Incidence and Severity of Spontaneous Subarachnoid Hemorrhage in a Severe Weather Area

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INTRODUCTION

Spontaneous subarachnoid hemorrhage (sSAH) has an annual incidence of approximately 10 cases per 100,000 people worldwide. Multiple studies have attempted to show correlations with sSAH and various meterological parameters. Arkansas has an above-average incidence of severe storms and tornados. We reviewed 60 cases of sSAH within this severe weather area within the continental US and examined correlations between those cases and barometric pressure (Pbar).

METHODS

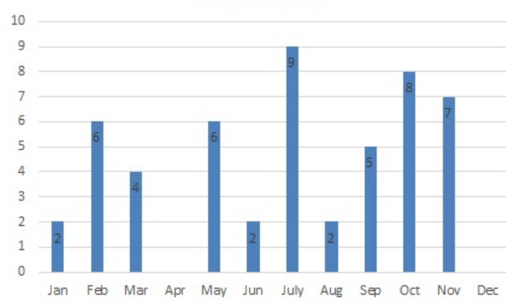
Clinical data regarding sSAH was obtained prospectively. Patient location at the time of ictus was gathered retrospectively. The patient's home zip code and the zip code at location of ictus were mapped to the nearest weather station. The National Oceanic and Atmospheric Association (NOAA) online database for quality controlled local climatologic data (QCLCD) provided Pbar measurements in inches of mercury (InHg). Data was extracted for each patient at the data station closest to their location of rupture for 7 days prior to ictus. Averages for the 22 month study period were recorded at that location as well. Classic Fisher score was used for radiographic evaluation of sSAH severity. Data was organized and analyzed with Excel (Microsoft) and Prism biostatistical software (Graphpad, La Jolla, CA).

RESULTS

51 patients had sufficient information to establish a reliable location at the time of ictus. Rupture by month is represented in Figure 1. Incidence of Fisher score is represented in table 1. Deflections in Pbar (positive versus negative) are represented in table 2. Comparisons of normal Pbar changes for the study period versus incidents of sSAH are represented in table 3. Correlations of Fisher scores and Pbar changes are represented in table 4. Cum 7 represents the cumulative change in Pbar over a 7 day period. In cases of sSAH, this corresponds to 7 days before ictus. Avg 7 represents the average daily change in Pbar over a period of 7 days. In cases of sSAH, this corresponds to 7 days prior to ictus. DBI represents the daily change in Pbar. In cases of sSAH, this corresponds to the change in Pbar the day before ictus.

Figure 1

sSAH by month



Abbreviations

Avg_{SP} : Average over the study period

Avg_{ICTAL} : Average for time periods in regards to episodes of sSAH

Cum 7 : Cumulative change in P_{bar} over 7 day periods. In regards to episodes of sSAH (Avg_{ICTAL}), this would be 7 days prior to ictus.

Avg 7 : Average daily change in P_{bar} magnitude over 7 day periods. In regards to episodes of sSAH (Avg_{ICTAL}), this would be 7 days prior to ictus.

DBI : Average daily change in P_{bar} magnitude. In regards to episodes of sSAH (Avg_{ICTAL}), this would be the day prior to ictus.

Note: Avg_{SP} for Avg 7 and DBI are the same

Table 1

Classic Fisher Score			
F1	F2	F3	F4
n = 0	n = 7	n = 14	n = 30

Table 2

	Deflection	
	Neg	Pos
Cum 7	28	23
DBI	25	26

Table 3

	Avg_{SP}	Avg_{ICTAL}	*p*
Cum 7	0.167	0.145	0.044
Avg 7	0.099	0.0933	0.092
DBI	0.099	0.097	0.94

Table 4

	Fisher	*p*	mean
Cum 7	F2 vs F3	*0.813*	(.2 vs .21)
	F2 vs F4	*0.0336*	(.2 vs .094)
	F3 vs F4	*0.0036*	(.21 vs .095)
Avg 7	F2 vs F3	*0.0617*	(.0644 vs .121)
	F2 vs F4	*0.269*	(.064 vs .086)
	F3 vs F4	*0.0481*	(.121 vs .086)
DBI	F2 vs F3	*0.126*	(.0571 vs .135)
	F2 vs F4	*0.345*	(.057 vs .085)
	F3 vs F4	*0.0889*	(.135 vs .085)

DISCUSSION

The monthly incidence of sSAH appears multi-modal. However, the period of this study is insufficient to determine if this is a yearly phenomenon. The results did not demonstrate statistical significance between changes in Pbar the day before, or 7 days prior to sSAH. This is consistent with previous studies (1,2,3). The data do suggest the development of Fisher grade 4 hemorrhage (differentiated by IVH or IPH) versus Fisher grade 2 or 3 when the cumulative Pbar changes over the 7 days prior to ictus are evaluated (Cum 7). This suggests that Pbar changes up to 7 days preceding rupture may play a larger role in severity of rupture than Pbar changes the day prior to ictus. However, the development of IVH or IPH appears to be associated with lower 7 day Pbar deflections, which is somewhat counterintuitive. Finally, a positive or negative Pbar deflection showed no significant correlation with sSAH. This suggests that the contributions made by Pbar, in aneurysm rupture, may be more closely associated with the absolute magnitude of the Pbar change versus a positive or negative deflection.

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