



Case Report

Adie's tonic pupil: Significance in aviators and aeromedical disposal

Juhi Borgohain¹, A. V. K. Raju², Ritesh Waghay³

¹Medical Evaluation Cell (East), 5 Air Force Hospital, Jorhat, Assam, ²Air Force Central Medical Establishment (AFCME), New Delhi, ³5 Air Force Hospital, Jorhat, Assam, India.



*Corresponding author:

Juhi Borgohain,
Medical Evaluation Cell (East),
5 Air Force Hospital, Jorhat,
Assam, India.

docjb1111@gmail.com

Received: 10 January 2022

Accepted: 11 November 2022

Published: 22 November 2023

DOI

10.25259/IJASM_2_2022

Quick Response Code:



ABSTRACT

Adie's tonic pupil is a benign, usually unilateral, pupillary syndrome, in which a larger than normal pupil responds minimally, if at all, to light, but constricts slowly and tonically to a near stimulus (light-near dissociation) and has cholinergic super-sensitivity. It induces impaired near vision, glare, photophobia, and difficulty with dark adaptation, which may not be conducive in a flying environment. A Weapon System Operator of a fighter aircraft with an isolated dilated pupil was assessed over approximately 3 years – right from the beginning until his condition became stable. His condition was not considered an absolutely disabling condition for aviation and he was finally retained in flying in the restricted medical category. The important aspects considered in the aeromedical assessment were – neurological assessment; ophthalmic issues such as tolerance to glare and visual acuity; anisocoria and the executive report on flying concerning visual response to bright sunlight, ability to read maps and MFDs, and ability to identify ground features and spot another ac in bright light conditions. The aviator did not have any neurological, traumatic, or systemic condition/Adie's syndrome. The tonic pupil stabilized at 4 mm and there was an anisocoria of 2 mm. Light-near dissociation persisted. His executive report was uncomplimentary concerning spotting another aircraft in bright sunlight in the air-superiority fighter (which flies at a max speed of 2120 kmph) as his eyes were getting shut by the glare. However, he could read MFDs, maps, and pick up ground features comfortably and satisfactorily. Hence, considering that Navigation in a transport ac was his parent branch (max speed 452 kmph), he was advised a trial on that ac to assess his capabilities in performing Flt Nav duties. If successful, the organization could revert him back to his parent branch and original ac, thereby avoiding attrition of a valuable human resource. This case demonstrates that Adie's tonic pupil is not always a disabling condition for military flying. Nevertheless, it has to be analyzed on a case to case basis. Aeromedical disposal of a potentially disqualifying case, having no reference in the available aeromedical guidelines.

Keywords: Adie's tonic pupil, Air-superiority fighter, WSO

INTRODUCTION

A dilated tonic pupil that fails to respond to light is justifiably regarded as a warning of a possible intracranial disease. However, such a pupillary sign does not necessarily indicate a severe central nervous system process, especially if there is no other associated neurological sign/systemic pathology or an oculomotor nerve paresis. If it exhibits cholinergic super-sensitivity too, such a pupil is known as Adie's tonic pupil and is totally benign. However, the resulting impaired near vision, difficulty in focusing, headache, and glare may hamper the routine professional activities of an aviator. Still, all efforts should be made to maintain the flier with Adie's pupil on flying status, depending on case to case basis.^[1]

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

©2023 Published by Scientific Scholar on behalf of Indian Journal of Aerospace Medicine

CASE REPORT

A 32-year-old male, serving AF officer, Weapon System Operator in an air-superiority fighter, fully fit medically, presented with a complaint of difficulty in focusing; increased glare and pupillary asymmetry in the right eye (as visible in the mirror) for a few days. He denied having headache, redness, and swelling of the right eye. There was no history of ocular trauma, facial or extremity weakness, dysarthria, ataxia or segmental differential sweating. There was no history of preceding viral infection. Ocular examination findings were as below:

	OD	OS
DVA	6/9	6/6
NVA	N-12	N-6
Iris	Vermiform mov	Normal
Pupil		
– Appearance	Dilated (anisocoria)	Normal
– Light reflex (direct/consensual)	Absent	Normal
– Accommodation reflex	Absent	Good

He was referred to a neuro physician to rule out any underlying nervous disorder, who confirmed the above findings. Clinically, no abnormality was detected in his nervous system. His MRI brain, MRA, and VEP were WNL and serological markers were absent. After around 1 year, he partially improved symptomatically; his accommodation reflex in the right eye normalized, and so did the NVA – N6. He was declared fit from the neurology side.

After various follow-ups by an ophthalmologist, his final ocular findings (after almost 3 years) were as below:

	OD	OS
DVA	6/9	6/6
NVA	N-6	N-6
Iris	Normal	Normal
Pupil		
– Appearance	Tonic, 4 mm. Anisocoria - 2 mm	Normal
– Light reflex (direct/consensual)	Absent	Normal
– Accommodation reflex	Good	Good

Ophthalmologist opined that his anisocoria was not likely to improve further and declared him fit.

Two executive reports were raised for him during this period, once he was cleared by the neurologist –

- a. A Full Motion Simulator (of the ASF) trial report raised after around one year was complimentary. Based on this, the Aerosp Med Spl upgraded the aircrew to a restricted flying category for the purpose of next executive report in the ASF itself.

- b. However, his flying report in the rear cockpit of the ASF was un-complimentary as he would shut his eyes in the bright sunlight. This was considered hazardous to flight safety.

During his past medical review, the aeromedical dilemma was how to prevent attrition of a precious trained human resource and also prevent financial loss to the ex-chequer – incurred on the training of an aircrew. Whether it was time to permanently ground him, or could the IAF utilize him in the cockpit again. The issues deliberated were –

- a. The officer being permanently commissioned had to be gainfully utilized in the service
- b. He had more than 11 years of service, so he could not be re-streamed
- c. His parent branch was navigation and he was trained originally on Tpt ac. So, could the officer be reverted back to his parent branch?

Hence, the offer was awarded a minimal flying category temporarily and asked to review with a fresh executive report on a tpt ac assessing him on ease of performing navigator duties in bright daylight covering the maximum endurance period of the ac. This would include reading maps, ground features, MFDs, and other navigational aids in bright daylight. Thereafter, he could be considered for a suitable flying category during his subsequent review. If required, a waiver could also be requested for loss of normal pupillary reflexes, which would otherwise not hinder with flying duties as a navigator in tpt ac.

DISCUSSION

Adie's tonic pupil has a prevalence of 2/1000 cases and is usually a unilateral condition reported mainly in women (around 70%) with a mean age of onset of 32 years (age group of 20–50 years).^[2] Unilateral affection is more common (around 80%) with 4%/year having the other pupil also involved.^[2,3]

Symptoms are due to iridoplegia and cycloplegia such as photophobia, glare, difficulty in focusing, headache with near activities, and blurred near vision. It should be stressed that, if accommodation is not significantly affected, most patients will be unaware of any acute onset to the problem.^[1] The anisocoria may go unnoticed for years. It is important to bring out here the importance of Annual Medical Examinations that even if an aircrew is asymptomatic, a thorough examination of eyes, iris and pupil in particular, is vital since a tonic dilated pupil is significant from a flight safety point of view.

The pathophysiology of an Adie pupil is acute denervation, followed by inappropriate reinnervation of the ciliary body and iris sphincter. Clinical features will vary depending on the stage of reinnervation at the time of examination. Accommodation paresis improves with reinnervation of the ciliary body. Further, the reinnervating fibers to the ciliary body wrongly innervate the iris sphincter causing tonic response to near stimuli.^[4]

The denervated/misinnervated iris sphincter is extremely sensitive to topical parasympathomimetic solutions like Pilocarpine drops (0.125%), to which the normal pupil will constrict only slightly, if at all. About 80% of patients with a tonic pupil show cholinergic denervation super-sensitivity.^[4]

When a patient presents with an isolated dilated pupil, it is important to classify it into one of the four categories: Local, neuropathic, systemic, and Adie's syndrome. Only once all these are ruled out, can a diagnosis of Adie's Tonic pupil be made.^[5]

- a. Local tonic pupil is due to orbital or systemic conditions affecting the ciliary ganglion or short ciliary nerves in isolation as in herpes zoster virus, ocular trauma, or intraocular surgeries
- b. Neuropathic tonic pupils are usually bilateral and occur as a part of widespread peripheral or systemic autonomic neuropathy as in Miller Fisher variant of Gullian-Barre syndrome, Charcot-Marie-Tooth disease, Shy-Drager syndrome, etc.
- c. Systemic such as systemic sclerosis, sarcoidosis, and rheumatoid arthritis
- d. Adie's syndrome refers to tonic pupil with segmental hyper/hypohydrosis (autonomic dysfunction) and absence of deep tendon reflexes.

In addition, there exists a rare syndrome of "episodic unilateral mydriasis," in which repeated episodes of unilateral mydriasis occur for varying periods of time in otherwise normal individuals, the etiology of which is not known.^[3,5]

Adie's tonic pupil, though benign, is not a common entity in fliers. There is a paucity of aeromedical literature on it,^[1] but it is significant in flying, because it does entail operational restrictions on flying, be it the branch of the flier, or the flying category, re-streaming or even re-mustering if it develops in the initial flying career.

At this stage, the authors feel that this entity is definitely not acceptable at the time of aircrew selection. For a trained aircrew, such a stringent approach would be too harsh. Hence, it is felt to have a balanced approach with an emphasis to utilize trained aircrew to the best advantage to the organization. This condition is certainly not conducive with fighter flying (be it WSO or pilot). However, a permanent commissioned pilot trained on fighters can be re-streamed and best utilized in transport or helicopter aircraft in a restricted flying medical category. Such pilots will be unfit to fly as captain of the ac, fit to fly only as co-pilot of multi-crew ac. The aircrew would be fit for flying duties with restrictions such as type of ac (pressurized/unpressurised and ceiling height), type of mission, instructional duties, levels of G stress,^[6] and chances of hypoxia/decompression sickness (as in para trooping/para dropping sorties).

Other aircrew with unilateral Adie's pupil can be retained in flying by gradual upgradation to a restricted flying medical category, with an executive report on the performance of Branch/Trade duties during each occasion of upgradation.

We recommend that prospective studies may be carried out taking into account all such future aircrew cases to see the effect of other aeromedical stressors such as G stress, spatial disorientation, hypoxia, decompression, and NVGs on Adie's tonic pupil. This would require close coordination between the Ophthalmologists, Aerospace Medicine Specialists, and Air Branch.

CONCLUSION

Adie's Tonic Pupil is an idiopathic isolated dilated pupil. The aeromedical literature is sparse on this entity. The aviator presents with photophobia, glare and poor near vision, which poses a threat to flight safety. Though it is a potentially disabling condition for military flying, it has to be analyzed on a case-to-case basis, and aeromedical disposition is to be given accordingly.

Acknowledgment

The authors would like to thank Dr S Bhargava, MBBS, MD (Aerospace Medicine), for his valuable guidance in the aeromedical disposal of the aircrew.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Epstein DL, Tredici TJ. Pupillonia (Adie's pupil): Diagnosis and significance in fliers. *Aerospace Med* 1972;43:555-9.
2. Thompson HS. Adie's syndrome: Some new observations. *Trans Am Ophthalmol Soc* 1977;75:587-626.
3. Thompson HS. Segmental palsy of the iris sphincter in Adie's syndrome. *Arch Ophthalmol* 1978;96:1615-20.
4. Miller NR, Bioussé V, Newman NJ, Kerrison JB. Walsh and Hoyt's Clinical Neuro-ophthalmology: The Essentials. 2nd ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2008. p. 307-14.
5. Peyman GA, Sanders DR, Goldberg MF. Principles and Practice of Ophthalmology. Netherlands: Saunders, Elsevier; 1980.
6. Manual of Medical Examinations and Medical Boards, IAP 4303. 5th ed. India: IAP; 2020.

How to cite this article: Borgohain J, Raju AV, Waghay R. Adie's tonic pupil: Significance in aviators and aeromedical disposal. *Indian J Aerosp Med* 2023;67:35-7. doi: 10.25259/IJASM_2_2022