ORIGINAL RESEARCH

40. MALAT1 and MIAT as Emerging Biomarkers for Diabetic Retinopathy: A Systematic Review and Meta-Analysis

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https://www.youtube.com/watch?v=4rJ3DHWeKRs&list=PLhqNq3xJCIbafO0Y5bvBcgMmXpgzJxd44&index=6&t=8306s

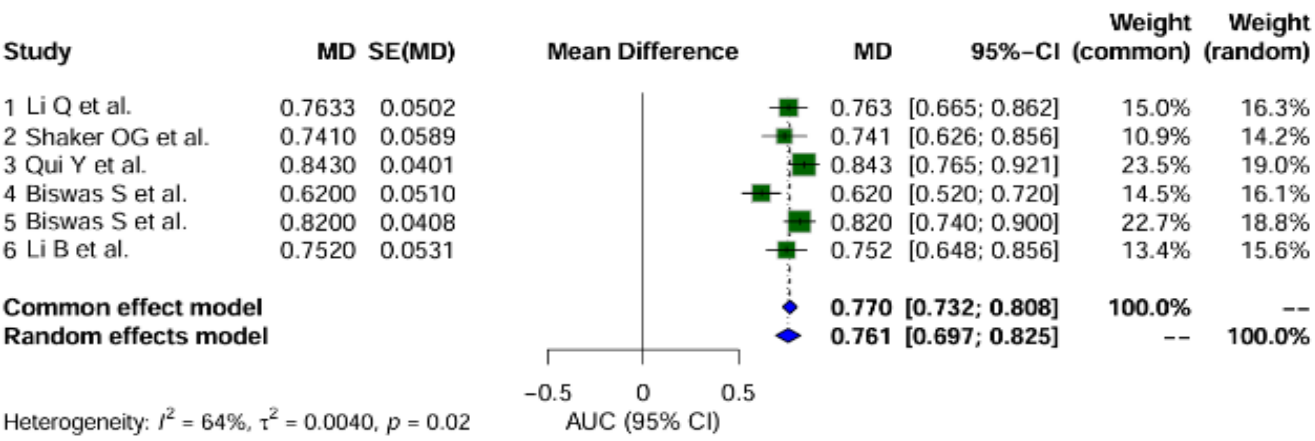
Background: Diabetic retinopathy (DR) is a leading cause of preventable blindness, affecting nearly one-fourth of diabetic patients worldwide. Early diagnosis remains a major challenge due to reliance on labour-intensive, clinician-dependent fundoscopy. Long non-coding RNAs (lncRNAs), particularly MALAT1 (Metastasis-Associated Lung Adenocarcinoma Transcript 1) and MIAT (Myocardial Infarction-Associated Transcript), have been implicated in the pathogenesis of DR through regulation of angiogenesis, inflammation, oxidative stress, and vascular dysfunction. Their measurable expression in accessible biofluids such as serum and tears make them promising candidates for non-invasive biomarkers. The objective of this systematic review and meta-analysis was to assess the utility of MALAT1 and MIAT as diagnostic biomarkers for diabetic retinopathy.

Methods: The study methodology complied with PRISMA 2020 standards and was documented in the PROSPERO registry (CRD420250650000). Databases including PubMed, Embase, Scopus, and PubMed Central were systematically searched, without date restrictions. Eligible studies included original, full-length research articles, case-control studies, and clinical studies evaluating MALAT1 or MIAT as biomarkers in patients with DR compared to diabetics without DR or healthy controls. Data on sensitivity, specificity, and area under the curve (AUC) were extracted. Quality assessment employed the Newcastle-Ottawa Scale, and pooled diagnostic performance was derived using a random-effects model.

Results: Out of 52 records screened, 5 studies (n = 795 participants) were included, comprising 3 studies on MALAT1, 2 on MIAT, and 1 assessing both. Study populations were drawn from China, Egypt, and Canada, with serum or plasma as the primary biological matrix. MALAT1 demonstrated AUC values ranging from 0.62 to 0.84, with a pooled AUC of 0.737 (95% CI: 0.607–0.868). MIAT showed AUC values between 0.75 and 0.82, with a pooled AUC of 0.786 (95% CI: 0.732–0.839). The overall pooled AUC for both biomarkers was 0.761 (95% CI: 0.697–0.825), indicating moderate-to-good diagnostic performance. (Figure) MIAT showed lower heterogeneity (I^2 = 0%, p=0.52) compared to MALAT1 (I^2 = 83%, p<0.01), suggesting more consistent diagnostic accuracy across studies. Risk of bias assessment indicated moderate methodological quality, with limitations in exposure ascertainment and control group definition.

Conclusion: The study demonstrates that MALAT1 and MIAT hold promise as non-invasive biomarkers for early detection of diabetic retinopathy. Both lncRNAs were significantly upregulated in DR patients, with diagnostic performance supporting their potential incorporation into molecular diagnostic panels. MIAT showed slightly higher accuracy and consistency compared to MALAT1. However, current evidence is limited by small sample sizes, methodological heterogeneity, and a lack of standardized detection protocols. Larger, multicentre studies with standardized methodologies are required to validate these findings and facilitate translation into clinical practice.

Figure 1. Forest Plot: Meta-Analysis of Mean Difference in AUC (Area Under the Curve).



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