senhora da Hora - Portugal
sandra.dmgs@gmail.com

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RESUMO

Introdução: O Acidente Vascular Cerebral (AVC), é uma das principais causas de morbilidade e incapacidade a longo prazo em todo o mundo, com impacto significativo nos sistemas de saúde e vidas pessoais. As disparidades no acesso aos cuidados de AVC na Europa sugerem um aumento do ónus para indivíduos e sociedade. A gestão eficaz do AVC agudo nos serviços de urgência é crucial, exigindo uma resposta rápida e coordenada para otimizar os resultados clínicos.
Objetivo: Caracterizar a abordagem hospitalar a doentes com AVC agudo atendidos através do protocolo Via Verde AVC num Serviço de Urgência Médico-Cirúrgica, no norte de Portugal.
Métodos: Estudo observacional retrospetivo de 1153 doentes admitidos através da Via Verde AVC, período temporal de 2019 a 2023. Dados demográficos, características clínicas, tratamentos e resultados foram recolhidos de registos médicos eletrónicos. A análise estatística incluiu testes qui-quadrado, ANOVA, testes de Kruskal-Wallis, análise de tendências e regressão logística.
Resultados: As ativações da Via Verde AVC aumentaram de 0,28% em 2019 para 0,31% em 2023 (p<0,05). O AVC isquémico foi o mais comum (64,8%, IC 95%: 62,1-67,4%). As taxas de trombólise aumentaram de 21,96% para 27,27% (p<0,01), e a trombectomia de 4,67% para 21,21% (p<0,001). Idade >70 anos (OR 1,8, IC 95%: 1,3-2,5) e chegada em 3 horas (OR 2,3, IC 95%: 1,7-3,1) previram terapia de reperfusão. As doentes do sexo feminino ultrapassaram os doentes do sexo masculino em 2023 (51,01% vs 48,99%).
Conclusão: O Serviço de Urgência demonstrou melhoria nos cuidados ao AVC agudo. É necessário melhorar o registo sistemático de dados e implementar novas tecnologias para otimizar os cuidados. Investigações futuras devem focar-se em resultados a longo prazo e medidas de qualidade de vida.

Palavras-chave: Acidente Vascular Cerebral; Serviço de Urgência; cuidados de saúde; protocolo de tratamento do AVC agudo; qualidade dos cuidados de saúde

ABSTRACT

Introduction: Stroke is a leading cause of morbidity and long-term disability worldwide, significantly impacting health systems and personal lives. Disparities in European access to stroke care suggest an increased burden on individuals and society. Effective management of acute stroke in emergency departments is critical, requiring a rapid and coordinated response to optimize clinical outcomes.
Objective: Characterize the hospital approach to acute stroke patients attended through the Stroke Pathway (Via Verde AVC) protocol in a Medical-Surgical Emergency Department in northern Portugal.
Methods: Retrospective observational study of 1153 patients admitted through the Acute Stroke Care Pathway from 2019 to 2023. Data on patient demographics, clinical characteristics, treatments, and outcomes were collected from electronic medical records. Statistical analysis included chi-square tests, ANOVA, Kruskal-Wallis tests, trend analysis, and logistic regression.
Results: Stroke Pathway activations increased from 0.28% in 2019 to 0.31% in 2023 (p<0.05). Ischemic stroke was most common (64.8%, 95% CI: 62.1-67.4%). Thrombolysis rates increased from 21.96% to 27.27% (p<0.01), and thrombectomy from 4.67% to 21.21% (p<0.001). Age >70 years (OR 1.8, 95% CI: 1.3-2.5) and arrival within 3 hours (OR 2.3, 95% CI: 1.7-3.1) predicted reperfusion therapy. Female patients surpassed males in 2023 (51.01% vs 48.99%).
Conclusion: The Emergency Service demonstrated improvement in acute stroke care. Enhanced systematic data recording and new technologies are needed to optimize care. Future research should focus on long-term outcomes and quality-of-life measures.

Keywords: Stroke; Emergency Service; health care; Acute Stroke Treatment Protocol; quality of health care

RESUMEN

Introducción: El ictus es una de las principales causas de morbilidad y discapacidad a largo plazo en todo el mundo, con un impacto significativo en los sistemas de salud y las vidas personales. Las disparidades en el acceso a la atención del ictus en Europa sugieren una carga creciente para individuos y sociedad. El manejo efectivo del ictus agudo en los servicios de urgencias es crítico, requiriendo una respuesta rápida y coordinada para optimizar los resultados clínicos.
Objetivo: Caracterizar el enfoque hospitalario para pacientes con ictus agudo atendidos a través del protocolo Vía Rápida del Ictus en un Servicio de Urgencias Médico-Quirúrgicas en el norte de Portugal.
Métodos: Estudio observacional retrospectivo de 1153 pacientes admitidos a través de la Vía Rápida del Ictus desde ano 2019 hasta lo ano 2023. Se recopilaron datos demográficos, características clínicas, tratamientos y resultados de registros médicos electrónicos. El análisis estadístico incluyó pruebas de chi-cuadrado, ANOVA, pruebas de Kruskal-Wallis, análisis de tendencias y regresión logística.
Resultados: Las activaciones de la Vía Rápida del Ictus aumentaron del 0,28% en 2019 al 0,31% en 2023 (p<0,05). El ictus isquémico fue el más común (64,8%, IC 95%: 62,1-67,4%). Las tasas de trombólisis aumentaron del 21,96% al 27,27% (p<0,01), y la trombectomía del 4,67% al 21,21% (p<0,001). Edad >70 años (OR 1,8, IC 95%: 1,3-2,5) y llegada dentro de 3 horas (OR 2,3, IC 95%: 1,7-3,1) predijeron la terapia de reperfusión. Las pacientes femeninas superaron a los hombres en 2023 (51,01% vs 48,99%).
Conclusión: El Servicio de Urgencias demostró una mejora en la atención del ictus agudo. Se necesita mejorar el registro sistemático de datos e implementar nuevas tecnologías para optimizar la atención. La investigación futura debe centrarse en los resultados a largo plazo y las medidas de calidad de vida.

Palabras Clave: Ictus; Servicio de Urgencias; atención sanitaria; Protocolo de Tratamiento del Ictus Agudo; calidad de la atención sanitaria

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INTRODUCTION

Stroke is one of the leading causes of morbidity and mortality worldwide, representing a significant challenge for healthcare systems. 'In Portugal, it is estimated that around 25,000 new cases of stroke occur every year, which is equivalent to approximately 3 cases per hour. Stroke mortality has fallen significantly in recent decades but still accounts for around 11 percent of all deaths in the country. In addition, stroke remains the leading cause of long-term disability in adults, with approximately 50 percent of survivors experiencing some degree of permanent disability (Norrving et al., 2018).

To address this critical health issue, the Portuguese National Health Service (Portuguese NHS) implemented the Acute Stroke Care Pathway ("Via Verde AVC"), similar to "stroke pathways" or "stroke protocols" in Anglo-Saxon countries. This protocol aims to optimize the care of acute stroke patients by reducing the time between symptom onset and treatment initiation.

The purpose of this study is to analyze emergency acute stroke cases with "Via Verde AVC" activation from 2019 to 2023 in a Medical-Surgical Emergency Department (SUMC) Heath Unit in Northern Portugal. By identifying patterns of performance and proposing strategies to increase the effectiveness and efficiency of the response, this study aims to contribute to the improvement of healthcare quality and align with the goals of the European Stroke Action Plan (SAP-E) (Aguiar de Sousa et al., 2023; European Stroke Organisation, 2024).

The World Health Organization (WHO) defines stroke as a sudden neurological impairment caused by a vascular issue, with symptoms that last beyond 24 hours or result in death (WHO, 2020). Similarly, the National Health System (NHS) characterises stroke as "a sudden neurological deficit caused by a lack of blood supply to the brain, either due to ischemia or haemorrhage" (Sistema Nacional Saúde, 2019). And

is considered a medical emergency, and response times are crucial to the outcome (Direção Geral de Saúde, 2017). The American Stroke Association classifies strokes into four types: ischemic, hemorrhagic, cryptogenic, and transient ischemic attack (TIA). Ischemic stroke, the most common type, accounts for approximately 87% of all strokes and occurs when blood flow to the brain is obstructed (American Stroke Association, 2023).

In terms of treatment, timely reperfusion is critical. High-quality evidence supports the use of intravenous thrombolysis with Alteplase within 4.5 hours of symptom onset and, in select cases, up to 24 hours based on advanced imaging criteria (Berge et al., 2021; Jadhav, 2021). Mechanical thrombectomy has also become the standard of care for patients with acute ischemic stroke due to large vessel occlusion (Jadhav, 2021).

The number of stroke cases has increased significantly over the past twenty years, with approximately 12.2 million cases reported worldwide (Jadhav, 2021). In Europe, stroke is the second leading cause of death and the leading cause of long-term disability (GBD 2019 Stroke Collaborators, 2021).

The European Stroke Organization (ESO) has unveiled the European Stroke Action Plan (ESAP-E), setting out 30 main targets and 72 essential research priorities across seven domains to enhance stroke services (Aguiar de Sousa et al., 2023). In Portugal, since 2017, a standardized procedure (DGS, 2017) has been implemented to provide a comprehensive framework for national stroke care.

Despite improvements in stroke care, the impact of stroke in Portugal remains significant. In 2022, cerebrovascular diseases, primarily stroke, were the leading cause of death, accounting for 7.7% of total resident deaths. The crude mortality rate from cerebrovascular diseases was 92.1 deaths per 100,000 inhabitants. Women continued to be more affected by stroke mortality, with a ratio of 75.8 male deaths per 100 female deaths (Instituto Nacional de Estatística, 2022). These statistics underscore the ongoing need for continued improvement in stroke prevention and care delivery in Portugal.

2. METHODS

This retrospective observational study was conducted at SMUC of a Health Care Unit in northern Portugal. The study analyzed 5 Years data from 2019 to 2023, focusing on patients admitted through the Acute Stroke Care Pathway (Via Verde AVC in Portuguese, similar to the "stroke pathway" or "stroke protocol" in Anglo-Saxon countries). The study was approved by the institutional Ethics Committee. All data were anonymized to protect patient privacy. The study was conducted in accordance with the Declaration of Helsinki and local regulations.

2.1 Sample

A total of 387,677 emergency episodes were recorded from 2019 to 2023. Of these, 1,688 episodes had VVAVC activation. After applying exclusion criteria (Patients with acute neurological symptoms not consistent with stroke diagnosis), the final sample size was 1,153 patients.

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Table 1 - Annual Distribution of Emergency Episodes, VVAVC Activations, and Final Sample Size (2019-2023)

YEAR	Total Emergency Episodes	VVAVC Activations	Final Sample Size (Year/Years)
2019	78,888	302	214
2020	68,921	270	201
2021	75,498	338	234
2022	82,843	397	253
2023	81,527	307	251
Total	**387,677**	**1,688**	**1,153**

2.2 Data collection instruments

Data were extracted directly from the hospital's electronic health records (EHRs) and entered into an Excel® spreadsheet for analysis. Variables collected included Patient demographics (Age, sex), admission time, triage priority classification, type of stroke, treatments performed (thrombolysis and/or thrombectomy), time between symptom onset and treatment, and destination after emergency department care.

2.3 Statistical analysis

Descriptive statistics were calculated for all variables. Chi-square tests were used to compare proportions between years for categorical variables. Kruskal-Wallis tests were applied for continuous variables due to the non-normal distribution of data. Trend analysis was performed using simple linear regression to assess changes over time. Logistic regression was used to identify factors associated with receiving reperfusion therapy. A p-value <0.05 was considered statistically significant. All analyses were performed Using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

3. RESULTS

This retrospective study analyzed 1.153 *VVAVC* activations from 2019 to 2023. The percentage of activations increased from 0.28% of total emergency department visits in 2019 to 0.31% in 2023 ($p<0.05$).

Table 2 – Key Variables and Their Statistical Significance (2019-2023)

Variable	2019	2023	Change	Significance
Ischaemic Stroke (%)	71.96	61.75	-10.21	p = 0.005
Wake-up Stroke (%)	3.27	10.76	+7.49	p = 0.005
Thrombolysis (%)	21.96	27.27	+5.31	p < 0.001
Thrombectomy (%)	4.67	21.21	+16.54	p < 0.001
Mean time to treatment (min)	180±60	150±45	-30	p = 0.001
VVAVC activated (trend)	-	-	β=0.007	p = 0.003
Predominant age group	70-79	70-79	-	p = 0.011
Predominant gender	Male	Female	Inverson	p = 0.045
Predominant admission period	Vesp		-	p = 0.053

Stroke Types and Treatments

Ischemic stroke was the most common diagnosis (64.8%, 95% CI: 62.1-67.4%), but decreased significantly from 71.96% in 2019 to 61.75% in 2023 ($\chi2(12) = 28.45$, $p = 0.005$). Wake-up stroke cases increased notably from 3.27% in 2019 to 10.76% in 2023. Hemorrhagic stroke (12.7%, 95% CI: 10.9-14.7%) and transient ischemic attack (14.1%, 95% CI: 12.2-16.2%) showed smaller fluctuations.

Changes in reperfusion therapies: Thrombolysis rates increased from 21.96% in 2019 to 27.27% in 2023 ($\chi2(8) = 35.67$, $p < 0.001$). Thrombectomy rates rose significantly from 4.67% in 2019 to 21.21% in 2023 ($p<0.001$).

Time Metrics

Significant differences over the years ($H(4) = 18.23$, $p = 0.001$). The median time from symptom onset to hospital arrival decreased from 180 minutes (IQR: 120-240) in 2019 to 150 minutes (IQR: 90-210) in 2023 ($p<0.05$). Door-to-needle time for thrombolysis improved from a median of 55 minutes (IQR: 45-70) to 45 minutes (IQR: 35-60) over the study period ($p<0.01$).

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3.1 Demographic Characteristics and Admission Patterns

Distribution by age group: In 2023, the 70-79 age group had the highest percentage of patients (32.32%), followed by the 80-89 age group. There was a percentage increase in the 30-39 age group in 2023. The mean age of patients was 72.3 ± 13.5 years, with 51.8% being male. Chi-squared test for age distribution: $\chi2(32) = 42.18$, $p = 0.011$, indicating significant differences in age distribution over the years.

Distribution by sex: The proportion of patients remained balanced between the sexes over the years, with a slight male predominance until 2022. In 2023, there was a reversal, with 51.01% of patients female and 48.99% male. Chi-squared test for gender distribution: $\chi2(4) = 9.76$, $p = 0.045$, showing a significant change in gender distribution over time.

Distribution by Period of Admission: The majority of admissions occurred in the afternoon period (12pm - 11.59pm) in all years. Chi-squared test for distribution by period: $\chi2(8) = 15.32$, $p = 0.053$, indicating a trend but not a statistically significant difference.

Monthly Distribution: A fluctuating distribution of activated VVAVC per month was observed over the years. Analysis of variance (ANOVA) for monthly distribution: $F(11, 48) = 1.87$, $p = 0.067$, suggesting no statistically significant differences in monthly distribution.

Factors associated with undergoing thrombolysis: Age > 70 years: OR = 0.75 (95% CI: 0.58 - 0.97), p = 0.028; Admission time < 3 hours: OR = 2.34 (95% CI: 1.86 - 2.95), p < 0.001. Ischaemic stroke: OR = 3.12 (95% CI: 2.45 - 3.97), p < 0.001. These results demonstrate significant changes in stroke care patterns, treatment approaches, and patient demographics over the five-year study period.
This aggregate analysis provides a comprehensive view of the significant changes in the distribution of stroke types, increase in reperfusion therapies, reduction in care times, and changes in the demographic characteristics of patients over the period studied.

Table 3 – Summary of Key Findings and Statistical Significance in Acute Stroke Care (2019-2023)

Category	Key Findings	Statistical Significance
Stroke Types	Ischaemic strokes decreased from 71.96% (2019) to 61.75% (2023)	$\chi2(12) = 28.45$, $p = 0.005$
Reperfusion Therapies	Wake-up strokes increased from 3.27% (2019) to 10.76% (2023)	$\chi2(8) = 35.67$, $p < 0.001$
Treatment Times	Thrombolysis increased from 21.96% (2019) to 27.27% (2023)	$H(4) = 18.23$, $p = 0.001$
Thrombolysis Factors	Thrombectomy increased from 4.67% (2019) to 21.21% (2023)	$p = 0.028$
Age Distribution	Average time from symptom onset to treatment reduced from 180 ± 60 min (2019) to 150 ± 45 min (2023)	$p < 0.001$
Gender Distribution	Age > 70 years: OR = 0.75 (95% CI: 0.58 - 0.97)	$p < 0.001$
Admission Period	Admission time < 3 hours: OR = 2.34 (95% CI: 1.86 - 2.95)	$\chi2(32) = 42.18$, $p = 0.011$

4. DISCUSSION

This study demonstrates significant improvements in the implementation of the Acute Stroke Care Pathway over a 5-year period. The increase in thrombolysis and thrombectomy rates, along with reduced treatment times, suggests enhanced efficiency in acute stroke management. Implementation of rigorous protocols and continuous training of emergency teams likely contributed to this steady improvement in identifying and validating stroke cases (Ahmed et al., 2019; Guidelines for the Early Management of Patients with Acute Ischemic Stroke, 2019).
The trends observed align with international efforts to improve acute stroke care. Our findings on age, early arrival, and stroke severity as predictors of reperfusion therapy are consistent with previous studies and highlight the importance of public education on stroke symptoms and rapid medical attention (Ahmed et al., 2019; Guidelines for the Early Management of Patients with Acute Ischemic Stroke, 2019; Heran et al., 2022).
The change in patient demographic profile, with an increased proportion of women, deserves attention and may indicate the need for specific strategies for this group. This could suggest a shift in stroke demographics or increased stroke awareness and healthcare accessibility among women (Kleindorfer et al., 2021; Heran et al., 2022).
Improving triage and adequate referral to specialized centers contributes to better clinical outcomes (Turc et al., 2023; Mokin et al., 2019; Marshall et al., 2022). Our findings are consistent with those reported in similar studies from other European countries, although our improvement in thrombectomy rates appears to be more pronounced (Aguiar de Sousa et al., 2023).

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The implementation of the Acute Stroke Care Pathway has significantly improved the identification and treatment of acute stroke patients in our Medical-Surgical Emergency Department.

To further enhance care, we sugest:

- Continuous optimization of the Via Verde AVC protocol based on performance data and latest evidence.
- Implementing standardized data collection systems for real-time analysis of outcomes and performance.
- Effective resource allocation considering admission patterns and patient needs.
- Ongoing public education about stroke symptoms and the importance of rapid medical attention.
- Integration of new technologies to support clinical decision-making.
- Focus on long-term outcomes and quality of life in future studies.
- Evaluation of cost-effectiveness for different rehabilitation pathways.

These efforts will foster continuous improvement in stroke care delivery, optimize pathways, and ultimately enhance patient outcomes through evidence-based decision-making and advanced technologies.

4.1 Strengths and limitations

This comprehensive 5-year analysis provides valuable insights into acute stroke management trends at our institution. The implementation of the VVAVC protocol demonstrates a commitment to evidence-based practices. However, limitations include inconsistent recording of some clinical data, potential selection bias in retrospective analysis, and the influence of the COVID-19 pandemic on stroke care patterns. The focus on VVAVC-activated episodes may limit a complete understanding of overall stroke management.

CONCLUSION

The Emergency Department demonstrated improvement in identifying and treating acute strokes over the study period. However, there is a need to enhance systematic data recording for real-time analysis and implementation of new technologies to further optimize care. Future studies should focus on long-term outcomes and quality of life of patients after hospital discharge.
The implementation of the *VVAVC* (Acute Stroke Care Pathway) in our SMUC Department has led to improvements in the identification and treatment of acute stroke patients. Continued efforts to optimize the pathway (Continuously refine *VVAVC* processes based on performance data and the latest scientific evidence), allocate resources effectively (considering the variations observed in admission patterns), and educate the public about stroke symptoms are needed to further enhance acute stroke care in our region. To provide excellent stroke care, it is crucial to improve the quality of regional and national registries.

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AUTHORS' CONTRIBUTION

Conceptualization, S.D., T.B., J.C., A.C., N.A. and L.S.; data curation, S.D., T.B., J.C., A.C., N.A. and L.S.; formal analysis, S.D., T.B., J.C., A.C., N.A. and L.S.; funding acquisition, S.D., T.B., J.C., A.C., N.A. and L.S.; investigation, S.D., T.B., J.C., A.C., N.A. and L.S.; methodology, S.D., T.B., J.C., A.C., N.A. and L.S.; project administration, S.D., T.B., J.C., A.C., N.A. and L.S.; resources, S.D., T.B., J.C., A.C., N.A. and L.S.; software, S.D., T.B., J.C., A.C., N.A. and L.S.; supervision, L.S.; validation, L.S.; visualization, S.D., T.B., J.C., A.C., N.A. and L.S.; writing-original draft, S.D., T.B., J.C., A.C., N.A. and L.S.; writing-review and editing, S.D., T.B., J.C., A.C., N.A. and L.S.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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