Introduction

Cerebrovascular disease (stroke) is the fifth leading cause of death in the United States, the second leading cause of death globally, and costs $33.6 billion a year. Stroke is classified as ischemic or hemorrhagic, and approximately 87% of all strokes are ischemic. Intravenous tissue plasminogen activator (tPA) is the only FDA approved treatment for acute ischemic stroke, and has been shown to reduce the risk of long term disability. Treatment with tPA depends on rapid clinical diagnosis of stroke and exclusion of contraindications including intracerebral hemorrhage. Computerized tomography (CT) is the gold standard for identifying hemorrhagic stroke, an exclusion criteria for ischemic stroke treatment with tPA. Early identification of hemorrhagic stroke is also essential to improve treatment and prevent disability associated with hemorrhagic stroke, including hospital arrival to CT imaging time, early management of elevated blood pressure, and immediate neurosurgical evaluation. There is a scarcity of research on developing a survey that differentiates stroke etiology to improve early diagnosis.
Developing a Prehospital Stroke Survey for Early Identification of Hemorrhagic Stroke

John Ramos, Benjamin Gogg, Shawn Joy, Kyle Obendorf
Faculty Advisor: Amy Guzik, MD
Department of Physician Assistant Studies

Fewer than 30-55% of ischemic stroke patients are treated within the American Heart Association recommended hospital arrival to treatment time frame of 60 minutes.\(^7,8\)
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Methods

Two hundred fifty seven consecutive Code Strokes from a database were selected for chart review using a predetermined survey of 45 findings common in stroke patients. Only medical records from Emergency Department or Neurology providers during the initial Emergency Department visit were accessed. Subjects were organized into groups based on final diagnoses of hemorrhagic stroke, and all other diagnoses. This study was declared exempt by IRB. Written informed consent was not obtained as chart review did not impact patient treatment or outcomes.

Inclusion Criteria: Code Strokes admitted to Wake Forest Baptist Medical Center between 1/1/2014 and 9/30/2014.

Exclusion Criteria: Age less than 18 years of age at presentation, patient found comatose, unresponsive, or unable to give a reliable history, and all in house Code Strokes.

Figure 1. Survey of History, Physical Exam, and Laboratory Findings

<table>
<thead>
<tr>
<th>Survey #</th>
<th>Date:</th>
</tr>
</thead>
</table>

1. Final Diagnosis of hemorrhagic stroke
2. Patient’s age at Emergency Department visit
3. Is the patient exhibiting any of these signs or symptoms:
   a. Unilateral facial weakness or paralysis
   b. Unilateral upper extremity weakness or paralysis
   c. Unilateral lower extremity weakness or paralysis
   d. Unilateral facial sensory deficit
   e. Unilateral lower extremity sensory deficit
   f. Unilateral upper extremity sensory deficit
   g. Inability to articulate speech (dysarthria)
   h. Exhibits Executive dysfunction
   i. Inability to walk or stand under own power (ataxia)
   j. Dizziness, while seated, with or without eyes closed
   k. Visual acuity deficit in the eye contralateral to the weakness
   l. Hyporeflexia in affected side extremities
   m. Rapid Blood Glucose 50<x<200 mg/dL
4. Are any of the following in the patient’s current or past medical history?
   a. Male gender
   b. Atrial Fibrillation
   c. Deep Vein Thrombosis
   d. Atrial Septal Defect or Patent Foramen Ovale
   e. Myocardial Infarction
   f. Dyslipidemia
   g. Atherosclerosis
   h. Hypertension
   i. Carotid Artery Stenosis
   j. Diabetes
   k. Pulmonary Embolism
   l. Tobacco Use of Any Kind
   m. Currently a 1 pack/dat smoker OR 1 can/day smokeless tobacco
   n. Prior Stroke or TIA
   o. Antiplatelet/Anticoagulant medication & has NOT taken in past 24 hours
   p. Hypertension medication & has NOT taken in past 24 hours
   q. Oral Contraceptive medication taken in past 48 hours OR Depo-Provera
   r. Recent invasive surgical procedure performed (past 72 hours)
   s. Alcohol use of <2 drinks/day in past 72 hours
   t. Have been a resident of North Carolina for previous 12 months
   u. Recent bacterial or viral illness requiring treatment
   5. Does the patient have any of the following additional signs, symptoms, or conditions?
   a. Loss of consciousness/responsiveness prior to the above symptoms
   b. Seizure or convulsions prior to the above symptoms
   c. “Thunderclap” or “10/10” headache prior to the above symptoms
   d. Combative or hypervigilant personality since onset of symptoms
   e. Dilates or unresponsive pupils on the affected side
   f. Positive Babinski sign on the affected side
   g. Fall from a height greater than that of the patient in past 24 hours
   h. Poorly controlled or potentially mismanaged Warfarin therapy
   i. Hypertension: SBP>200mmHg or DBP>120mmHg
   j. Patient is or may possibly be pregnant
Results
Of the 257 code strokes, 65 were excluded from the study. Of the 192 enrolled subjects, 21 were diagnosed with hemorrhagic stroke (Age, Mean=62.8, SD 16.50) and 171 had a final diagnosis other than hemorrhagic stroke (Age, Mean=64.18, SD 16.57). Other final diagnoses included ischemic stroke (109), transient ischemic attack (15), and other non-stroke diagnoses (47).

Table 1. Odds Ratios for Five Survey Variables (P<.05 from Fisher’s Exact Tests) Predicting Hemorrhagic Stroke in 192 Code Stroke Patients

<table>
<thead>
<tr>
<th>Survey Variablesa</th>
<th>HS (n=21)</th>
<th>OD (n=171)</th>
<th>P</th>
<th>OR</th>
<th>95% CI</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Loss of Consciousnessa</td>
<td>7 (33)</td>
<td>18 (11)</td>
<td>.27</td>
<td>2</td>
<td>.55, 8.27</td>
<td>.70</td>
</tr>
<tr>
<td>“Thunderclap” or “10/10” Headache</td>
<td>4 (19)</td>
<td>3 (2)</td>
<td>.001</td>
<td>19</td>
<td>3.27, 116.62</td>
<td>.91</td>
</tr>
<tr>
<td>Pupil Abnormalitya</td>
<td>4 (19)</td>
<td>1 (5)</td>
<td>.005</td>
<td>34</td>
<td>2.86, 398.30</td>
<td>1.26</td>
</tr>
<tr>
<td>Fall in last 24 hoursa</td>
<td>2 (10)</td>
<td>1 (5)</td>
<td>.007</td>
<td>34</td>
<td>2.63, 428.93</td>
<td>1.30</td>
</tr>
<tr>
<td>Hypertension at presentationa</td>
<td>4 (19)</td>
<td>5 (3)</td>
<td>.004</td>
<td>11</td>
<td>2.12, 56.37</td>
<td>.84</td>
</tr>
</tbody>
</table>

*Some survey variable items are abbreviated or edited in this table, see Figure 1 for original wording. HS= Final diagnosis of hemorrhagic stroke, OD= Final diagnosis other than hemorrhagic stroke, P=P value from binary logistic regression analysis, OR= odds ratio, CI=confidence interval, SE= Standard Error.

Conclusions
The study identified four history and physical examination findings in Code Stroke evaluation that were associated with increased probability of hemorrhagic stroke diagnosis. These findings may aid providers in the prehospital setting to identify patients who are at a higher risk of hemorrhagic stroke. Although these four predictive findings are consistent with the literature, the small sample size and low frequencies of findings among hemorrhagic stroke patients inflated odds ratios and confidence intervals, limiting the clinical utility of the research at this stage. A larger sample size, and a larger sample of hemorrhagic stroke subjects is necessary to improve significance and odds ratios from logistic regression analysis. Further, a validated prehospital evaluation to identify ischemic stroke or hemorrhagic stroke must be compared to the gold standard of diagnostic imaging.
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References

1. Centers for Disease Control, National Center for Health Statistics [Internet]. Deaths and Mortality. (Updated 2015 Sep 30, Cited 2015 Dec 8).
   doi: 10.1080/1090312080290828.
   doi: 10.1161/STR.0000000000000069.

Images
Slide 1: https://s.graphiq.com/sites/default/files/4553/media/images/Transient_ischaemic_attack_3986996.jpg