Periodic Research

Effect of Climatological Variables on the Frequency of Incident Stroke Hospitalization During Spring

Abstract

Stroke data were obtained as SMR01 (157,639 incident stroke hospitalization in Scotland between 1986-2005). To observe variation in weather parameters with first stroke incidences per day, during spring daily mean temperature/total rainfall/average daily atmospheric pressure was compared with frequency of incident strokes per day using ANOVA (Analysis of Variance). An analysis reveals no statistically significant relationship for any of the variables of climate. Reduction in consumption of alcohol and smoking and maintenance of the blood pressure within normal range, are suggested during spring to minimize the chance of stroke.

Keywords: Stroke, hospitalization, climatological variables, temperature, atmospheric pressure, rainfall, spring.

Arsalan Moinuddin
Post- Graduate Student
Deptt. of Physiology
Himalayan Institute of Medical Sciences
HIHT University
Jolly Grant, Dehradun
Uttarakhand

Nafis Ahmad Faruqi
Department of Anatomy
J.N. Medical College
AMU, Aligarh, UP,
drarsalan_faruqi@hotmail.com

Introduction

Stroke is defined as "abrupt impairment of brain function by a variety of pathological changes involving intracranial or extracranial blood vessels[1] . Prognosis after stroke seems to be very poor. Good number of people (25% to 30%) die in the initial three weeks and 33% to 66% in the 1st year following stroke incidence[2]. In U.K. itself about 111,000 stroke incidents are reported every year[3]. Yearly deaths in U.K. were reported to be 53,000[4]. Though there has been remarkable decline in the stroke mortality rates since 1968 a lot of variability is still present within U.K. The rates are highest in Scotland, followed by North England, Ireland, Wales and South England[5].

Although overall climatological variability of stroke is appreciable in Europe and other continents like America, it is difficult to establish a specific trend due to large area wise weather differences and pathophysiological metamorphism. The aim of the present study is to assess whether there is any association between climatological variables (temperature, rainfall and atmospheric pressure) and incidence of stroke in Scotland (1986 – 2005) during spring and suggest measures to reduce them.

Methods

Stroke data relate to all incident hospitalization for stroke in Scotland between 1986-2005. The data set comprises of a sample size 157, 639 incident hospitalization. Following service divisions were kind enough to provide informations about patient's details year-wise.

1. National Health Service (NHS)
2. Information Service Division (ISD)
3. Scottish Morbity Record (SMR)

SPSS (Statistical Package for Social Sciences, 15.0 versions for Windows) was used for statistical analysis.

Weather data was obtained from the Met Office- UK's National Weather Service in the form of data sets which provide information about average temperature, total rainfall and average atmospheric pressure on a daily basis from 1986 – 2005.

Temperature is measured at a height of 1.25 meters above ground level over a gross surface. A wide range of temperature recording is performed including air temperature, dew point, wet temperature, gross temperature and soil temperature and each is recorded using a different and specific type of thermometer .The values for temperature are noted in degree Celsius and tenths and values below 0^0C are preceded by a minus sign[6].

Rainfall is measured hourly, then totalled up for the daily total rainfall. The values of rainfall are noted in millimeters (mm), (25.4mm=1 inch) (Personal reference) [7].

Atmospheric pressure at any point on the Earth's surface is proportional to the weight of the air above it. It is measured using a precision aneroid barometer (PAB). The daily average air pressure is corrected to sea level and averaged out over the daily period 0.001 to 2400 GMT/UTS. The pressure unit used in meteorology was previously the millibar (one bar=1000 millibars). However, this has been replaced by the SI unit of pressure – the pascal (Pa) and one hectopascal (hPa) = 1 millibar (mb) [8].

To observe for variation in weather parameters with first stroke incidences per day, daily mean values of variables were compared with frequency of incident strokes per day using ANOVA (One way analysis of variance). Graphically it was presented by 95% confidence interval plot with number of strokes in a day on X-axis and weather parameters on Y-axis.

Ethical approval was granted from Faculty of Medicine Ethics Committee for Non-Clinical Research involving human subjects, University of Glasgow (Project No-FM00609). The retrospective data were approved by Privacy Advisory Committee (PAC).

Results

Spring (Temperature): The 95% CI plot (Fig.1) reveals that the daily average temperature in Scotland is relatively consistent between 7.5 ^{0}C and 8.5 ^{0}C as the number of strokes rises from 1-14 per day. The variability visible thereafter is attributed to non precise estimation as the total number of strokes each day is very few. This is graphically illustrated as narrow CI intervals in figure 1. The pattern of plots and a 'p' value of 0.2 (ANOVA test) therefore indicates a statistically non-significant relationship between daily average temperature and number of strokes per day.

Spring (Rainfall): The 95% CI plot (figure 2) is quite uneven although the amount of daily total rainfall increases (2 mm – 3 mm) during the same frequency. The 95% CI are also narrow thoughout the stroke frequency (figure 2) which suggests precise estimation. The pattern of plots and a 'p' value of 0.2 (ANOVA test) therefore indicates that a statistically non-significant relationship between daily total rainfall and number of strokes per day.

Spring (Atmospheric pressure): From the 95% CI plot (figure 3), the average atmospheric pressure is quite consistent between (1012 and 1014) hPa as stroke frequency increases from 1 to 15 strokes per day. A few outliers at the end hints an error in the estimation (total number of strokes is less) as illustrated by corresponding wide CI intervals (Figure 3). A 'p' value of 0.7 (ANOVA test) therefore indicates a non- significant relationship between daily average atmospheric pressure and number of strokes per day.

Duscussion

None of the variables of climate showed significant variation with stroke frequency in spring. Parallel reports do not exist in literature. Our study has large sample size (157, 639) and is conducted over a period of 20 years, thus the results are highly unlikely to be a product of chance. Some precautionary measures are suggested to minimize the chance of stroke i.e. decrease in alcohol consumption and smoking and maintaining blood pressure within safe range during spring season.

References

1. Goldman L, Benette JC. Cecil textbook of Medicine,21st edition; 1999: 2092, 2109- 2112, 2113 – 2115.
2. Ebrahim S, (1990), Clinical Epidemiology of Stroke, Oxford University Press, New York, 18 – 19, 147,184.
3. British Heart Foundation's Statistics Website, Stroke Statistics 2009 (cited 2010 March 12) Available from http://www.heartstats.org/temp/chaptersp2hs2hs.pdf"
4. British Heart Foundation's Statistics Website, Stroke Statistics 2009 (cited 2010 March 12) Available from http://www.heartstats.org/temp/chaptersp1.pdf
5. Information Service Division (ISD) Scotland Website Stroke, (cited 2010 March 12), Summary of latest publications, available from http://www.isdscotland.org/isd/5783.html
6. R Barry Hall, Climate Enquiry Officer UK Met Office outlined this information on temperature by email on Tuesday 8th June 2010 (email: barry.r.hall@metoffice.gov.uk.)
7. R Barry Hall, Climate Enquiry Officer UK Met Office outlined this information on rainfall by email on Tuesday 8th June 2010 (email: barry.r.hall@metoffice.gov.uk.)
8. R Barry Hall, Climate Enquiry Officer UK Met Office outlined this information on atmospheric pressure by email on Tuesday 8th June 2010 (email: barry.r.hall@metoffice.gov.uk.)

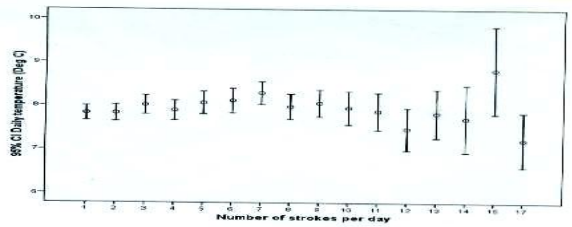

Figure 1 : Daily mean temperature by number of strokes on a given day

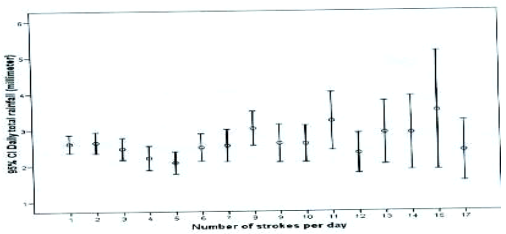

Figure 2 : Daily total rainfall by number of strokes on a given day

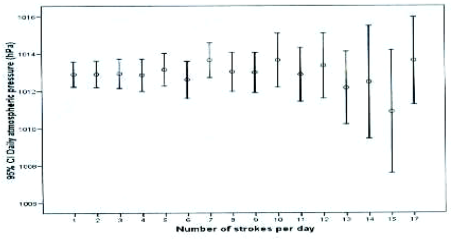

Figure 3 : Daily average atmospheric pressure by number of strokes on a given day