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Argyll Robertson Pupil: Clinical Significance and Underlying Mechanisms

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Introduction

Argyll Robertson pupil (ARP) is a distinctive ocular sign characterized by bilateral small pupils that constrict during accommodation but fail to constrict in response to direct light stimulation. First described by the Scottish ophthalmologist Douglas Argyll Robertson in the 19th century, this clinical feature is most commonly associated with neurosyphilis, though it may rarely appear in other neurological disorders. The presence of ARP indicates damage to the midbrain pretectal area or the pupillary light reflex pathway, highlighting its value as a neuro-ophthalmic marker. Understanding its pathophysiology, clinical presentation, and differential diagnosis is essential for accurate recognition and timely intervention [1,2].

Discussion

Clinically, patients with Argyll Robertson pupil present with bilateral, small, irregular pupils that show minimal or absent response to bright light but retain normal constriction when focusing on a near object (accommodation reflex). This dissociation between the light reflex and near response is sometimes summarized as "light-near dissociation." Pupils are typically asymmetric in size but maintain their characteristic response pattern. Patients may be asymptomatic regarding vision, although visual disturbances can occur if the underlying condition progresses [3,4].

The pathophysiology of ARP is rooted in selective involvement of the pretectal area of the dorsal midbrain, which contains neurons responsible for the pupillary light reflex. In neurosyphilis, tabes dorsalis leads to degeneration of the dorsal columns and associated midbrain structures, sparing the edinger–Westphal nucleus pathways responsible for accommodation. This selective impairment explains why the pupillary light reflex is lost while the near response is preserved. Other causes of light-near dissociation include diabetic neuropathy, multiple sclerosis, pineal tumors, and midbrain lesions, but ARP remains most classically linked to syphilitic infection [5-8].

Diagnosis relies primarily on clinical examination, including careful assessment of the pupillary responses to light and near stimuli. Slit-lamp examination may assist in ruling out anterior segment abnormalities, while neuroimaging is reserved for atypical presentations to exclude structural lesions. Serologic testing for syphilis, including VDRL and FTA-ABS, is essential when ARP is suspected, as it often signals neurosyphilitic involvement requiring urgent treatment. Differential diagnosis must consider other causes of light-near dissociation, such as Adie's tonic pupil, which typically presents unilaterally and shows delayed constriction to near stimuli [9,10].

Conclusion

Argyll Robertson pupil remains a hallmark sign of neurosyphilis and a classic example of light-near dissociation. Its recognition is clinically significant, offering insights into midbrain integrity and serving as a window to underlying systemic or neurologic disease. Careful pupillary assessment, combined with serologic testing and appropriate management of the primary cause, is essential for optimizing patient outcomes. While ARP itself may persist despite therapy, timely diagnosis and treatment of the underlying condition can prevent further neurologic damage and reduce morbidity. As a historical yet still relevant clinical sign, Argyll Robertson pupil underscores the enduring importance of meticulous ophthalmic examination in modern medicine.

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