JURA
Journal of Undergraduate Research in Alberta
UNIVERSITY OF CALGARY

CEREBRAL INFARCT VOLUME CHANGE OVER TIME IN ISCHEMIC STROKE

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INTRODUCTION

Stroke is the second leading cause of death worldwide [1]. This interruption of blood flow causes a lack of oxygen and nutrients in the brain which leads to a loss of brain function and the build up of infarct (dead) tissue [1]. This build up is a dynamic process in which stroke volume changes over time. Stroke evolution is characterized by two types of edema (swelling). Cytotoxic edema (imaged using DWI [2]) occurs acutely and causes the build up of fluid intracellularly [3] while vasogenic edema (imaged using FLAIR [4]) occurs due to the breakdown of the blood brain barrier or CSF barrier and is prolonged [5].

Imaging of subjects in clinical trials of stroke is done over periods of time (up to 90 days). Long intervals between imaging sessions not only lead to a decrease in patient retention, but also allows for events such as trauma, secondary stroke, or even death to confound the data acquired. Evidence has shown that stroke volume 90 days post-infarct is not significantly different than 30 days post-infarct suggesting that stroke volume plateaus at the 30-day mark [6]. The purpose of this research was to study infarct volume evolution and to determine if MR imaging at early time points can be used to predict final infarct volume. This would increase the number of patients that can be analyzed in clinical trials as well as help in earlier stroke management and treatment decision making.

METHODS

This was a retrospective study of patients who had strokes with DWI done at baseline and 2 or more FLAIR imaging sessions post baseline (ranging from 12 hours to 90 days). Infarct tissue was traced using Cerebra and MIPAV software and confirmed by a neuroradiologist. Statistical analysis was done using a Kurskal-Wallis test and Spearman correlation coefficients ($p<0.001$).

RESULTS

It was determined that infarct volumes at the 24-hour and 5-day time points were significantly larger than volumes at baseline. The volume at the final (>30day) time point was found to be significantly lower than the 5-day time point.

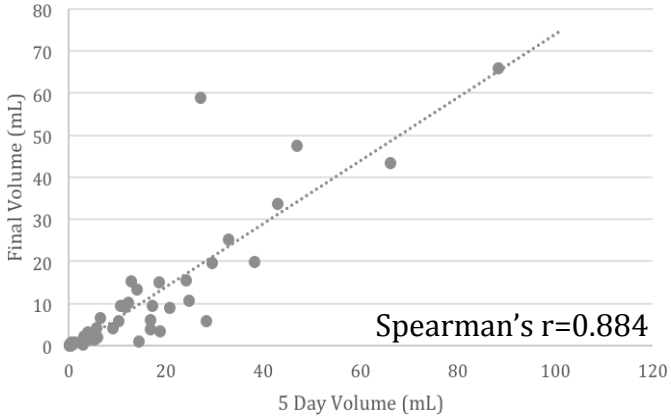

Figure 1. Regression lines of final lesion volume (mL) plotted against the 5-day volume (mL) in subjects. Analysis determined a correlation coefficient (r) of 0.884 (n=51).

Correlation analysis indicated a strong positive correlation between stroke volume at the 5-day vs final time points in patients (Figure 1).

DISCUSSION AND CONCLUSIONS

The results of this study suggest that vasogenic edema affects patients significantly between the acute and prolonged stage, increasing lesion volume until a peak is reached at around 5 days. A strong correlation between the 5-day and final volumes in patients suggests that more vasogenic edema at 5 days correlates to increased overall neuronal damage in the patient. The research shows that approximations of final outcome can be determined at earlier time points leading to a reduced need of subjects coming back in clinical trials, inclusion of more subjects in trial analysis, and quicker decision making in the stroke management process.

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