The Impact of Increased Intracranial Pressure on Pupillometry: A Replication Study

Sameer Al-Obaidi, BDS MPH, Folefac Atem, PhD, Sonja Stutzman, PhD, and DaiWai M. Olson, PhD RN

University of Texas Southwestern Medical Center

INTRODUCTION

- Pupillometry assessment of the pupillary light reflex (PLR) is gradually replacing manual PLR assessment.[1,2]
- McNett et al.[3] recently investigated the association between intracranial pressure (ICP) and serial pupillometer values and found that pupillometry readings are different significantly in the setting of increased ICP.
- This is a replication of the McNett study in a larger multicenter cohort to explore these findings.

METHODS

- Data were pooled from the Establishing Normative Data for Pupillometer Assessments in Neuroscience Intensive Care (END-PANIC) Registry.[4]
- 273 subjects with documented ICP readings provided 16,221 observations (daily mean ICP values) which were included in this analysis.
- Statistical analysis (SAS v9.4) included descriptive statistics and to examine the differences (*t* test) among various PLR metrics across ICP readings (ICP< 15 vs ICP≥ 15).

RESULTS

- Excepting latency and right eye NPi, lower PLR values were associated with higher ICP (compared to low or normal ICP) for all mean pupilometer/PLR variables for both left and right eyes (*t* range [-9.78 to 33.67]; p-value range [<0.0001 to 0.03]).

CONCLUSION

- Finding confirmed and extend McNett original study.
- Automated pupilometer can predict ICP trends to help in assessing patients with neurological conditions.

UTSouthwestern
O'Donnell Brain Institute

MAGNET RECOGNIZED
AMERICAN NURSES CREDENTIALING CENTER

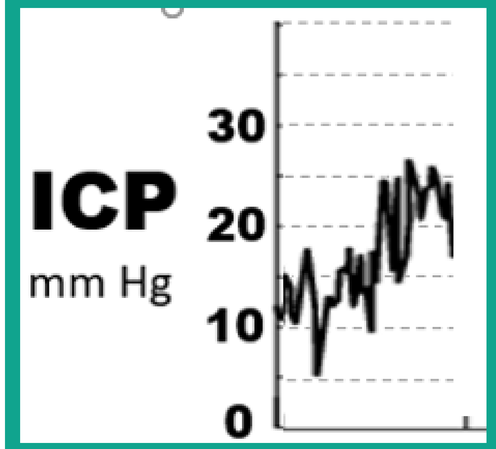
Patients with

increased ICP

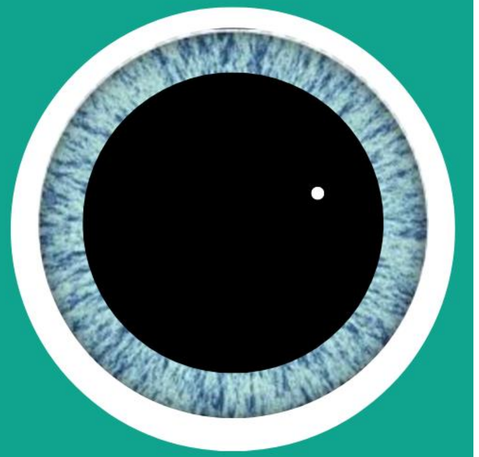
tend to have

lower pupillometer

values



=



Sameer.obaidi@gmail.com

Table 1. Descriptive Statistics (First Observation for Each Patient)

Variable	Statistic	All	ICP<15	ICP≥ 15	P-value
Age	Mean	53.47	53.59	52.62	0.75
	Median	54.00	54.00	51.50	
	SD	16.76	16.92	15.75	
Glasgow Coma Scale	Mean	10.55	10.85	8.44	0.003
	Median	13.00	13.00	7.00	
	SD	4.46	4.33	4.83	
Hospital LOS	Mean	17.88	18.52	13.38	0.02
	Median	16.00	17.00	11.50	
	SD	12.33	12.53	9.84	
ICU LOS	Mean	13.95	14.29	11.59	0.12
	Median	13.00	13.00	10.00	
	SD	9.36	9.46	8.38	
ICP (mm Hg)	Mean	8.05	6.62	18.05	<.0001
	Median	7.00	7.00	17.00	
	SD	4.98	3.24	3.28	

Abbreviations: ICP: intracranial pressure; LOS: length of stay; ICU: intensive care unit

Table 2. Pupilometry In Relation to Intracranial Pressure Values

Variable (n)	Mean (SD)	t (df)	P-value
RNPi		-2.23 (4452.8)	0.03
ICP< 15 (12235)	3.92 (1.16)		
ICP≥ 15 (3063)	3.98 (1.26)		
LNPi		11.54 (3893.8)	<.0001
ICP< 15 (11894)	3.92 (1.21)		
ICP≥ 15 (2983)	3.56 (1.58)		
RCV		27.00 (5469.5)	<.0001
ICP< 15 (11706)	1.48 (0.88)		
ICP≥ 15 (2845)	1.08 (0.67)		
LCV		33.67 (4668.1)	<.0001
ICP< 15 (11245)	1.47 (0.88)		
ICP≥ 15 (2566)	0.93 (0.69)		
RDV		27.07 (5244.6)	<.0001
ICP< 15 (11091)	0.66 (0.41)		
ICP≥ 15 (2767)	0.47 (0.32)		
LDV		30.42 (4536)	<.0001
ICP< 15 (10543)	0.66 (0.40)		
ICP≥ 15 (2465)	0.43 (0.31)		
RLat		1.03 (4184.1)	0.30
ICP< 15 (11711)	0.26 (0.06)		
ICP≥ 15 (2843)	0.26 (0.07)		
LLat		-9.78 (3478.8)	<.0001
ICP< 15 (11251)	0.25 (0.06)		
ICP≥ 15 (2566)	0.27 (0.07)		
R Size		24.23 (4879.6)	<.0001
ICP< 15 (12235)	3.35 (1.21)		
ICP≥ 15 (3063)	2.78 (1.15)		
L Size		26.62 (5054.1)	<.0001
ICP< 15 (11894)	3.32 (1.17)		
ICP≥ 15 (2983)	2.74 (1.04)		
ICP		-70.01 (3463)	<.0001
ICP< 15 (12996)	7.77 (3.58)		
ICP≥ 15 (3225)	19.47 (9.32)		

Abbreviations: RNPi: right neurological pupil index; LNPi: left neurological pupil index; RCV: right constriction velocity; LCV: left constriction velocity; RLat: right latency; LLat: left latency; R Size: right pupil size; L Size: left pupil size; ICP: intracranial pressure; RDV: right dilation velocity; LDV: left dilation velocity

REFERENCES

1. Couret, D. *et al.* Reliability of standard pupillometry practice in neurocritical care: an observational, double-blinded study. *Critical Care* **20**, 99 (2016).
2. Larson, M. D. & Behrends, M. Portable infrared pupillometry: a review. *Anesthesia & Analgesia* **120**, 1242-1253 (2015).
3. McNett, M., Moran, C., Grimm, D. & Gianakis, A. Pupillometry Trends in the Setting of Increased Intracranial Pressure. *J Neurosci Nurs* **50**, 357-361, doi:10.1097/JNN.0000000000000401 (2018).
4. Olson, D. M. *et al.* Establishing normative data for pupillometer assessment in neuroscience intensive care: The "END-PANIC" registry. *J Neurosci Nurs* **49**, 251-254, doi:10.1097/jnn.0000000000000296 (2017).