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Stroke Seasonality and Weather Association in a Middle East Country: A Single Tertiary Center Experience

Saeed A. M. Alghamdi, **Mohammed A. Aldriweesh**, Bayan A. Al Bdah , Muath A. Alhasson , Sultan A. Alsaif, Waleed A. Alluhidan , Faisal M. Almutairi, Mohammed A. Alskaini, Naser Alotaibi and Ali M. Al Khathaami

College of Medicine, King Saud bin Abdulaziz University for Health Sciecnes (KSAU-HS), SA; Division of Neurology, Department of Medicine, King Abdulaziz Medical City (KAMC-RD), National Guard Health Affairs, SA;- King Abdullah International Medical Research Center (KAIMRC), SA

Introduction

Stroke is a medical condition that leads to major disability and mortality worldwide. The overall age-standardized stroke incidence rates, deaths, disability-adjusted life years have decreased. However, absolute stroke numbers are increasing significantly in developing countries, like Saudi Arabia. In KSA, an epidemiological model predicted an increase of 67% in the first stroke in the upcoming 10 years. A large and growing body of literature has investigated the relationship between environmental factors such as weather, meteorological factors, seasonal variations, air pollution, and stroke incidence. However, the current evidence is inconclusive. Therefore, this study examines the seasonal variations and meteorological influences on stroke incidence and outcome in the largest city in Saudi Arabia.

Methodology

- **Study design and setting**: Retrospective, cohort study from February 2016 – July 2019 at Stroke Unit-King Abdulaziz Medical city, Riyadh, Saudi Arabia.
- **Inclusion criteria:** We screened all patients with ischemic stroke, or intracerebral hemorrhage admitted to the stroke unit.
- **Exclusion criteria:** Stroke mimics, transient ischemic attacks, and patients older than 80 years of age who are either bedridden, had a prior stroke, have dementia or terminal cancer.
- **Seasons:** We considered the months from November 1 to March 31 as the cold season and from April 1 to October 31 as the hot season. Meteorological data were obtained from the Presidency of Meteorology and Environment for the study period.

Data Analysis

Multivariate logistic regression was applied for predicting stroke presentation and outcomes after adjusting for weather and clinical characteristics of the patients. All statistical tests were considered significant at a P-value < 0.05. STATA Statistical program (version 15) was used for analysis.

Results

- **The final cohort included 1,271 stroke patients**
- 60.89% (n = 774) cases occurred in the hot season
- 39.1% (n = 497) in the cold season.
- Males accounted for 69.6% (n = 884) of the cases.
- The proportion of ischemic stroke was 83.2% [hot season 83.9% (n = 649) vs. cold season 82.3% (n = 409)].
- The proportion of hemorrhagic stroke was 16.8 [hot season 16.1% (n = 125) vs. cold season 17.7% (n = 88)].
- One-unit increase in mean relative humidity resulted in ***statistically significant*** odds of change in NIHSS on discharge (mean relative humidity 21.3%: AOR 0.98; 95% CI: 0.96–0.99; p = 0.041). Also, a 1-unit increase in mean atmospheric pressure resulted in statistically significant odds of a different outcome in ICU admission (mean atmosp. 1009.5 hPa; AOR: 0.93; 95% CI: 0.87–0.99; p = 0.045) and death (mean atmosp. 1009.0 hPa; AOR: 0.9; 95% CI: 0.83–0.99; p = 0.022).

Discussion & Conclusion

- The discrepancy between seasonal variations and stroke incidence and outcome in many published papers makes it difficult to conclude the potential relationship.
- In our study, we found no such relationship.
- This is also the case in previously published papers (7, 9, 16, 17, 19–22).
- A large study with data extending up to 40 years, and more than 300,000 ischemic and hemorrhagic strokes, found neither seasonal nor meteorological association with stroke incidence (7). Moreover, a recent meta-analysis analyzed the data from 33 studies with more than 200,000 participants found unremarkable seasonal variation (17).
- On the other hand, several studies linked the weather or seasonal variations with stroke incidence (4–6, 9, 10, 13–15, 23, 24). Locally, in Qatar, Salam et al. reported a significant relationship between seasonal variation and incidence of IS relative to ICH in summer (4).
- In Riyadh, Saudi Arabia, neither weather nor seasonal variations impact stroke incidence or outcome. Thus, our study might explain the cause–effect results in the previous observational studies, requiring an adjustment for the confounding factors.

References

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