

# Prospective Validation of the Miami Emergency Neurologic Deficit (MEND) Exam for Detection of Stroke

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## Background

- Over the past two decades, since the development of the National Institutes of Health Stroke Scale (NIHSS), several other scales have been developed in an attempt to devise a simpler and quicker exam for stroke detection, without significantly compromising sensitivity and specificity.
- The first stroke scale that was developed to help prehospital providers quickly assess patients for stroke, the Cincinnati Prehospital Stroke Scale (CPSS), was found to only have an overall sensitivity of 66%. It detects anterior circulation strokes well (sensitivity=88%), but misses posterior strokes.<sup>1</sup>
- The Miami Emergency Neurologic Deficit (MEND) exam, developed in 1998, incorporates the NIHSS posterior circulation elements missed by the CPSS, while still being brief and straightforward.
- The MEND exam has a maximum score of 22, and includes all three components of the CPSS and six additional components from the NIHSS (level of consciousness, orientation, commands, visual fields, gaze, leg drift, limb ataxia, and sensation).
- The MEND exam can be performed in less than two minutes, and requires no tools, making it ideal for patient screening, or for frequent, repeated examinations.
- A previous study showed that the MEND exam performed by paramedics in the field highly correlated with the NIHSS performed by the stroke team on arrival to the hospital.<sup>2</sup>

## Purpose

- The purpose of this study was to determine the predictive value of the MEND exam for final diagnosis of stroke.

## Methods

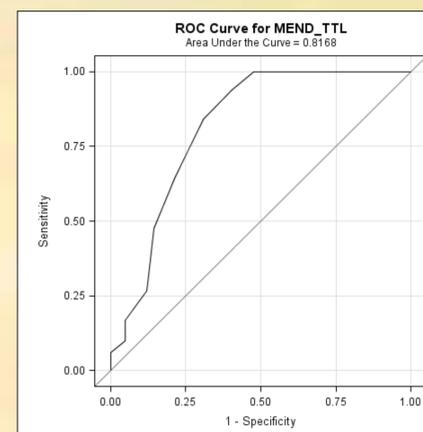
- Paramedics and flight nurses in Monroe County, FL were trained in the Advanced Stroke Life Support (ASLS®) Curriculum, which incorporates hands-on MEND exam training.
- Paramedics performed the MEND exam in the field on patients suspected of having a stroke.
- The patients were then airlifted directly from the scene in Monroe County, FL to Jackson Memorial Hospital, a comprehensive stroke center in Miami, FL.
- Upon arrival, patients were evaluated by the Emergency Department (ED) physician and the Stroke Team, who performed an NIHSS.
- The investigators analyzed MEND exam findings conducted by paramedics on consecutive patients suspected of having stroke, and a convenience sample of additional emergency medical services (EMS) patients with various complaints.
- Hospital electronic health records were then reviewed to determine the NIHSS score, imaging results and final diagnosis on hospital discharge.
- The investigators' goal was to determine the ability of the MEND exam, when administered by paramedics, to predict stroke or transient ischemic attack (TIA), based on the patient's final diagnosis on hospital discharge.
- Additionally, we analyzed the correlation of the MEND exam with stroke on imaging, where available.
- Receiver operating characteristic curves, sensitivity, specificity, positive predictive value and negative predictive value were determined.
- Statistical analysis was conducted by biostatisticians at the University of Miami Miller School of Medicine using SAS, v.9.3.

## MEND Exam

MENTAL STATUS		CHECK IF ABNORMAL	
Level of Consciousness (AVPU)		<input type="checkbox"/>	
Speech "You can't teach an old dog new tricks." (repeat) Abnormal = wrong words, slurred speech, no speech		<input type="checkbox"/>	
Questions (age, month)		<input type="checkbox"/>	
Commands (close, open eyes)		<input type="checkbox"/>	
CRANIAL NERVES			
Facial Droop (show teeth or smile) Abnormal - one side does not move as well as other	RT	<input type="checkbox"/>	LT <input type="checkbox"/>
Visual Fields (four quadrants)		<input type="checkbox"/>	<input type="checkbox"/>
Horizontal Gaze (side to side)		<input type="checkbox"/>	<input type="checkbox"/>
LIMBS			
Motor—Arm Drift (close eyes and hold out both arms) Abnormal—arm can't move or drifts down	RT	<input type="checkbox"/>	LT <input type="checkbox"/>
Leg Drift (open eyes and lift each leg separately)		<input type="checkbox"/>	<input type="checkbox"/>
Sensory—Arm and Leg (close eyes and touch, pinch)		<input type="checkbox"/>	<input type="checkbox"/>
Coordination—Arm and Leg (finger to nose, heel to shin)		<input type="checkbox"/>	<input type="checkbox"/>

Figure 1: Miami Emergency Neurologic Deficit (MEND) Exam

## Results



Graph 1: Receiver Operating Characteristic (ROC) Curve for MEND Exam

MEND SCORE	≥2	≥3	≥4	≥5
Sensitivity	94%	84%	64%	47%
Specificity	59%	69%	78%	85%
PPV	84%	87%	87%	89%
NPV	81%	64%	47%	40%

Table 1: Accuracy of the MEND Exam in Final Diagnosis of Stroke or TIA on Hospital Discharge

## Results

- From September 2008 to June 2017, 143 patients presenting to EMS had MEND exams completed.
- The mean age was 68 years (range 21-98), and 81% (n=57) were males.
- The average MEND score was 5 (range 0-14) and the average NIHSS score was 10 (range 0-34).
- Of 101 strokes, 89 were ischemic (88%) and 12 hemorrhagic (12%).
- Area under the curve for MEND exam predictability for final diagnosis of stroke or TIA was 0.82 (95% CI 0.73-0.91).
- The sensitivity, specificity, PPV and NPV for different score cut-offs of the MEND exam were:
  - MEND ≥2: 0.94, 0.59, 0.84, 0.81
  - MEND ≥3: 0.84, 0.69, 0.87, 0.64
  - MEND ≥4: 0.64, 0.78, 0.87, 0.47

## Conclusions

- The MEND exam, completed in the prehospital setting by paramedics, is an effective screening tool for detecting stroke.
- Since the MEND exam includes components excluded in other commonly used screening exams, and can be completed quickly, it is a valuable tool for assessing stroke patients.
- A cut-off of ≥2 captured the majority of strokes, including posterior circulation strokes.

## References

- Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati Pre-hospital Stroke Scale: reproducibility and validity. *Ann Emerg Med.* 1999;33:373-378.
- Brotons AA, Motola I, et al. Correlation of the Miami Emergency Neurologic Deficit (MEND) Exam Performed in the Field by Paramedics with an Abnormal NIHSS and Final Diagnosis of Stroke for Patients Airlifted from the Scene. International Stroke Conference. Feb. 2012, New Orleans, LA.

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This study was approved by the University of Miami Institutional Review Board (#20120370).