Geographic atrophy (GA), an advanced form of age-related macular degeneration (AMD)

This is a description of the geographic atrophy infographic that can be found on dryAMD.eu. This version is optimised for people living with blindness who are using a text-to-speech reader.

First section: Awareness

This section explains what geographic atrophy (GA) is and how it affects the back of the eye.

Geographic atrophy refers to an advanced form of age-related macular degeneration.

Geographic atrophy is a term used to describe an advanced form of AMD, a progressive and irreversible disease affecting the macula, the central part of the retina.

- Currently GA affects more than 5 million people worldwide. This number is expected to increase to more than 18 million by 2040
- From the age of 50, its prevalence quadruples every 10 years
- GA accounts for up to 20% of all legal vision loss attributed to AMD

Geographic atrophy is a chronic progressive degeneration of the macula, which is a central part of the retina that allows the eye to see accurate details for daily activities.

In this infographic, there are two images illustrating the retina, macula and drusen, followed by descriptions:

The retina contains millions of light-sensitive cells (rods and cones) that receive and organise visual information.

The fovea at the centre of the macula is a small pit that contains the largest concentration of cone cells and thus provides the greatest visual acuity.

Drusen are small yellow deposits of fatty proteins (lipids) that accumulate under the retina. They can be used to grade the stage and severity of AMD.

End of descriptions.

Dry and wet AMD

Geographic atrophy and wet age-related macular degeneration (wAMD) are different manifestations of advanced AMD.

An eye with GA can also naturally develop wet AMD; and vice versa.

Key fact: 98% of patients with wet AMD progressed to geographic atrophy over an average of 7.3 years of follow-up.

An overview of the three stages of AMD

Early-stage AMD affects an estimated 196 million people. It is characterized by the presence of a few small and medium-sized drusen.

Intermediate AMD is marked by medium-sized drusen or one large drusen.

Advanced AMD includes wet AMD and geographic atrophy and is characterized by multiple large drusen.

Causes

In people with AMD, the photoreceptors in the macula, the part of the retina responsible for sharp vision and colour recognition, deteriorate.

Geographic atrophy is characterised by progressive and irreversible loss of the retinal pigment epithelium, photoreceptors, and underlying choriocapillaris, all of which are key components of the macula.

Signs and symptoms

Signs and symptoms of GA may include:

- Hazy or blurred vision
- Straight lines may appear crooked
- An inability to see details closely, as well as difficulty identifying objects from a distance
- A small, but growing, blind spot in the centre of vision
- Inability to identify and distinguish colours

Fact: 50% of patients develop GA in both eyes within 7 years of their initial diagnosis.

Risk factors

Risk factors associated with geographic atrophy can be modifiable and non-modifiable.

First, the modifiable environmental risk factors:

Smoking:

Smoking tobacco and cigarettes increases the likelihood of developing GA.

Body mass index (BMI):

Individuals with a BMI of 30+ are more susceptible to developing GA.

Fatty diets:

Consumption of foods high in cholesterol and fat can increase a person's glycaemic index, which causes disposition of adipose tissue in the blood vessels of the retina.

Usage of medications:

Certain medications have been linked with an increased risk of developing AMD. If you are taking any medication for

other conditions, you should discuss this with your healthcare professional.

Secondly, the non-modifiable risk factors:

Age:

There is an increased chance of being diagnosed with GA the older people become.

Genetics:

People with a family history of AMD are at a higher risk of developing the condition.

Ethnicity:

The prevalence of GA is highest amongst older people of Caucasian descent.

This is the end of the first section about the awareness of geographic atrophy. The next section is about diagnosis and disease progression.

Second section: Diagnosis and disease progression

The most predictive and central feature of developing geographic atrophy is the presence of larger (>125 µm) or merging drusen, as over 95% of patients with these features develop the condition.

The infographic shows an image with four steps illustrating

the disease progression.

Step 1:

Non-central atrophy. Some loss of peripheral low light vision. Patient only notes under certain conditions or through designed tests.

Step 2:

Growth of non-central atrophy. Loss of peripheral, low light vision.

Step 3:

Beginning to affect fovea, the central vision. Includes loss of peripheral, low light vision; patches of lost central vision.

Step 4:

Severe central atrophy. Loss of central vision leading to vision loss.

While lesion growth in GA may appear to proceed slowly, disease progression is constant and irreversible.

Diagnosis

Geographic atrophy can be diagnosed and monitored by an ophthalmologist, retinal specialist or optometrist.

Retinal imaging techniques are used to identify, diagnose and monitor all stages of AMD, including advanced AMD. When diagnosing and monitoring AMD, your doctor will look

for the following features in the retina via ophthalmoscopy or fundus photography:

- Presence of drusen
- A sharply demarcated area in the macula with areas of damage in the retina, lacking pigmentation
- Visible underlying choroidal blood vessels

Ways to diagnose

Fundus autofluorescence angiography imaging is currently a standard technology to visualise the retinal pigment epithelium in geographic atrophy.

Optical coherence tomography (OCT): The atrophy of the retinal layers can be clearly seen with this non-invasive imaging technique.

While lesion growth in GA may appear to proceed slowly, disease progression is often constant and irreversible.

Progression can be highly variable; it typically takes several years from the onset of GA to cause consistent deficits in vision.

This is because the fovea, which is responsible for central vison and visual acuity, may be spared until GA is very advanced.

However even before the fovea is affected by GA, lesion growth is already affecting functional vision.

This is the end of the second section, which is about the diagnosis and disease progression of geographic atrophy. The last section is about its treatment.

Treatment of advanced dry AMD

Though there are currently no approved therapies to reduce geographic atrophy progression, several potential medicines are under investigation in clinical trials.

How to best manage geographic atrophy

First, regular eye examinations:

Progression of GA may be managed through regular eye examinations and early detection of the retinal changes.

Second, visual rehabilitation:

In addition to regular eye examinations, the disease can also be managed through visual rehabilitation with the use of magnifiers and low vision aids.

Third, lifestyle modification:

Some simple approaches that can help prevent or slow the progression of GA include:

- Quitting smoking
- Exercising to reduce BMI
- Eating foods low in cholesterol
- Intake of antioxidants and vitamins such as vitamin C, vitamin E, beta-carotene and zinc

Overview of treatment strategies under investigation

- Modulating the visual cycle to reduce the accumulation of toxic byproducts
- Reducing or inhibiting drusen formation
- Complement inhibition to regulate an overactive complement system
- Improving blood flow in the choroid
- Reducing or eliminating oxidative stress
- Reducing or eliminating inflammation
- Replacing, repairing, or regenerating lost RPE cells and photoreceptors
- Cell therapy

This is the end of the third section about the treatment of geographic atrophy.

Visit dryAMD.eu for more information and videos on topics such as how vision works and the different forms of advanced AMD.

Thank you for reading.

This infographic on geographic atrophy is not intended to replace diagnosis by a specialist. Please consult a healthcare professional if you believe you are suffering from AMD.

This is the end of the document, only followed by the references:

1. Gehrs KM, *et al. Ann Med*. 2006;38(7):450–471.
2. Fleckenstein M, *et al. Ophthalmology*. 2018;125:369–390.
3. Wong WL, *et al. Lancet Glob Health*. 2014;2:e106–116.
4. Rudnicka AR, *et al. Ophthalmology*. 2012;119:571–580.
5. Biarnés M, *et al. Optom Vis Sci*. 2011;88(7):881–889.
6. Bear M, *et al.* Neuroscience: Exploring the brain. 3rd ed. London; 2006.
7. Mitchell P, *et al. Lancet*. 2018;392(10153):1147–1159.
8. Remington LA. Aqueous and vitreous humours. In: Clinical Anatomy and Physiology of the Visual System. 3rd ed. Elsevier Health Science; 2012.
9. Klein R, *et al. Ophthalmology*. 1991;98(7)1128–1134.
10. BrightFocus Foundation. Age-related macular degeneration: Facts and figures. Available at: https://www.brightfocus.org/macular/article/age-related-macular-facts-figures (accessed July 2023).
11. Rofagha S, *et al. Ophthalmology*. 2013;120(11):2292–2299.
12. Ferris FL 3rd, *et al. Ophthalmology*. 2013;120(4):844–851.
13. Young RW. *Surv Ophthalmol*. 1987;31(5):291–306.
14. Boyer DS, *et al. Retina*. 2017;37(5):819–835.
15. Eye See You. Geographic atrophy. 2021. Available at: https://eyeseeyou.care/en/geographic-atrophy/ (accessed July 2023).
16. Sunness JS, *et al. Ophthalmology*. 2007;114(2):271–277.
17. Holz FG, *et al. Ophthalmology*. 2014;121(5):1079–1091.
18. Lindblad AS, *et al. Arch Ophthalmol*. 2009;127(9):1168–1174.
19. Lakshminarayanan, V. Visual acuity. In: Chen J, *et al.* (eds). Handbook of Visual Display Technology. Vol. 1. Springer-Verlag Berlin Heidelberg; 2012; pp.93–99.

20. American Academy of Ophthalmology. What is the difference between direct and indirect ophthalmoscopy? Available at: https://www.aao.org/eye-health/ask-ophthalmologist-q/what-is-difference-between-direct-indirect-ophthal (accessed July 2023).

21. EyeWiki. Geographic atrophy. Available at: https://eyewiki.aao.org/Geographic_Atrophy (accessed July 2023).

22. Townsend WD. *Optom Clin.* 1992;2(3);127–144.

23. Ferguson LR, *et al. PLoS ONE*. 2014;9(10):e111203.

24. American Academy of Ophthalmology. What is optical coherence tomography? Available at: https://www.aao.org/eye-health/treatments/what-is-optical-coherence-tomography (accessed July 2023).

25. Buschini E, *et al. Clin Ophthalmol*. 2015;9:563–574.

26. Chakravarthy U, *et al. BMJ*. 2010;340:c981.

EU-GA-2300004