

Retinal OCT Thickness as a Diagnostic and Prognostic Biomarker in Central Retinal Artery Occlusion: Systematic Review and Meta-Analysis



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Introduction

- **Central retinal artery occlusion (CRAO)** is an ophthalmic emergency that causes sudden, painless monocular vision loss from acute retinal ischemia
- Many reperfusion approaches target a **narrow time window, often around 4.5 hours**, and benefit decreases with longer ischemia duration
- These challenges create a need for **objective retinal biomarkers** that estimate ischemia duration and injury severity to guide triage, prognosis, and treatment decisions

This review synthesizes the evidence on OCT derived retinal thickness in CRAO as a diagnostic and prognostic biomarker by pooling affected versus fellow eye differences and associations with final visual outcomes.

Methods

Databases: Ovid MEDLINE, EMBASE, Web of Science, and CENTRAL searched from inception to February 3rd 2026. Dual reviewers screened, extracted data and completed risk-of-bias assessments.

Outcomes:

- Retinal thickness difference between CRAO affected eyes and fellow eyes
- Association between early retinal thickness and final BCVA outcome

Thickness Constructs and Definitions:

1. Central macular thickness (CMT) (1000 μ m) via OCT ETDRS maps sector \rightarrow ILM to Bruch's membrane
2. Central foveal thickness (CFT) measured with manual calipers \rightarrow ILM to the retinal pigment epithelium (RPE)

Inclusion Criteria

Exclusion Criteria

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| <ul style="list-style-type: none"> • Clinical CRAO diagnosis • OCT retinal thickness reported • Acute symptom onset to OCT time (0-7 days) • Correlation to final BCVA | <ul style="list-style-type: none"> • Non human studies • Non English studies • Case reports • Conference abstracts |
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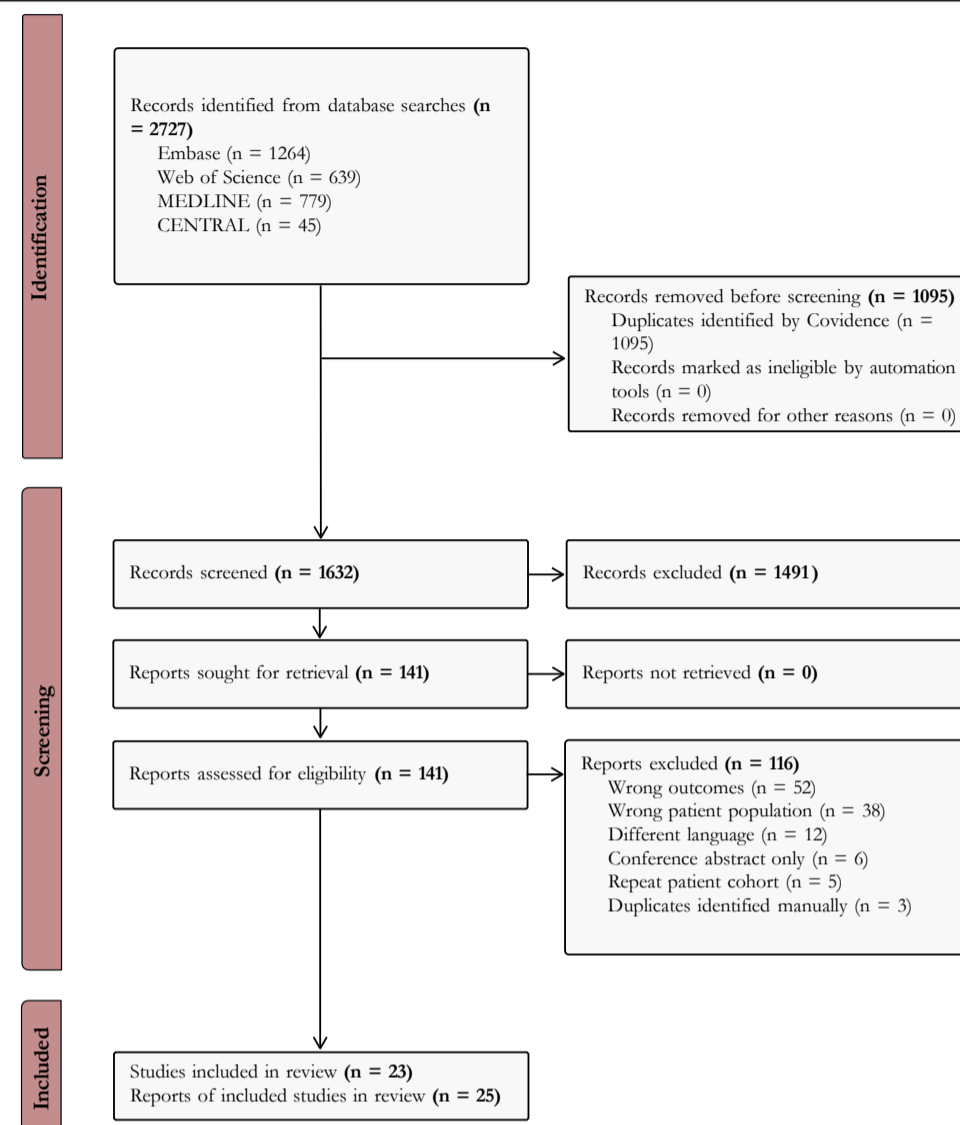


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram showing included studies.

Diagnostic Utility of Retinal Thickness

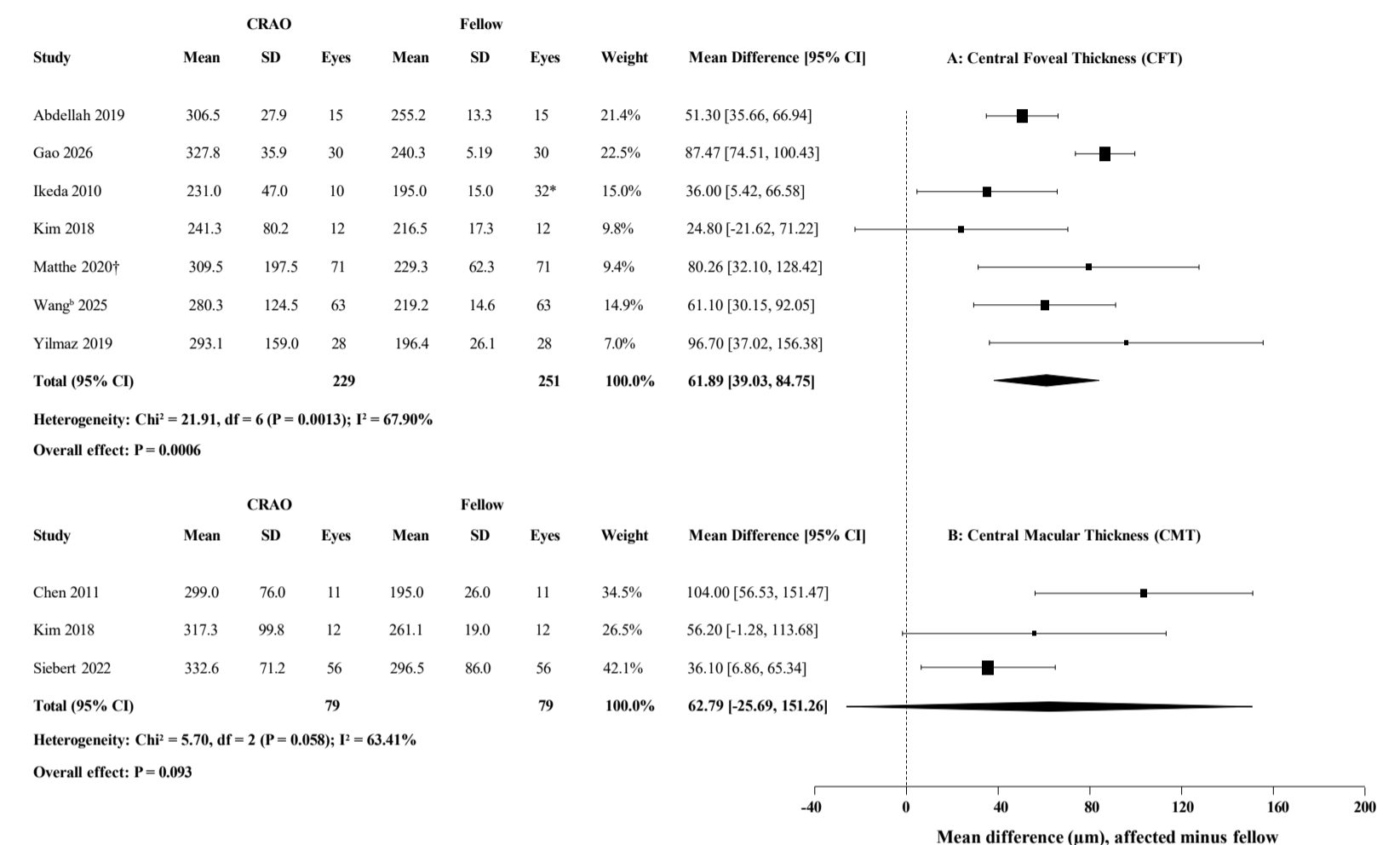


Figure 2. Forest plots of paired mean differences in retinal thickness between CRAO eyes and fellow eyes. Panel A shows central foveal thickness (CFT) and Panel B shows central macular thickness (CMT). For each study, the mean difference is calculated as CRAO eye minus fellow eye, with 95% confidence intervals. Random effects models were used to pool mean differences.

Prognostic Associations with Follow-up Visual Outcome

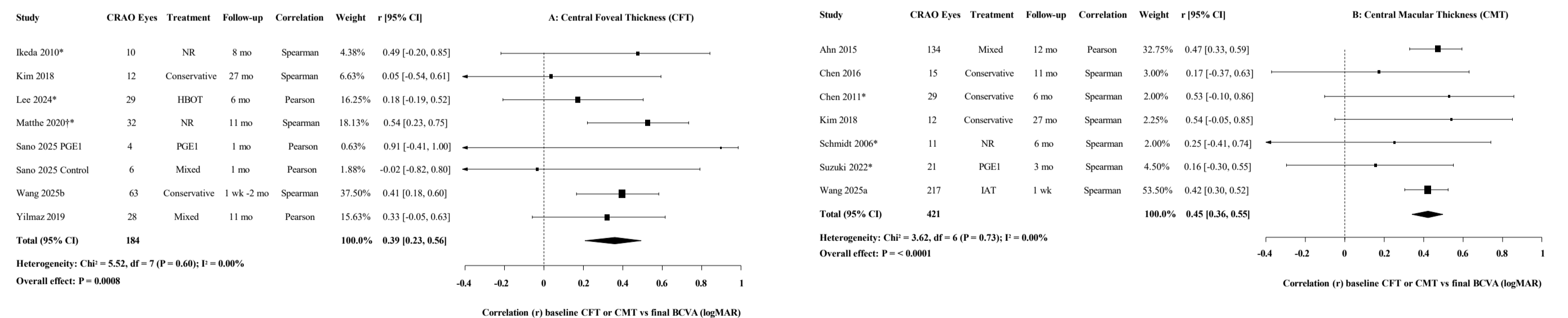


Figure 3. Forest plots of pooled Fisher's Z correlations between baseline retinal thickness and final best corrected visual acuity (BCVA, logMAR) in CRAO. Panel A shows central foveal thickness (CFT) and Panel B shows central macular thickness (CMT). Each row reports n, the correlation coefficient r with 95% confidence interval (back transformed from Fisher's Z), correlation type (Spearman or Pearson), treatment cohort, and follow up duration. Correlations were transformed to Fisher's Z for meta analysis and pooled using random effects models, then back transformed to r for display.

Discussion

- **CRAO eyes showed thicker macula and fovea than fellow eyes** in pooled paired analyses, supporting acute retinal edema as a consistent early OCT finding.
- Baseline thickness showed a positive pooled correlation with final BCVA, meaning **thicker retina at baseline tended to align with worse final vision**.
- Standardized reporting of biomarkers is needed, including clear construct definitions, segmentation boundaries, and measurement across devices and software.
- **Mixed treatment pathways across studies limit interpretation** because differences in symptom onset timing, follow up, and interventions such as IAT, HBOT, and conservative care can influence both OCT appearance and visual outcomes.

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