The Use of Automated Pupillometry in Children

Jennifer Hayakawa, DNP, PCNS-BC, CCRN, CNRN; Jennifer Bray, BSN, RN, CCRN; Melanie Go, BSN, RN, CCRN
CHOC Children's Hospital, Orange, CA

ABSTRACT

Pupillary assessment is a fundamental component of neurological examination and can provide vital diagnostic information[1-8]. Evidence suggests that the traditional pen-light pupil examination is subjective, has low precision and reproducibility, and limited inter-rater reliability[2-8]. Automated hand-held pupillometers have recently been used to provide more objective measurements of pupillary size and reactivity. Studies suggest early detection of subtle changes using pupillometers may improve patient outcomes in adults,[1,2,4-9] yet there is a paucity of literature on its use in pediatrics.
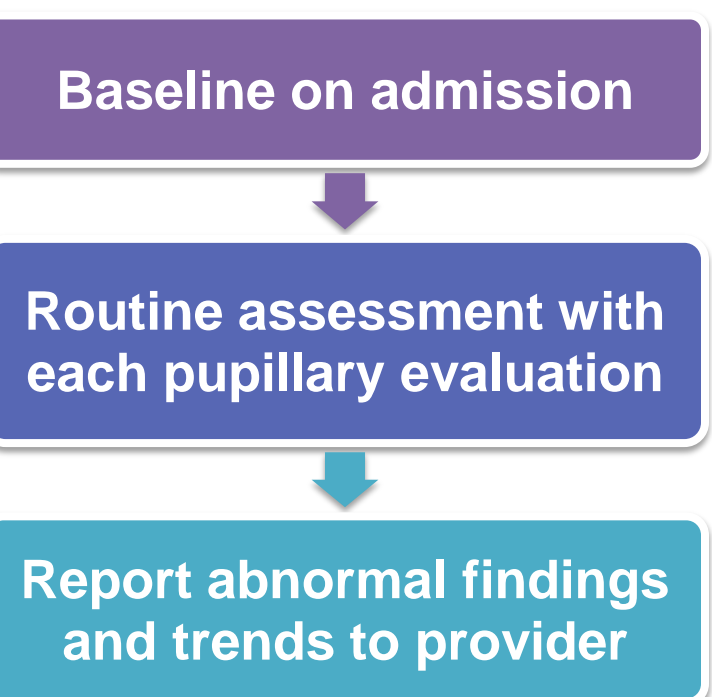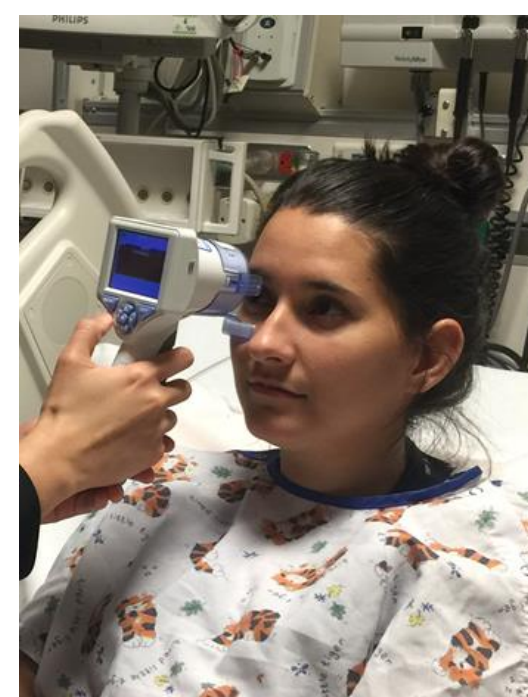
PURPOSE STATEMENT

Describe the practical use of automated pupillometry in children: what it is, what types of patients we are using it on, and how it is being used.

OBJECTIVES

- Review principles of automated pupillometry and how it can augment assessment.
- Discuss pupillometry in children and how one children's hospital has successfully implemented its use.
- Describe the preliminary demographics of a pediatric database.

INTRODUCTION

- The NPi®-200 is a hand-held portable infrared device that uses video recording to analyze the size and reactivity of the pupil to light.

Baseline on admission
↓
Routine assessment with each pupillary evaluation
↓
Report abnormal findings and trends to provider

- Neurological Pupil Index™ (NPi™): An algorithm developed to remove subjectivity from the pupillary evaluation.
  - Size, latency, constriction velocity, dilation velocity is compared against a normative model of pupil reaction and graded on a scale of 0 to 5.

NPi Value	Assessment
≥ 3	Normal/Brisk
< 3	Abnormal/Sluggish
0	Non-Reactive or Atypical Response

A difference in NPi between right and left pupils of ≥ 0.7 may also be considered an abnormal reading.

METHODS

- Single center, retrospective pilot study on pediatric critical care patients that received pupillary assessment with the NPi®-200 as part of their standard of care during a three-year period.
- Establish database of pediatric measurements.
- Cross-sectional analysis of patient demographics, clinical characteristics, and practice patterns.

PRELIMINARY DEMOGRAPHICS

- 120 critical care patients, 3 weeks-26 years old
- 20% of subjects had ICP monitoring during stay
- > 2100 pupillometry readings

- 38% of subjects had at least one documented NPi value of <3
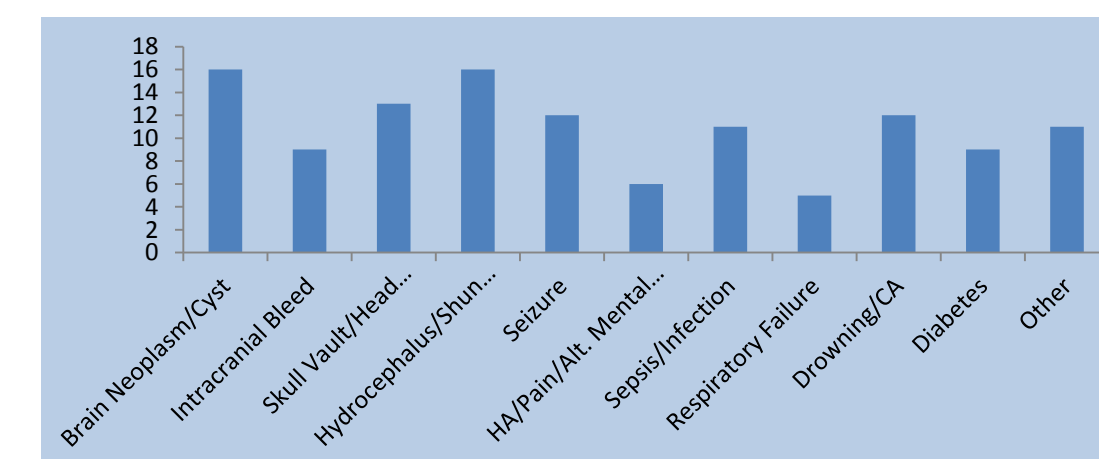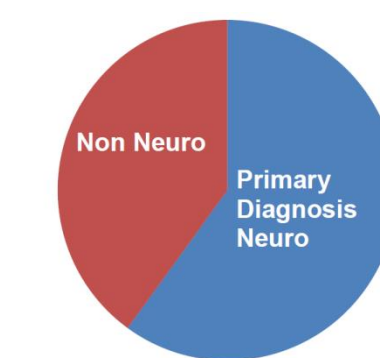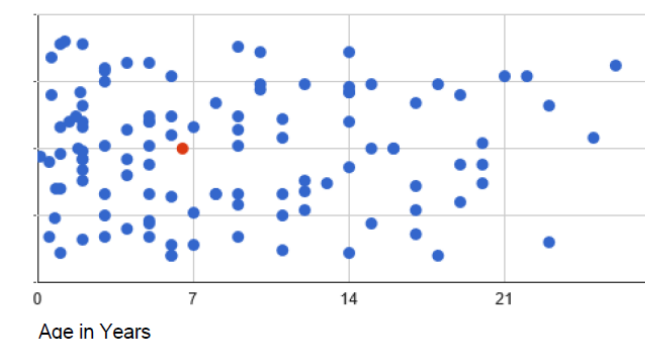
IMPLICATIONS

- Adult studies suggest that pupillometry is a sensitive measure of pupil reactivity and may be an early indicator of increasing intracranial pressure (ICP)[1,3-5,8,9]. Need to evaluate in pediatrics.
- Early detection of subtle pupillary changes may result in more timely and effective treatments[1,3,4,8,9].

Next Steps
- Complete a cross-sectional analysis of patient demographics and practice patterns.
- Examine the association between pupillometry and ICP measurements (documented within 30 minutes of each other) in pediatric patients.
- Study pupillary reactivity as an early indicator of increased ICP in infants and children.
- Multicenter study to evaluate the clinical utility of pupillometers in the pediatric patient population.

REFERENCES

References available upon request.

ACKNOWLEDGMENTS

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

AACN BEACON AWARD FOR EXCELLENCE

CHOC Children's Nursing Research

2018