Abstracts
SWALLOW-3D, a Simple 2-minute Bedside Screening Test, Detects Dysphagia in Acute Stroke Patients With High Sensitivity When Validated Against Video-Fluoroscopy

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Background: Dysphagia is a common complication of stroke that leads to aspiration pneumonia if not identified early. The videofluoroscopic swallow study (VFSS) is the gold-standard for identifying dysphagia. We hypothesized that a simple 2-minute bedside dysphagia screen, called SWALLOW-3D, would have high sensitivity for identifying dysphagia when compared against the gold-standard, VFSS. Methods: Patients were prospectively recruited from an urban, tertiary care hospital. Inclusion criteria were: admission diagnosis of acute stroke, ability to participate in VFSS (defined by ASA alertness score > 5), and age=19. The SWALLOW-3D screen was administered by the study coordinator, within 8 hours prior to VFSS (mean 2.7 hrs). The VFSS was conducted by a speech language pathologist blinded to the results of the screen. SWALLOW-3D, developed by Washington University-Barnes-Jewish Hospital Division of Rehabilitation, has 5 components: Signs of Weakness or Asymmetry of Lingual/facial/palatal Location, Of Wakefulness, and 3 ounce water Drink test (see Figure). If any item was abnormal, the test was scored as “fail”, otherwise the test was scored as “pass”. The VFSS was scored utilizing the New Zealand Multidisciplinary Swallowing Index and a functional score was assigned using the Dysphagia Outcomes Severity Scale (DOSS). A DOSS score of < 5 was defined as “dysphagia”, while a score of 6 or 7 was rated as “no dysphagia”. Power calculation prior to testing revealed that 75 truly impaired patients would need to be recruited to achieve a sensitivity of .90 (1-0.05; 95% CI) with a dysphagia prevalence of 35% in our stroke population. Sensitivity, specificity, positive and negative predictive values were calculated. Results: Our cohort enrolled 225 subjects with suspected acute ischemic stroke. Mean age was 63 (22-97), 48% were female, 57% were Caucasian, and 42% were African-American. Mean NIHSS was 8.7. Previous established intra and inter-rater reliability (Edmiaston et al. AJCC. 2010; 19, 4: 357-364) for this screen was .92 and .93. Sensitivity of the SWALLOW-3D was 95% and specificity was 68%. Figure). If any item was abnormal, the test was scored as “fail”, otherwise the test was scored as “pass”. The VFSS was conducted by a speech language pathologist blinded to the results of the screen. SWALLOW-3D, developed by Washington University-Barnes-Jewish Hospital Division of Rehabilitation, has 5 components: Signs of Weakness or Asymmetry of Lingual/facial/palatal Location, Of Wakefulness, and 3 ounce water Drink test (see Figure). If any item was abnormal, the test was scored as “fail”, otherwise the test was scored as “pass”. The VFSS was scored utilizing the New Zealand Multidisciplinary Swallowing Index and a functional score was assigned using the Dysphagia Outcomes Severity Scale (DOSS). A DOSS score of < 5 was defined as “dysphagia”, while a score of 6 or 7 was rated as “no dysphagia”. Power calculation prior to testing revealed that 75 truly impaired patients would need to be recruited to achieve a sensitivity of .90 (1-0.05; 95% CI) with a dysphagia prevalence of 35% in our stroke population. Sensitivity, specificity, positive and negative predictive values were calculated. Results: Our cohort enrolled 225 subjects with suspected acute ischemic stroke. Mean age was 63 (22-97), 48% were female, 57% were Caucasian, and 42% were African-American. Mean NIHSS was 8.7. Previous established intra and inter-rater reliability (Edmiaston et al. AJCC. 2010; 19, 4: 357-364) for this screen was .92 and .93. Sensitivity of the SWALLOW-3D was 95% and specificity was 68%. Positive and negative predictive values were 72% and 94%, respectively. Conclusion: SWALLOW-3D is a simple, reliable, test that identifies the presence of dysphagia with high sensitivity and moderate specificity. To our knowledge, no other dysphagia screen has demonstrated both qualities of accuracy and ease of administration in the literature. We believe that this screen could be practically implemented by registered nurses and patient care technicians as a useful and sensitive dysphagia screen in stroke patients.

We Can Hear (and See) You Now: Telestroke Increases tPA Use for Ischemic Stroke

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Background: Telemedicine has been shown to be an effective method for the delivery of stroke expertise to patients presenting to an outlying hospital with acute stroke symptoms. In 2008, Yale-New Haven Hospital (YNH) and Lawrence and Memorial Hospital (LAM) established Connecticut’s first HUB and SPOKE acute care telestroke model, offering 24/7 acute care expertise to all patients presenting to LAM with acute stroke symptoms for which a stroke code (code Brain Attack Team) was called. Purpose: We (the HUB) sought to determine the effect of delivery of fulfills telestroke services on the rates of IV tPA administration at our SPOKE hospital. Methods: We compared the rate of IV tPA administration in 2007 (prior to the implementation of telestroke services) with the rate of IV tPA administration in 2009 (1 year following the implementation of telestroke services) at LAM. Results: R2-Despite calling a code B.A.T. within a shorter time window, there was a 160% increase in the administration of IV tPA in 2009 when compared to 2007. In 2007, 7.35% of those for whom a stroke code was called got IV tPA whereas in 2009, 38.24% of those for whom a stroke code was called got IV tPA. This difference was highly significant (X2=29.74, df=1, P<0.001). The decision to consider symptoms too mild to treat was significantly reduced (X2=5.34, df=1, P<0.05), thus allowing more patients to potentially benefit from thrombosis. Conclusions: A HUB and SPOKE model for delivering acute stroke expertise is successful in treating a larger number of eligible tPA candidates. Studies to assess long-term functional outcome are needed.

Post-Graduate Academic Neurovascular Fellowship Education for APNs and PAs: Impact on First-Year Graduates and Sponsoring Physicians

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Background: Prompt recognition of ischemic stroke (IS) is imperative for appropriate evaluation and management. Most patients with IS present to the emergency department (ED) with a multitude of symptoms. Patients whose symptoms are not recognized as potentially due to IS may not benefit from thrombolysis or early secondary stroke prevention. Evidence suggests that the diagnosis of IS is often missed in patients with atypical (non-traditional) symptoms. 

Purpose: Our purpose was to: 1) Determine if there is an association between symptom presentation in the ED and diagnostic accuracy; 2) Identify type and frequency of non-traditional symptoms in patients whose diagnosis of IS is missed in the ED. 

Methods: We reviewed medical records of 162 patients with a discharge diagnosis of IS who presented directly to the ED at Yale-New Haven Hospital between 10/08 and 6/09. We recorded presenting symptoms documented in the pre-hospital and ED record and then designated them as traditional or non-traditional. We defined traditional symptoms based on the F.A.S.T. criteria. Non-traditional symptoms included altered mental status, generalized weakness/fatigue, dizziness, altered gait, fall, vision changes, seizure, syncope, and Gl symptoms. We defined a missed diagnosis as no documentation of stroke in the differential diagnosis by any health care provider in the ED. Patients whose initial stroke symptoms occurred after admission were excluded. We used chi square analysis to determine the association of symptom type with accuracy of stroke diagnosis as determined by MRI imaging. We then identified the most commonly occurring symptoms in the patients with only non-traditional symptoms whose diagnosis of IS was missed in the ED. Results: The sample of 162 patients was 51% male, 60% white, and had an average age of 71 ± 16 years; 30 (18.5%) strokes were missed in the ED. Of the 130 patients presenting with any traditional symptom, the diagnosis of stroke was missed in 7.7%. Of the 32 patients presenting with only non-traditional symptoms, the diagnosis was missed in 62.5%. Patients presenting with non-traditional symptoms are 20 times more likely to be misdiagnosed in the ED (OR = 20.0, 95% CI = 7.6 - 52.4, P < 0.0001). Twenty of the patients whose stroke was missed had only non-traditional symptoms. The most common symptoms in this group were altered mental status (70%), generalized weakness/fatigue (65%), dizziness (45%), altered gait (35%), and a fall (35%). 

Conclusions: Our data reveal that a missed diagnosis of IS in the ED is associated with non-traditional symptoms. Emergency health care providers need to have a heightened awareness that patients presenting with altered mental status, generalized weakness/fatigue, dizziness, altered gait, or fall may require further neurological evaluation to assess for stroke. Inclusion of these symptoms in acute stroke triage protocols should be considered.

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Admission Blood Pressure, Stroke Etiology, and Inpatient Course Impact Discharge Blood Pressure Control

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Background: Blood pressure (BP) control is crucial in the secondary prevention of stroke. Patients with transient ischemic attack (TIA) are rarely inpatients for more than a couple of days. After acute ischemic stroke (AS), hypertension (HTN) is commonly permitted for a few days, with slow reduction of BP thereafter. In contrast, the BP is typically lowered in the first 24 hours after intracerebral hemorrhage (ICH), and these patients have longer length of stay (LOS) than patients with TIA or AS. We sought to determine the relationship between diagnosis, presenting BP, LOS, and discharge BP and number of BP lowering medications. Methods: Patients presenting between November 2008 and June 2010 with TIA (n=71), AIS (n=140), or ICH (n=56) were identified by retrospective chart review. We collected and compared data including; final diagnosis, prior history of HTN, premorbid use of antihypertensive medications, admission BP, discharge BP, LOS, and antihypertensive medications prescribed at discharge. Results: Baseline demographic rates of prior diagnosis of HTN and use of antihypertensive medications and admission BP are in Table 1. There was a significant difference in the LOS among the three groups (TIA, AIS, and ICH), P<0.001. Discharge DBP was significantly associated with LOS (P<0.001), but discharge SBP was not (P=0.279). By discharge, 40.6% of patients with TIA, 52.7% of patients with AIS, and 64.9% of patients with ICH had high BP (SBP >140 or DBP >90mmHg), P=0.031. Significant correlations between admission SBP and DBP and discharge SBP and DBP were identified. The number of antihypertensive medications prescribed on discharge was associated with higher admission SBP (P<0.001), higher admission DBP (P=0.04), stroke diagnosis (P=0.007), and LOS (P=0.001). Table 1 demonstrates the LOS, discharge SBP, and antihypertensive prescribed on discharge. Conclusions: Patients who experience stroke often have very high BP at presentation and need aggressive secondary stroke prevention, but BP is often poorly controlled by discharge. Despite a higher number of antihypertensive agents prescribed, BP's are higher on discharge in patients with high admission BP, but are lower as LOS is prolonged. Early follow-up in the outpatient setting is necessary when BP control is poor on discharge.
Augmented Visual Feedback Affects Endpoint Stiffness Control in Chronic Stroke Survivors during Learning of Reaching Movements in a Dynamic Environment

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Background: Controlling reaching movements in a dynamic environment requires manipulation of endpoint stiffness. After a stroke, such manipulations are difficult to achieve. However, augmented visual feedback is effective for learning reaching movements in dynamic environments. The purpose of this study, supported by the AHA (#08201362), was to determine if endpoint stiffness control during learning of reaching movements in stroke survivors is affected by augmented visual feedback. Methods: Chronic stroke survivors (n=12), randomly assigned to either a control or an experimental group, performed reaching movements with the Inmotion2 robotic system (Interactive Motion Tech Inc., MA) using the affected arm in a velocity-dependent force field. Controls received actual feedback of their movement while experimental subjects received augmented visual feedback where their perpendicular deviation from the straight line path to the target was magnified two-fold. The effect of the learning period (baseline, early and late dynamic training) was tested separately for each of the eight targets (located at 80°, 135°, 180°, 225°, 270°, 315°, 0° and 45° with respect to the positive x-axis) across the two groups. The dependent variables were the stiffness ellipse orientation and area. Results: For area, there was a significant group effect for the targets located at 135° (p = 0.017), 315° (p = 0.008) and 45° (p = 0.044). In each case the experimental group had a smaller stiffness area than the control. There was a significant learning period effect (p = 0.033) and a significant interaction (p = 0.047) but only for the target at 315°. For orientation, there was a significant group effect for the targets at 90° (p = 0.041), 135° (p = 0.003), 225° (p = 0.021), and 315° (p = 0.013). In each case the experimental group was oriented closer to the direction of motion than the control. There was a significant learning period effect at 180° (p = 0.004), 270° (p = 0.008) and 315° (p = 0.012). In each case, training caused stiffness to be oriented more parallel to the direction of motion. There was a significant interaction (p = 0.039) but only at 315°. Conclusions: For learning reaching movements in dynamic environments with augmented visual feedback, stroke survivors reduce the amount of endpoint stiffness and employ a strategy of directing the stiffness towards the movement direction. This occurs probably because the orientation of muscle actions is affected by the stroke. These results provide useful information for employing augmented visual feedback for stroke rehabilitation specific to reaching movements in dynamic environments.

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Focus on our Future: School-Aged Stroke Education

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Background: Stroke prevention programs have traditionally focused on education for adults. Data strongly indicate that unhealthy behaviors such as poor nutrition, sedentary lifestyle, smoking and their associated risk factors including obesity, diabetes, and hypertension begin when they become adults. Purpose: The aim of this study was to demonstrate an improvement in knowledge of stroke symptoms and risk factors in the school aged population utilizing effective teaching strategies to optimize learning and retention. Our hypothesis was that an interactive educational program would improve learning and retention of stroke facts in a teenage population. Methods: An interactive stroke program approved by the Institutional Review Board (IRB) was designed for eleventh grade students at a private philanthropic boarding school. The multi-dimensional content consisted of a local stroke survivor’s story, self-assessment of stroke risk factors, a brief PowerPoint presentation, a stroke deficit competitive game, and a video of a local 17-year-old stroke survivor all taught by trained hospital staff nurses and therapists specializing in stroke care. A 12 question test was administered before the educational session, then 14 days later and scored on a 0 – 100% scale. Pre- and post-test scores were evaluated by 4 experts in stroke prevention and health education. Statistical significance was determined by paired t-tests of pre- and post-test scores. Results: The sample included 71 students with an average age of 17: 48% Caucasian, 20% African American, 13% Hispanic, and 19% other. The average pre-test score was 72.85% and the average post-test score increased to 78.6%. Results showed statistically significant differences in pre (M = 6.70, SD = 1.87) and post-test (M = 9.44, SD = 1.52) scores (t = 3.39, p < .001). Conclusions: Through this structured program, students gained and retained knowledge about stroke signs and symptoms and risk factors. The varied presentation format facilitated maintaining their attention and learning, and this innovative stroke education program appears to be an effective teaching strategy for teenagers. Further research is planned to: assess this education format in younger ages and diverse settings, expand the timeframe for teaching with emphasis on nutrition and exercise, test for retention of knowledge over a longer period, and encourage students to disseminate stroke knowledge to others. The goal is that by improving students’ knowledge, we will enable them to make healthy lifestyle choices and inspire their family members to do the same.

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Combined Adaptive Physical Activity and Treadmill Training in Stroke

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Treadmill exercise rehabilitation in stroke produces gains in cardiovascular fitness, improved insulin-glucose metabolism, and increased walking function, but has led to no significant improvement in balance, falls efficacy, or daily step activity. Adaptive Physical Activity produces complementary improvements in balance and dynamic gait, 6 minute walk distances, and small increases in VO2 peak. Combining these models, (TM + APA) could influence free-living activity patterns. We hypothesized that TM + APA would be more effective in improving fitness, ambulation, balance, and free-living daily step activity patterns than APA alone. Twenty-three adults with chronic stroke completed the 6 month intervention: 13 had standard APA training, 10 had progressive high-intensity treadmill training in combination with APA. Exercise sessions in both cohorts were of the same duration, for 1 hour 3x/wk for six months. Average attendance was 81%. Outcome measures included VO2 Peak, Berg Balance Scale, Dynamic Gait Index, 6 Minute Walk, and step activity. At six months, both the APA and TM + APA subjects showed improvements in Berg Balance Scale (38 ± 10 to 44 ± 8 [22%]; vs. 38 ± 9 to 40 ± 8, [5%], mean ± SD), and Dynamic Gait Index (14 ± 3 to 15 ± 4 [7%] vs. 14 ± 5 to 16 ± 3 [14%]). 6MW increased in the APA group by 25% (600 ± 317 to 748 ± 351 ft) vs. 34% in the TM + APA group (805 ± 371 to 1077 ± 498 ft). Both groups showed similar gains in VO2 peak at 3 months (15.6 ± 4.6 to 17.0 ± 4.5 [14.4%] vs. 14.3 ± 3.1 to 16.3 ± 3.8 [14.1%]). However, at 6 months, the APA group merely retained the gain of 14.2% over baseline, compared with 26.5% in the TM + APA group. TM + APA yielded an 18% change overall in step activity (2691 ± 2003 to 3179 ± 1895, p = 0.05), compared to 8% in the APA group (2882 ± 1773 to 2894 ± 1775). TM + APA is safe and feasible, and produces greater gains in 6 MW, VO2 Peak, and Step Activity than APA alone. These results suggest that to increase free-living activity, individuals with stroke require a complement of fitness and functional improvements.

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