# Accuracy and Reliability of Noxious Stimuli Delivery in Altered Patients

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## INTRODUCTION

There is significant variability in methods used to perform neurological examination in poorly responsive patients. Inconsistent and poor inter-examiner reliability may lead to poor, consequential clinical decision-making and care.[1] Noxious stimuli are routinely administered to elicit motoric responses to determine the depth of unresponsiveness in comatose patients.[2] However, no study has tested the reliability of noxious stimuli delivery (NSD) method or quantified applied force that elicit motor responses in patients with coma.

## OBJECTIVES

- Double-blinded prospective study determining the reliability of “central” NSD methods (supraorbital pressure, TMJ pressure, earlobe pressure, trapezius pinch, sternal rub) to elicit motor response in poorly responsive patients with brain injury.
- Determine whether ”low” or “high” force reliably produces motoric responses (above or below 800 force units).

## MATERIALS & METHODS

- Subject eligibility:
  - Age ≥ 18 years
  - GCS or FOUR Score < 10
  - Imaging defined brain injury
- Control group:
  - Age ≥ 18 years
  - GCS or FOUR Score < 10
  - ICU admission for non-neurologic conditions (e.g., sepsis)
- Exclusion criteria:
  - Pregnant and vulnerable patients

## MATERIALS & METHODS cont.

**Investigator Blinding Protocol:**

(A) NSD provider: blinded to underlying condition.
(B) Motor response recorder: blinded to NSD type and force applied (Figure 1).

**Figure 1. Motor Response Blinding.** Recorder unaware of NSD location and force delivered

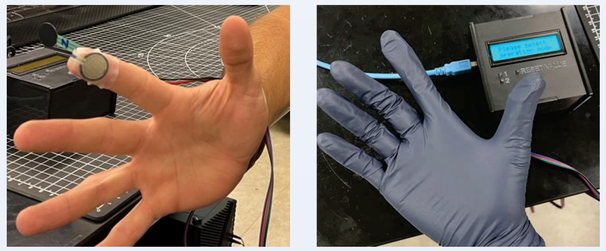
**Noxious Stimulus Type**

Earlobe Squeeze | Sternal ”rub” | Supraorbital pressure | TMJ Pressure | Trapezius Pinch

**Noxious Stimulus Force Quantification: (Figure 2)**

- A tactile pressure sensor is worn by provider Device quantifies amount of applied force
  - Two levels of force applied: (A) < 800 (B) > 800
  - Pragmatic design, mimics clinical practice
- Developed by UC Davis Biomedical Engineering

**Figure 2. Force Sensor Device**



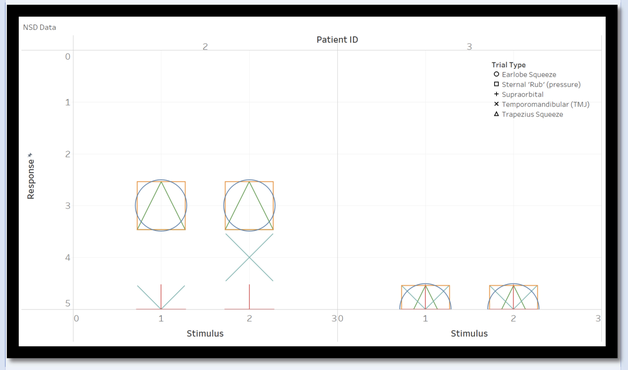
## RESULTS

- 3 subjects enrolled (LAR)
  - 1 subject not tested due to clinical instability (pathological elevation in intracranial pressure)
- Subject #1 (“Patient ID 2”)

  *Diagnosis: Severe left MCA ischemic stroke*
  - Earlobe squeeze, sternal rub, and trapezius squeeze elicited flexor posturing at both force levels (e.g., < 800 and > 800).
  - TMJ pressure elicited extensor posturing at > 800 vs. no motor response at < 800
  - Supraorbital stimuli elicited no motor response at either force level
- Subject #2 (“Patient ID 3”)

  *Diagnosis: Catastrophic Pontine Hemorrhage*
  - Mute to all stimuli.

**Table 1. Motor Responses of Comatose Patients based on Noxious Stimulus Delivery Type**




## Discussion

- Demonstrated feasibility of protocol
- Reproducibly quantify applied force
- Projected sample size of 25 subjects
- Preliminary results suggest:
  - Earlobe squeeze, sternal “rub”, and trapezius pinch reliably elicited motor response
  - TMJ elicited variable motor response based on force applied
  - Infratentorial lesions (e.g., Pontine brainstem hemorrhage) exhibit poor motor responses irrespective of intensity and NSD type

## REFERENCES

1. Cook NF, Braine ME, Trout R. Nurses' understanding and experience of applying painful stimuli when assessing components of the Glasgow Coma Scale. *J Clin Nurs*. Nov 2019;28(21-22):3827-3839

2. Wijdicks EF. Temporomandibular joint compression in coma. *Neurology*. Jun 1996;46(6):1774.

## ACKNOWLEDGEMENTS

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