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Case Report

Disorganization of Inner Retinal Layers (DRIL): Definition, OCT Features and Clinical Significance

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A B S T R A C T

Background: Disorganization of inner retinal layers (DRIL) has emerged as a key biomarker on optical coherence tomography (OCT), particularly in diabetic macular edema (DME).

Objective: To review the definition, OCT characteristics, pathophysiology and clinical implications of DRIL and to clarify its distinction from other retinal disorganization patterns.

Methods: Narrative review of the literature focusing on OCT-based structural biomarkers and their functional correlations.

Results: DRIL corresponds to the inability to distinguish boundaries between inner retinal layers (GCL, IPL, INL) on OCT. It is strongly correlated with visual acuity and reflects underlying neuronal dysfunction rather than purely exudative changes.

Conclusion: DRIL is a robust and clinically relevant biomarker that should be systematically assessed in routine OCT interpretation to guide prognosis and therapeutic decisions.

Keywords: Diabetic macular edema; Prognosis; Biomarker; Neuronal dysfunction

Introduction

Optical coherence tomography (OCT) has become an essential imaging modality in the evaluation of macular diseases. While retinal thickness was historically the main parameter used to assess disease severity, several structural biomarkers have been identified as more reliable predictors of visual function[1,2]. Among these, disorganization of inner retinal layers (DRIL) has gained increasing attention, particularly in diabetic macular edema. However, confusion persists between DRIL and other forms of retinal disorganization, which differ in both pathophysiology and clinical implications. This review aims to clarify the concept of DRIL and its role in daily clinical practice[3,4].

Definition and OCT Features

DRIL is defined as the inability to distinguish the boundaries between the ganglion cell layer, inner plexiform layer and inner nuclear layer on OCT. This definition is generally applied within the central macular area, typically over a 1 mm segment centered on the fovea. On OCT, DRIL appears as a homogeneous region

where the normal laminar architecture of the inner retina is lost. It is frequently associated with retinal thickening and may coexist with intraretinal cystic changes. Unlike outer retinal abnormalities, DRIL specifically involves inner retinal layers and reflects disruption of neuronal organization.

Etiological Associations

DRIL is most commonly described in diabetic macular edema, where it has been extensively studied as a functional biomarker. It is also observed in other retinal vascular diseases such as retinal vein occlusion and ischemic maculopathies. In addition, DRIL may be present in inflammatory conditions and postoperative macular changes. Across these conditions, DRIL is consistently associated with impaired visual function.

Pathophysiology

The exact mechanisms underlying DRIL remain incompletely understood. Several hypotheses have been proposed. Capillary ischemia involving the deep retinal plexus may lead to neuronal dysfunction and structural disorganization. Neurodegenerative processes affecting bipolar and amacrine cells may also contribute to the loss of laminar architecture. Additionally, disruption of synaptic connectivity within the inner retina may impair signal transmission. These mechanisms suggest that DRIL represents a marker of neuronal dysfunction rather than a direct consequence of fluid accumulation.

Clinical Implications

DRIL has been shown to correlate strongly with visual acuity. An increased extent of DRIL is associated with poorer visual outcomes and this correlation is often stronger than that observed with retinal thickness alone. Importantly, DRIL provides prognostic information that can guide clinical management. Persistence of DRIL despite treatment is associated with limited visual recovery, whereas partial resolution may be linked to functional improvement. In clinical practice, identification of DRIL helps refine prognosis and avoid unrealistic expectations regarding visual outcomes.

Discussion

Although DRIL is part of a broader spectrum of retinal disorganization, it should be distinguished from other OCT biomarkers. Disruption of the ellipsoid zone reflects photoreceptor damage, while intraretinal fluid indicates active exudation. Epiretinal membranes and vitreomacular traction cause mechanical distortion of retinal architecture. In contrast, DRIL specifically reflects dysfunction of inner retinal neuronal pathways. Recognizing these differences is essential, as each biomarker carries distinct prognostic and therapeutic implications.

Conclusion

Disorganization of inner retinal layers (DRIL) is a robust OCT biomarker with significant functional and prognostic value. It reflects neuronal disruption within the inner retina and provides information beyond traditional structural parameters[5,6]. Accurate identification of DRIL allows for improved assessment of disease severity, better prediction of visual outcomes and more appropriate therapeutic strategies in retinal diseases.

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