

# Near-Infrared Spectroscopy's Predictive Ability of Neurological Injury in ECMO Patients

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## Introduction

### ECMO and Cerebral Oximetry (NIRS)

Support treatment for heart/lung failure  
Most common complication is neurological injury  
NIRS helps monitor cerebral oxygenation levels while on ECMO

### ECMO + NIRS: Previous Studies

NIRS detects regional changes in oxygen  
Mixing of oxygenated blood in circuit and deoxygenated in lungs is unpredictable

### Most research on NIRS have been done in acute settings or pediatric settings

Recently used as a trend monitor for cerebral oxygenation levels in adults

### Both are relatively new technology not available to most hospitals

### Currently, the neurological exam is the gold standard in prompting a CT scan

NIRS may be more accurate



## Objectives

Elucidate sensitivity and specificity of NIRS in detecting neurological injury

Determine magnitude of NIRS decline in ECMO patients with neurologic injury

Explore how effective cerebral O<sub>2</sub> monitoring is regionally and globally

## Methods

### Inclusion criteria for study

VA or VV ECMO with head/brain CT  
NIRS monitoring documented  
+/- clinical neurological sign  
At least 5 baseline readings  
At least 2 readings at time of CT

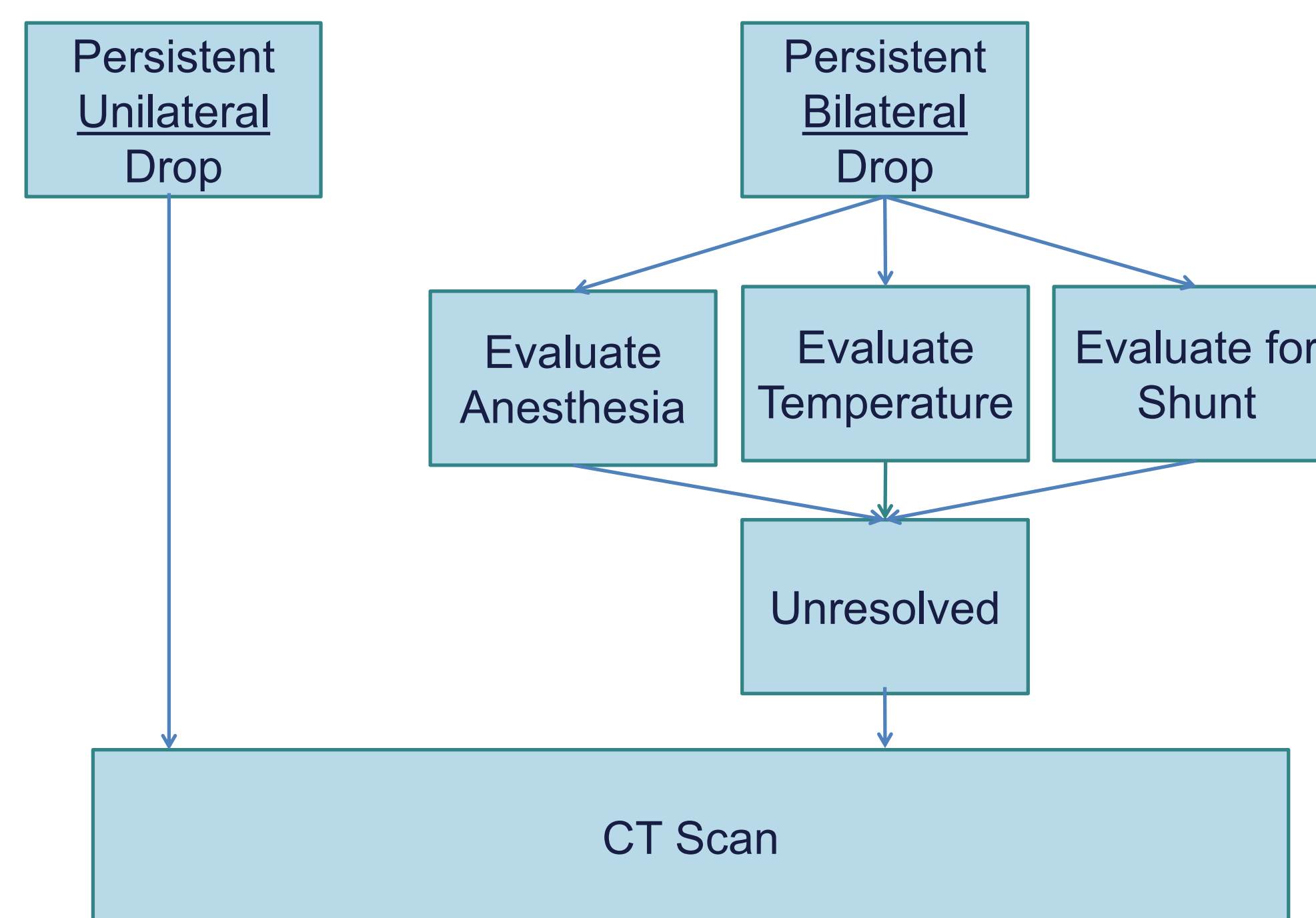
Study period: 2010-2017

Total number of patients: 73 (out of 204)

### Demographics of patients

73 patients: 51M; 22F  
Mean Age: 49 ± 13 y/o  
Type of ECMO: VA: 56; VV: 17  
Days from ECMO to CT: 4.4 ± 4.6d.  
Cardiac – 75%, Respiratory – 25%  
Retrospective analysis with IRB approval.

### NIRS Algorithm



### Patient Groups based on Neuro signs\* and NIRS drop

Group A: Neuro (+) / NIRS drop (+) n=14 (19%)  
Group B: Neuro (+) / NIRS drop (-) n=40 (55%)  
Group C: Neuro (-) / NIRS drop (+) n=0 (0%)  
Group D: Neuro (-) / NIRS drop (-) n=19 (26%)

### \*Clinical Neurological Signs:

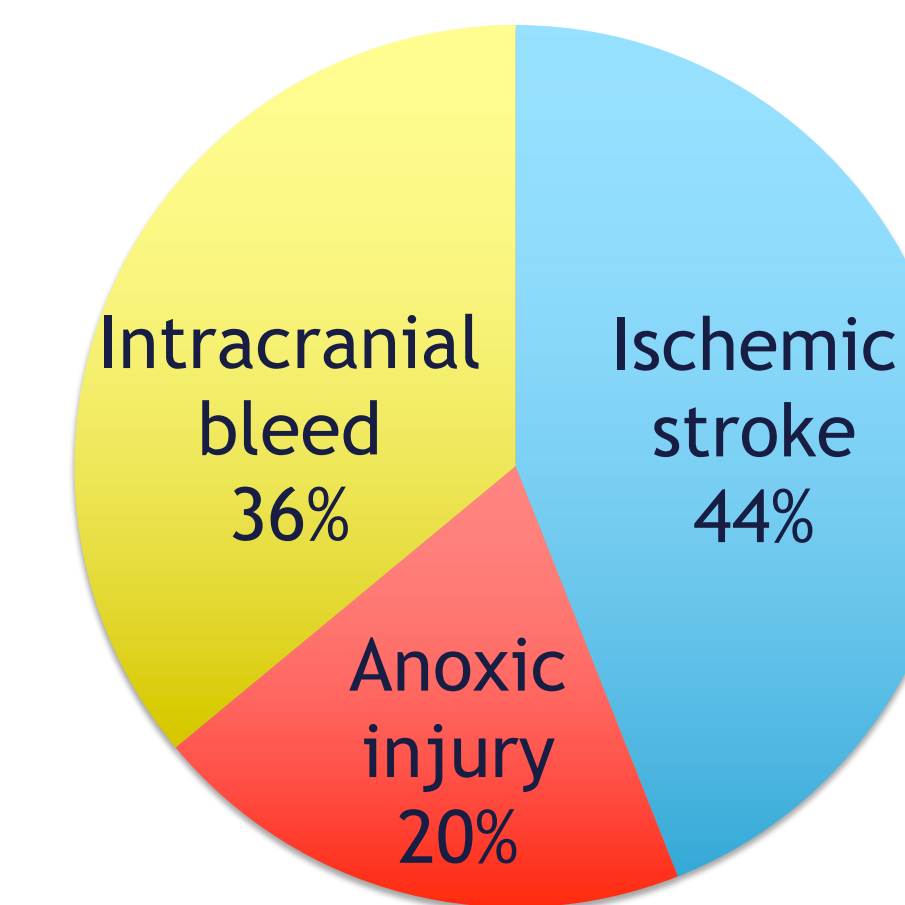
1. Comatose despite sedation vacation
2. Acute neurological Injury (ANI) - (hemiplegia, unequal pupils, seizures)

## Results

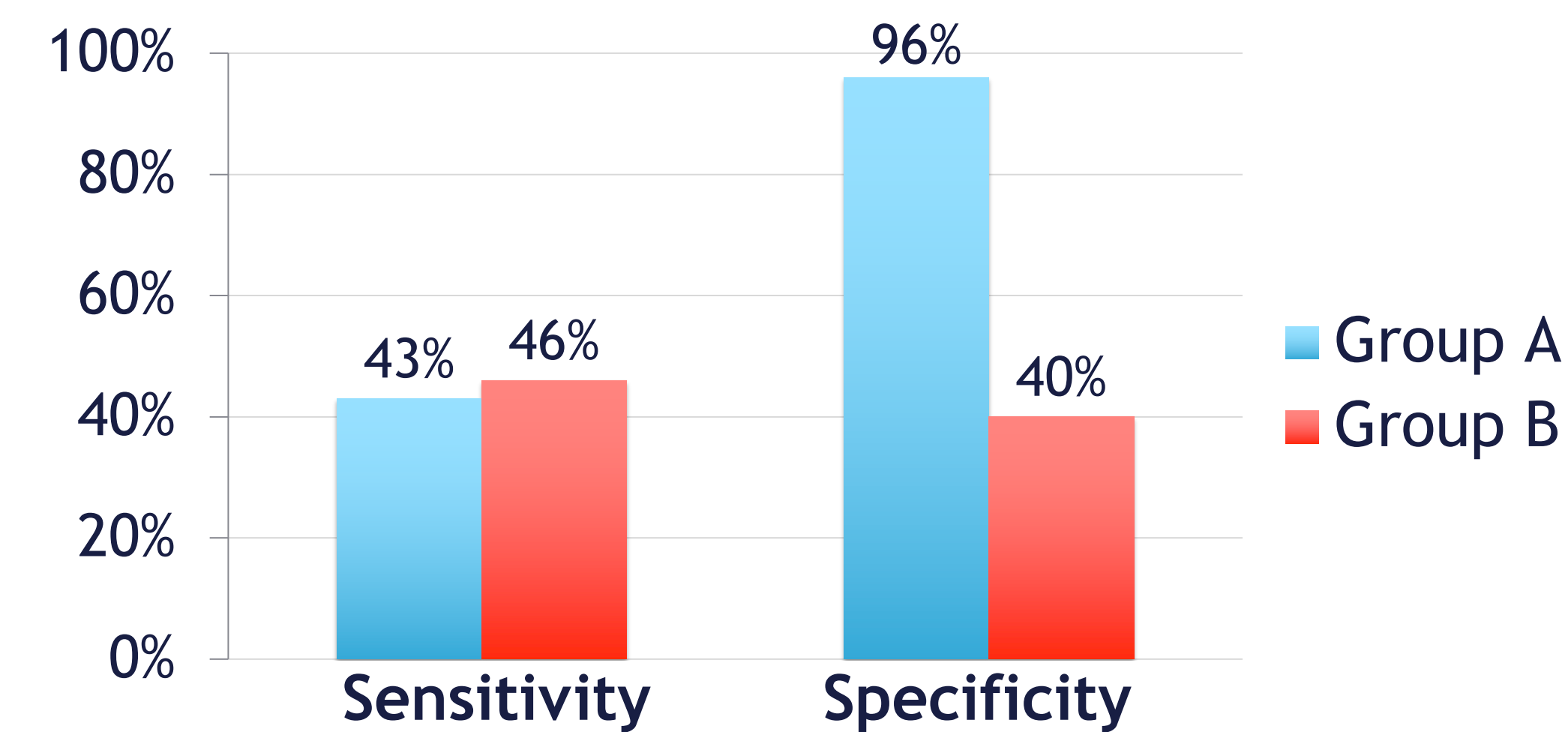
CT scans confirmed 28 (out of 73) patients had a neurological injury:

Group A Neuro (+) / NIRS drop (+) :12 (86%)  
Group B Neuro (+) / NIRS drop (-) :14 (33%)  
Group D Neuro (-) / NIRS drop (-) : 3 (16%)

### Neurological Injuries by CT scan

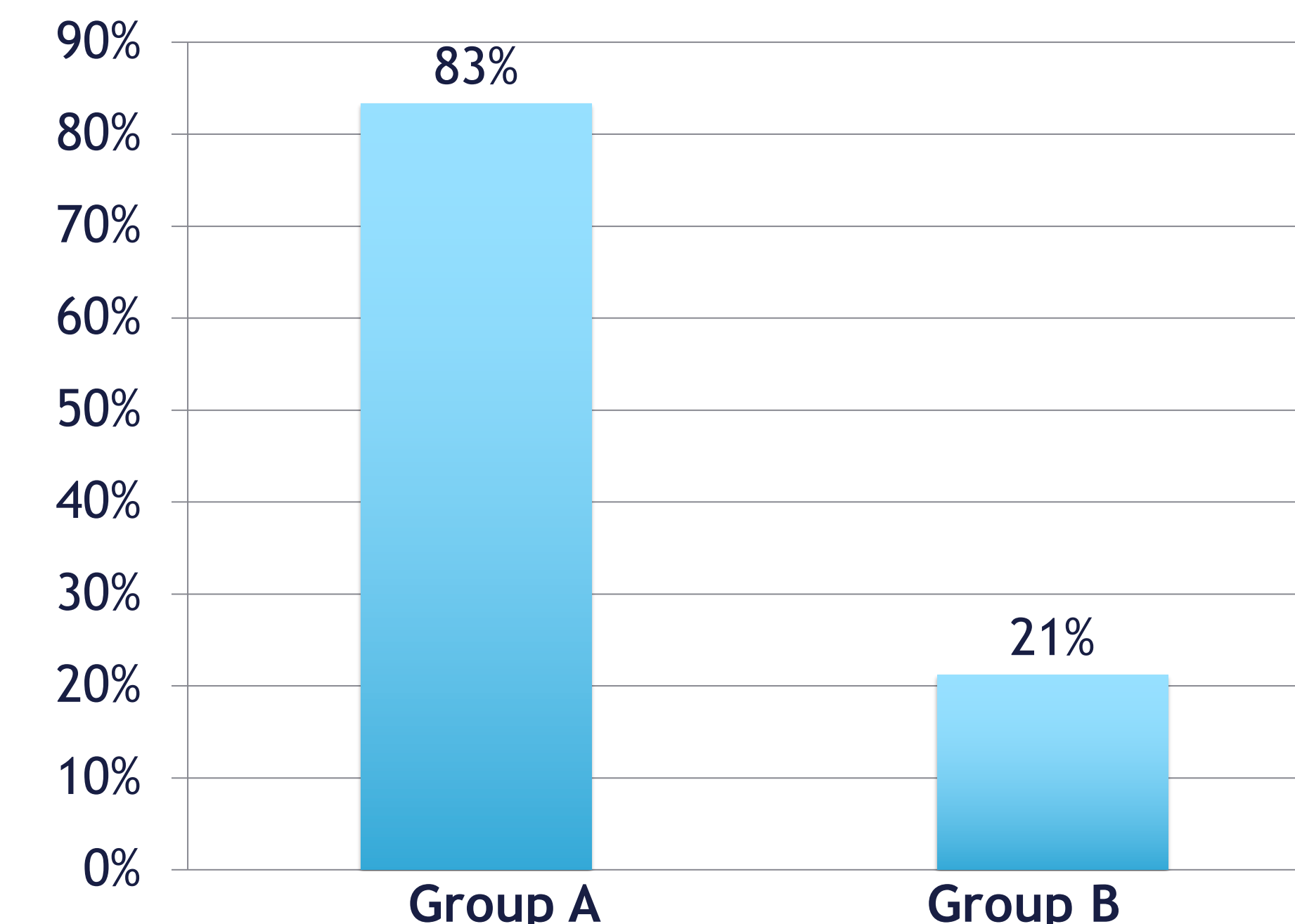


### Sensitivity and Specificity of Groups to identify CT confirmed Neurological injury



\*A: Neuro (+) / NIRS (+); B: Neuro (+) / NIRS (-)

### Comatose Patients with CT confirmed Neurological Injury



Among comatose patients, NIRS drop had a sensitivity and specificity of 59% and 93% of detecting neurological injury respectively.

## Results

### Neurological Sign (+) & CT (+)

Group A (N=12)	Group B (N=13)
• Comatose – 10 (83%)	• Comatose 7, (54%)
• ANI – 2 (17%)	• ANI 6, (46%)
• <u>NIRS – 13.5% drop</u>	• NIRS – 1.5% drop

### Regional vs. Global Injury Distribution

Group A	Group B
Comatose (N=10)	Comatose (N=7)
• ACA/MCA – 4	• ACA/MCA – 2
• <u>ANOXIC – 4</u>	• <u>MULTIPLE – 3</u>
• PCA – 2	• PCA – 2

ANI (N=2)	ANI (N=6)
• ACA/MCA – 1	• OTHER – 6
• OTHER – 1	

### NIRS accuracy in detecting neurological injury in expected distributions:

Sensitivity: 81.8%  
Specificity: 78.6%

## Conclusion

- NIRS & neuro exam is just as sensitive and more specific than neuro exam alone
- Particularly useful in comatose patients, the majority of ECMO patients
- Accuracy in distribution is high
- Future studies to be done on global monitoring via NIRS

## Contact Information

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