

Clinical usefulness of quantitative assessment of pupillary light reflex in hospital-onset unresponsiveness

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Background

- Hospital-onset unresponsiveness (HOU) may occur in patients hospitalized for non-neurological conditions.
- Quantitative pupillometry (QP) provides neurological pupillary index (NPi), a quantitative measurement of pupillary light reflexes that have been traditionally assessed via subjective visual impression.
- We determined the clinical usefulness of NPi in predicting the outcomes of patients who have experienced HOU.

METHODS

- A total of 345 cases in 331 patients were analyzed, out of which 214 cases (62%) had been assessed with QP
- A newly developed altered mental status and cases coded as "unresponsive" in the ACUDU
- Analyzed the demographics, radiological findings, etiology of HOU, NPi, in-hospital mortality, 3-month mRS

Table 1. ACUDU scale definition in this study

Scale	Description
Alert	Awake and appropriate conversation
Confused	Awake but inappropriate conversation, irritability, agitation or disoriented state
Drowsy	Tendency to sleep. Proper or inappropriate conversation can be done by calling or shaking
Unresponsive	No eye, voice or motor response by calling or shaking. No conversation even there is spontaneous eye opening

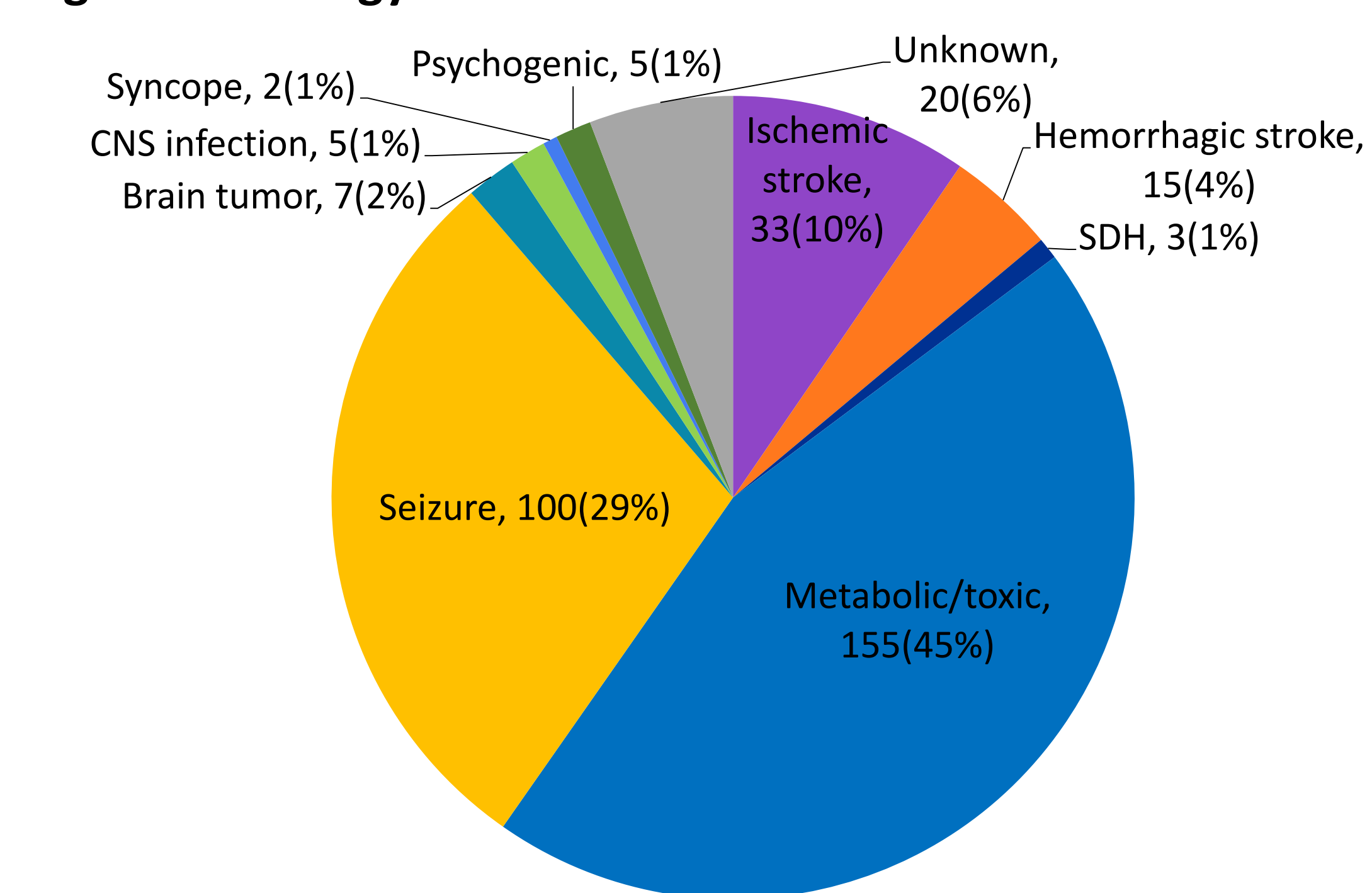
Table 2. The NPi pupil reactivity assessment scale

Measure value *	Assessment
3.0 – 4.9	Normal, "Brisk"
< 3.0	Abnormal, "Sluggish"
0	Non-reactive or atypical response

* Per the NPi algorithm, provide by The NeurOptics NPi-100 pupillometer, developed by NeurOptics

RESULTS

Figure 1. Etiology of HOU



Quantitative assessment of pupillary light reflex was independently associated with the risk of cerebral herniation syndrome, in-hospital mortality and 3-month functional outcome in patients with hospital-onset unresponsiveness

Cerebral herniation syndrome

Table 3. Comparison of clinical data and quantitative NPi between with and without cerebral herniation syndrome (CHS) in HOU

	CHS(-) (n=265)	CHS(+) (n=52)	P-value
Age, mean ± SD	64 ± 15	57 ± 15	0.004
mRS ≥ 4 before admission	104 (40%)	11 (22%)	0.01
Hypertension	125 (47%)	16 (31%)	0.04
Diabetics	78 (29%)	11 (21%)	0.29
Previous Stroke	48 (18%)	7 (14%)	0.54
GCS score, median (IQR)	6 (3-8)	5 (3-8)	0.008
Hypotension (SBP ≤90 mmHg)	26 (10%)	5 (10%)	1.00
NPi, mean ± SD	3.6 ± 1.2	2.1 ± 1.7	< 0.001 ^a

^a Independent association with CHS in multivariate analysis (NPi: odds ratio 0.61 [0.26-0.77], p=0.003)

In-hospital death

Table 4. Comparison of clinical data and quantitative NPi between with and without in-hospital mortality in HOU

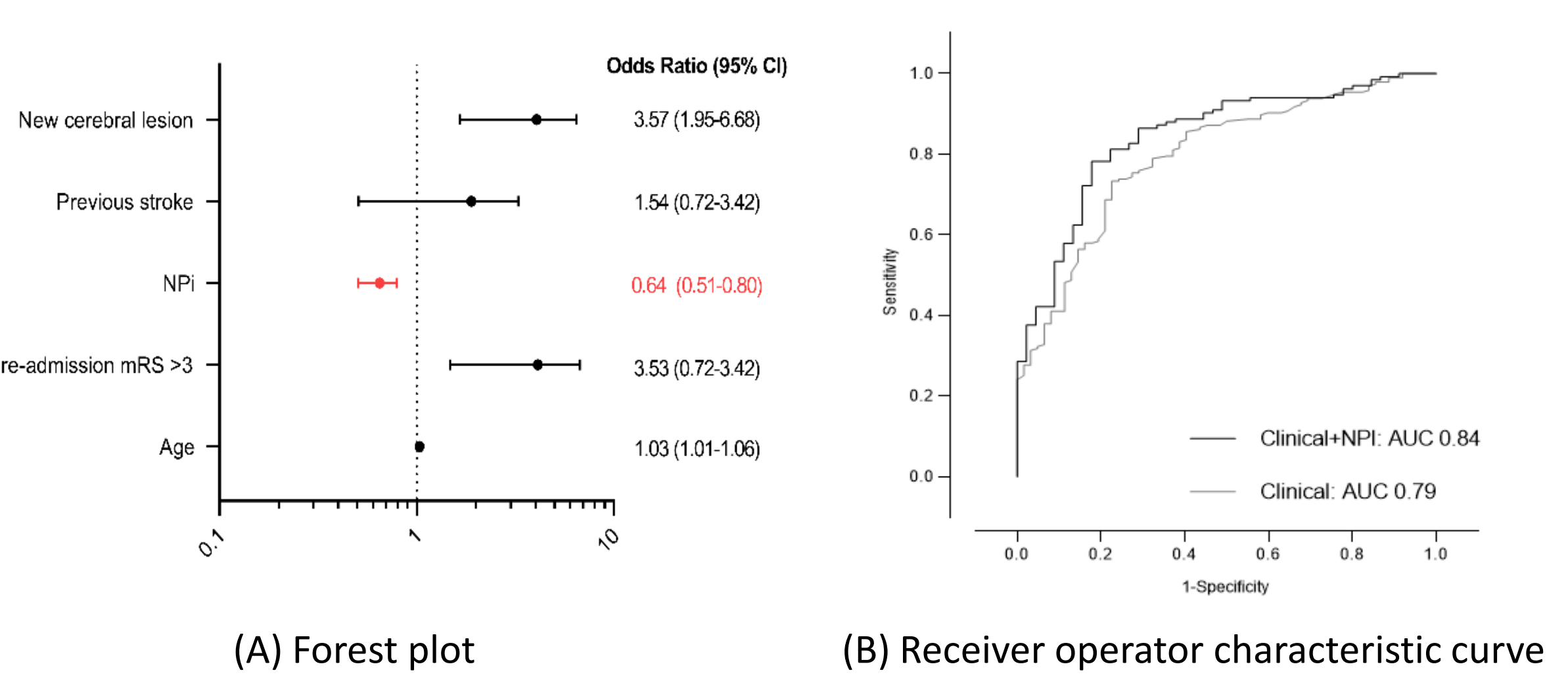
	Survival (n=243)	Death (n=102)	P-value
Age, mean ± SD	62 ± 16	64 ± 14	0.42
mRS ≥ 4 before admission	81 (34%)	39 (39%)	0.41
Hypertension	115 (45%)	36 (35%)	0.05
Diabetics	67 (28%)	28 (28%)	1.00
Previous Stroke	46 (19%)	15 (15%)	0.43
GCS score, median (IQR)	6 (3-8)	4 (3-7)	0.001
Hypotension (SBP ≤90 mmHg)	15 (6.4%)	18 (19%)	0.001 ^a
NPi, mean ± SD	3.5 ± 1.3	2.7 ± 1.7	0.001 ^a

^a Independent association with in-hospital mortality in multivariate analysis (Hypotension: odds ratio 21.57 [1.6-27.7], p=0.01; NPi: odds ratio 0.52 [0.29-0.94], p=0.02)

3-month functional outcome

- Multivariate analysis showed an independent association between lower NPi and unfavorable clinical outcomes (common odds ratio 0.64; 95% CI, 0.51-0.80; p=0.02).
- The area under a receiver operating characteristic (ROC) curve of clinical covariates and NPi for predicting 3-month poor outcome (mRS ≥ 4) was 0.84.

Figure 2. Clinical variables and NPi associated with an increased risk of unfavorable outcome



CONCLUSIONS

- HOU are at high risk of in-hospital death and severe functional impairment at 3-month, suggesting the need for increased awareness of this in-hospital complication.
- NPi was associated with the risk of CHS, morbidity and mortality in non-neurological patients with HOU.