Clinical Letter

# Bedside Antisaccades: A Time-Efficient Method to Assess Cognition

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Antisaccade is a voluntary eye movement produced opposite to a suddenly presented target. Antisaccade involves activation of multiple brain structures in inhibiting a reflex target seeking saccade and production of a voluntary contralateral saccade.[1] Antisaccade directional errors associate with impaired attention, processing speed, memory, and executive function.[2,3] Clinical value is limited as sophisticated equipment is needed. We previously reported the association of questionnaire-based impaired attention with errors on bedside assessment of antisaccades.[4] In this study we evaluated bedside antisaccades and neuropsychologic function to investigate an association between them.

## Methods

This was part of an institutional review board-approved study of proton therapy of craniopharyngioma, and informed consent was obtained. Participants were evaluated by a neurologist at enrollment, after completing proton therapy, and at each follow-up.

Neuropsychologic assessment was obtained at enrollment and annually. Data were used if both assessments happened within three months of each other. A child had to be aged at least five years at assessment.

Antisaccades were assessed with the examiner seated at an arm's length from the subject with their eyes in primary position at the same horizontal plane. The examiner extends both arms with fingers equidistant from the subject and his own eyes. Subject is instructed to turn the eyes without head movement exactly opposite to the fingers that snap and bring them back to the examiner's eyes on the back command. After a few trials to confirm comprehension, two sets of 10 random snaps are performed. Eye deviation ipsilateral to the snapping finger is considered an error. Errors on both sets were averaged to give a final error score.

Neuropsychologic battery included age-standardized Working Memory and Processing Speed Indices from Wechsler Scale[5] and scores from the Conners Continuous Performance Test.[6]

The error rate frequency was examined descriptively for the full sample and across age and time since diagnosis to identify a cutoff anti-saccade error rate that differentiated the 30% highest measurements from the bottom 70%. Associations of the identified score and neuropsychologic variables were addressed in a univariate generalized estimating equation model to identify likely correlates. Variables significantly associating with antisaccade error rate were then entered in a multivariate generalized estimating equation model.

**TABLE.**
Univariate Analysis

| Variable | Participants | Data Points | P value |
|---|---|---|---|
| Time point | 85 | 185 | 0.46 |
| Age at assessment | 85 | 185 | 0.13 |
| Working memory | 82 | 174 | 0.17 |
| Inattention | 73 | 116 | 0.01 |
| Processing speed | 81 | 173 | 0.001 |
| Impulsivity | 73 | 116 | 0.03 |
| Hypothalamic dysfunction | 85 | 185 | 0.7 |
| Visual field cut | 81 | 177 | 0.6 |

## Results

Ninety-six participants had 398 assessments from July 2012 to May 2017. The median age at tumor diagnosis was 9.1 years, and 53% were girls. Unilateral impaired vision was present in five (5.7%) and bilateral in seven (8%). Median follow-up in those with multiple assessments was 390 days (range 273 to 1290). Univariate associations were found between antisaccade error rate of $\geq$20% and inattention, impulsivity, and processing speed ($P = 0.01$, $P = 0.03$, and $P = 0.001$), but not age at assessment, time point of assessment, working memory, hypothalamic insufficiency, or visual field cut (Table). Only impulsivity remained significant in a multivariable model ($P = 0.04$). There was no significant variability in error rate over time except the suggestion of improvement at postradiation visit (Fig).

## Discussion

This study demonstrates clinical utility of bedside antisaccade assessment and identified $\geq$20% errors associating with worsening impulsivity, inattention, and processing speed. Further confirmation of our findings in additional studies will enhance a clinician's ability to quickly screen for cognitive dysfunction. Antisaccade utilizes multiple brain networks,[1] and its measurement will be useful in assessing pathologies such as attention deficit disorder and radiation-induced cognitive impairment.

We did not assess inter-rater reliability, and limited number of participants with more than 20% error rate prevented examination
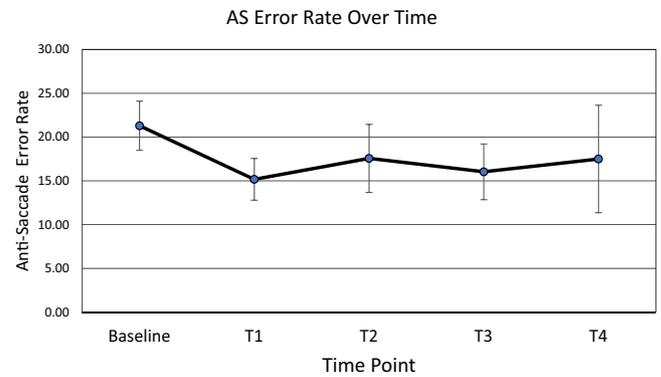


**FIGURE.** Mean anti-saccade error rates with standard error bars at different time points. T1 is post completion of radiation and T1-T4 are each three to six months apart. The color version of this figure is available in the online edition.

of higher error rates. This may be a reason that multivariable model was significant only for increased impulsivity.

In conclusion, bedside antisaccades may quickly assess attention, impulsivity, and processing speed. Confirmation in further studies will make it useful in screening patients for impaired attention and processing speed.

## References

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