

Prediction of Postoperative Visual Recovery after Pituitary and Anterior Skull Base Surgery with Optical Coherence Tomography: A Systematic Review and Meta-Analysis

Misha Amini¹, Adrian E Jimenez¹, Charles T Borchers¹, Michael G Argenziano¹, Arjun R Adapa¹, Alexandra Backlund², Ashwin Viswanathan¹, Anthony J Tang¹, Nathaniel W Rolfe¹, Meital Ben Dov³, Jeffrey N Bruce¹, Brett E Youngerman¹

¹Department of Neurological Surgery Columbia University Medical Center New York, New York, USA

²Department of Neurological Surgery, Weill Cornell Medical College, New York Presbyterian Hospital, New York, NY, USA.

³Edward S. Harkness Eye Institute, Department of Ophthalmology, Columbia University Irving Medical Center, New York, New York.

Introduction

Postoperative visual recovery after surgery for pituitary and anterior skull base lesions compressing the optic apparatus remains difficult to predict.¹

Optical Coherence Tomography (OCT) is a rapid, non-invasive imaging modality that provides high-resolution visualization of retinal architecture.² By measuring retinal nerve fiber layer (RNFL) thickness and other retinal components, OCT can capture the extent of structural damage to the retina.³

Here, we evaluate the utility of preoperative OCT measurements, particularly RNFL thickness, for predicting visual outcomes after surgical decompression in patients with pituitary and skull base lesions causing compression of the optic apparatus.

Methods and Materials

PubMed, Embase, and Cochrane databases were searched through August 2025.

Inclusion Criteria:

- Assessment of the utility of preoperative retinal OCT measures as predictors of postoperative visual outcomes.
- Patients undergoing surgical removal of lesions compressing the optic apparatus using either endoscopic/microscopic endonasal or transcranial approaches.
- Peer-reviewed, prospective or retrospective cohort studies and RCTs published in English language journals.

Meta analysis:

Studies that dichotomized cohorts based on their visual outcomes and reported cohort-level preoperative RNFL thickness measures by retinal quadrant were included in a meta-analysis. The primary outcome was based on a patient-level dataset, while eye-level analyses were conducted as secondary analyses and are not shown in this poster.

A random-effects meta-analysis of mean differences comparing preoperative RNFL thickness for "favorable" and "unfavorable" outcome groups was performed. Statistical heterogeneity was assessed using the I² statistic and τ² estimates.

Results

Qualitative Review:

- 44 studies including 2904 patients and 4815 eyes across 13 countries were identified.
- Most studies were non-US-based; South Korea (n=13), China (n=6), India, France, Japan, Turkey (n=3), US (n=2).
- Pituitary adenoma was the most common pathology.
- Spectral domain OCT measuring the retinal nerve fiber layer thickness was the most common OCT method.
- 41 studies supported a predictive association between preoperative OCT measurements and postoperative outcomes.

Meta Analysis:

- Fifteen studies were eligible for the meta-analysis.
- There was a significant difference in preoperative RNFL thickness between favorable and unfavorable outcome groups in every retinal quadrant (Figure 2).
- The temporal retinal quadrant showed the highest mean difference (MD=10.08) in RNFL thickness between favorable and unfavorable groups, with minimal between-study heterogeneity (I²=0.0%).

Figure 2a. Temporal retinal quadrant meta-analysis forest plot.

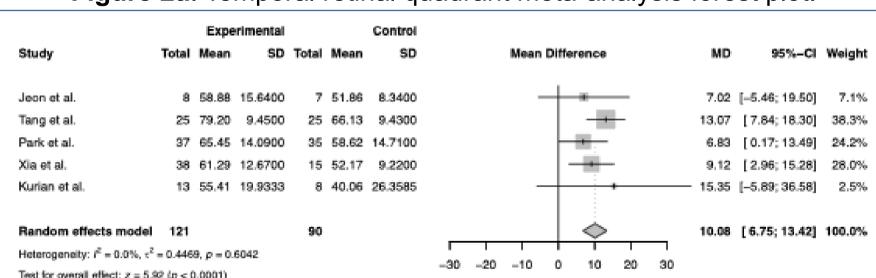


Figure 2b. Inferior retinal quadrant meta-analysis forest plot.

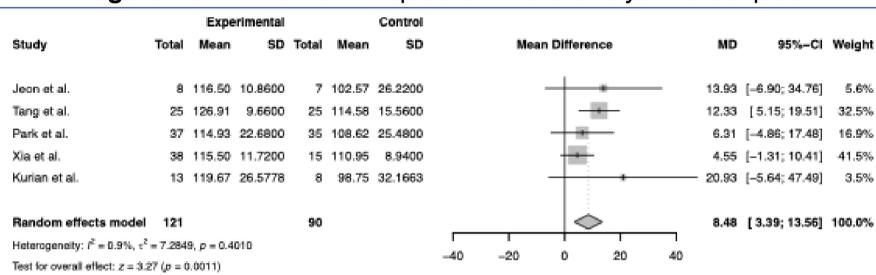


Figure 2c. Superior retinal quadrant meta-analysis forest plot.

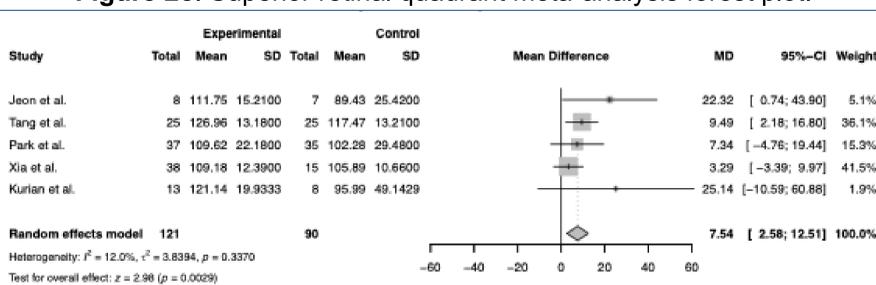


Figure 2d. Nasal retinal quadrant meta-analysis forest plot.

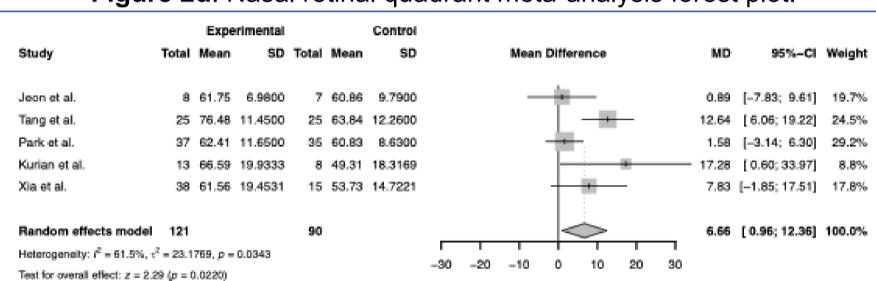
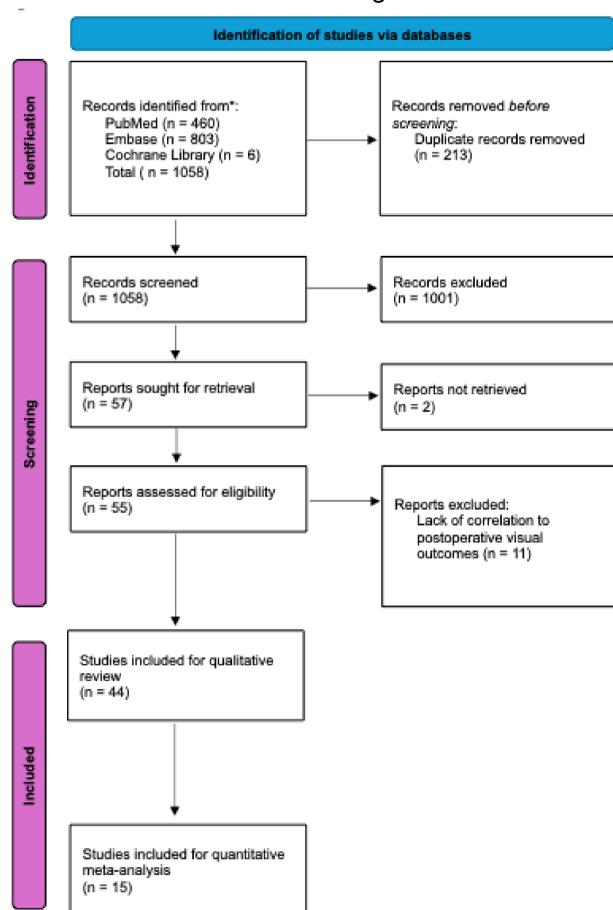


Figure 1. Prisma flow chart showing search and screening results.



Conclusions

Preoperative OCT measurements, particularly RNFL thickness, predict postoperative visual recovery and should be considered in the preoperative evaluation of patients with chiasmal compression. In our analysis, temporal quadrant RNFL showed the highest predictability of postoperative visual outcome, aligned with the anatomy of chiasmal compression preferentially affecting crossing temporal field fibers.

Contact

Misha Amini MD
Columbia University Department of Neurosurgery
177 Ft. Washington Avenue
New York, NY 10032
ma4557@cumc.columbia.edu
347-835-8535

References

1. Danesh-Meyer HV, Yoon JJ, Lawlor M, Savino PJ. Visual loss and recovery in chiasmal compression. *Prog Retin Eye Res.* 2019;73:100765. doi:10.1016/j.preteyeres.2019.06.001
2. Bouma BE, de Boer JF, Huang D, et al. Optical coherence tomography. *Nat Rev Methods Primers.* 2022;2:doi:10.1038/s43586-022-00162-2
3. Banc A, Bioussé V, Newman NJ, Kedar S. Ocular Optical Coherence Tomography in the Evaluation of Sellar and Parasellar Masses: A Review. *Neurosurgery.* Jan 01 2023;92(1):42-67. doi:10.1227/neu.0000000000002186