Pupillometry as a predictor of outcome after hemicraniectomy

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Purpose

To study the effect of hemicraniectomy on pupillary changes quantified with a pupillometer and to analyze the impact of these changes on patient outcome

Background

Decompressive hemicraniectomy is used to relieve life-threatening mass effect and evidence-based guidelines support its use in patients with large hemispheric infarction. Pupillary light reflex (PLR) changes can be an indicator of cerebral herniation and often serve as a trigger for hemicraniectomy. Pupillary abnormalities have been found to be a poor prognostic indicator in some, but not all studies of outcome after hemicraniectomy. Subjective pupil examination using a hand-held flashlight is error prone and none of these previous studies employed quantitative automated pupillometry.

Methods

Design

Retrospective analysis

Patient Selection

Patients from November 2016 to July 2018 who underwent hemicraniectomy and had pupillometer readings

Data Collection

- PLR measured by NPi before and after craniectomy
- Midline shift on CT scans before and after hemicraniectomy

Primary Outcome

Modified Rankin Scale (mRS) score at discharge

Data Analysis

Means and central tendencies were examined and regression model were constructed using SAS v9.4

Results

Demographics

Patients, n	13
Mean age, years(SD)	39.7 (11.4)
Male, n(%)	5 (38.5)
Female, n(%)	8 (61.5)

Primary Diagnosis

Ischemic Stroke	7(53.8)
Intracranial Hemorrhage	3 (23.1)
Subarachnoid Hemorrhage	1 (7.7)
Subdural Hematoma	1 (7.7)
Infection	1 (7.7)

Hemicraniectomy Indications

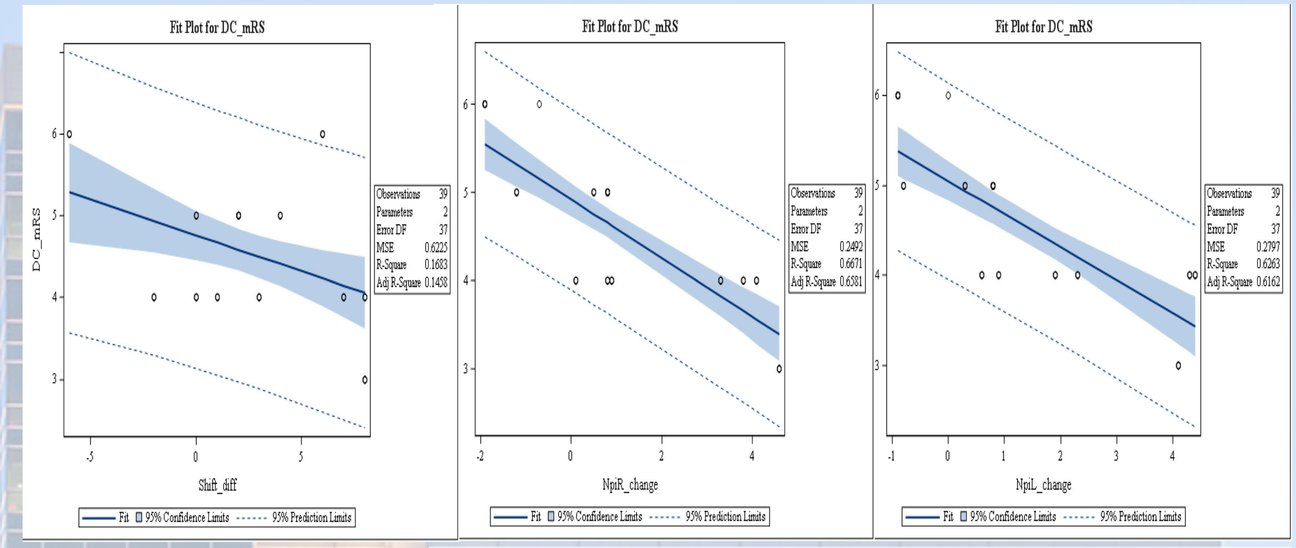
Pupil Change	6(46.1)
Decreased consciousness	4 (30.8)
Increased ICP	2 (15.4)
Multifactorial	1 (7.7)

Ischemic stroke characteristics

Artery involved	
MCA	7
Others	0
Mean days from stroke to surgery (in days)	1.3 (0-3)
Side(%)	
Right	3
Left	4

Change in Midline shift and NPi

Mean (SD)	Midline shift (in cm)	NPi Right Eye	NPi Left Eye
Before hemicraniectomy	9.5 (5.3)	1.2 (2.2)	1.4 (1.9)
After Hemicraniectomy	6.9 (3.9)	1.1 (2.2)	1.4 (1.9)
Difference	2.5 (4.0)	0.36 (0.31)	0.11 (0.36)



Figures above: Regression analyses of mRS at discharge with Difference in midline shift, Change in NPi in right eye and change in NPi in left eye, respectively (left to right)

Outcome

Difference in midline shift (before minus after hemicraniectomy) was predictive of mRS ($r2=0.15$; $p<0.01$).

Improved NPi scores were associated with lower mRS for left eye ($r2 = .63$, $p<.001$) and right eye ($r2 =.67$; $p<.001$).

Conclusion

Improvement in NPi after hemicraniectomy is correlated with better patient outcomes at discharge.

References

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