Glaucoma definition: Implications for equitable care

Merriam Webster's dictionary defines the word "definition" as: A statement expressing the essential nature of something. According to Wikipedia, there are various types of definitions, each with a distinct focus and purpose.[1] For example, intentional definitions try to give the sense of a term and extensional definitions provide a list of objects that a term describes. Theoretical definition is akin to intentional definition, and in the context of glaucoma would indicate attempts to include retinal ganglion cell death as the primary event or equating glaucoma to a neurodegenerative disease.

The operational definition of glaucoma––a statement of validation tests needed to determine the existence of a condition—has been the mainstay of glaucoma definition and has witnessed a lot of changes with evolving technologies over time. In the seventeenth and eighteenth centuries, the disease was defined by intraocular pressure (IOP). Intraocular pressure measurement evolved from digital tonometry to indentation (Schiotz) and then applanation tonometry. The ability to evaluate the optic nerve with the ophthalmoscope described by von Helmholtz and the recognition of cupping of the optic nerve head by Von Graefe shifted the focus to optic nerve.[2] Typical features of optic nerve head changes in glaucoma, like loss of neuroretinal rim as well as retinal nerve fiber layer (RNFL) in a characteristic format were identified as glaucomatous optic neuropathy (GON) over time.[3]

Epidemiological data that optic nerve damage typical of glaucoma can occur with normal IOP, and the fact that optic nerve head changes can precede the development of visual field defects, resulted in the definition being limited to GON.[4] In 1996, for the first-time American Academy of Ophthalmology (AAO) proposed that GON was the only defining feature of glaucoma.[5] Neither visual field defects nor a level of IOP was in the new definition of primary open angle glaucoma (POAG). In the guidelines published by AAO (2016) glaucoma was defined as a "chronic progressive optic neuropathy".[3] While the AAO preferred practice patterns did not differentiate between high-tension POAG and normal tension glaucoma, European Glaucoma Society (2014), and Asia Pacific Glaucoma Society (2017) guidelines differentiated these two variants of POAG.[6,7]

Subjective evaluation of the optic nerve, either clinically or by photographs, is documented to have the disadvantage of intra and inter observer variance. The advent of optical coherence tomography (OCT) with an objective measurement of the optic nerve head parameters promises to be superior to the subjective optic disc evaluation. Iyer *et al*.[8] proposed a new definition of glaucoma combining the data from OCT and standard automated perimetry (SAP). In a study involving data of 2580 eyes from nine centers, they reported a low sensitivity of 77% and a specificity of 98%. What parameters of OCT and SAP would yield the best sensitivity and specificity is still in debate.[9] In the study by Kalyani *et al.* in the current issue of IJO, the diagnostic ability of OCT, SAP, and short-wavelength automated perimetry (SWAP) are reported. Macular ganglion cell-inner plexiform layer (GCIPL) analysis did better than RNFL analysis with sensitivity of 79.6% and specificity of 81%. SWAP (97.3%) and SAP (94.6%) had good specificity but suboptimal sensitivity.[10]

While all the above changes were a result of what is seen clinically in patients, an effort to make a definition that could be uniform for epidemiological studies resulted in the International Society of Geographic and Epidemiologic Ophthalmology (ISGEO) definitions and classification. The main thrust of this effort was to separate normal from abnormal based on distribution of a parameter (IOP or cupping) in the population. Eyes with features that showed values in the 5th, 2.5th, and 1st percentile were used to define disease.[11]

The pursuit of "state of the art" operational definition and the objective of diagnosing the disease at a very early stage have probably distanced the academic glaucoma community from the needs of case detection and blindness prevention in underserved communities, with two consequences. Firstly, clinical practice in low socio-economic societies without the latest gadgets runs the risk of being perceived as not "current and evidence based". Early detection of the disease is practical and useful if all the population is within an effective health care system network. But in resource-constrained communities, a large majority of the patients are in established stage of glaucoma; a significant number of them with very advanced disease-blind in one eye at presentation. These patients can be diagnosed and helped with minimal technology, provided well trained eye care professionals are available. This approach has the additional advantage of avoiding over diagnosis based on technology alone. It could also avoid "hyposkillia—habitual reliance on sophisticated medical gadgetry for diagnosis prevents physicians from using the most sophisticated, intricate machine they will ever and always have—the brain".[12] What may be appropriate for health care systems operating in low socio-economic societies is to move away from screening for very early disease and focus on case detection. Diagnosis and treatment of moderate-to-severe glaucoma is less dependent on latest technology (an advantage in economically underserved populations).[13] While this is feasible at secondary and tertiary levels of care, innovations in low-cost technology like nonmydriatic fundus photography and newer methods of visual field screening might facilitate case detection at primary level. Implementing the above is a cost-effective public health approach.[13]

Secondly, the policy makers have not included glaucoma in the causes of blindness that could be addressed. The WHO report of 1997, as well as the action plan (2006–2011) of Vision 2020, published in 2007 highlight that there is no single test for screening glaucoma in the population and the 1997 report also says that the treatment of POAG is controversial.[14,15] With all the evidence that is accumulated with multicenter randomised controlled studies like Collaborative normal tension glaucoma study; Collaborative initial glaucoma treatment study; Early manifest glaucoma trial and Advanced glaucoma intervention study, the treatment of glaucoma is not controversial at all.[7] Reduction of IOP by medical, laser and surgical means does prevent glaucoma progression and can prevent blindness due to glaucoma. Availability of multiple means to reduce the IOP is an advantage that

treatment can be tailored to patient's medical risks and society or individual financial affordability.

In summary, while I see value in an objective operational definition of glaucoma using the state-of-the-art technology, the needs of established, neglected disease in the underserved communities with cost effective means needs better documentation, so that policy can be influenced and evidence base for such an approach established.

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Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_3771_20

Cite this article as: Sekhar GC. Glaucoma definition: Implications for equitable care. Indian J Ophthalmol 2021;69:1025-6.

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Dr. G. Chandra Sekhar (popularly known as Dr. GC) has been associated with LV Prasad Eye Institute from its inception in 1987 and is currently the Vice Chair. The institution of a Chair on his name "G Chandra Sekhar Chair of Director of Education" in 2003 recognized his contributions as the Director of Education at LV Prasad Eye Institute. He has published over 200 papers in national and international peer reviewed journals, and has been a reviewer for a number of Ophthalmology journals. He holds the position of clinical Professor at the University of Rochester and has been a Visiting Professor at University of California; San Diego, U.S.A. Dr. GC has served as the President of the Glaucoma Society of India (2005-06). He has been a member of the Glaucoma Research Society since 2005, and has served on the Clinical Guidelines Committee of ICO. Dr. GC has been a Governor of the World Glaucoma Association Board from 2013 to 2017. Being a teacher of the teachers who has trained generations of glaucoma specialists in India, a mindful and a rational clinician with excellent clinical skills, and a deep analytical thinker and one of the sharpest minds in glaucoma today, it is a privilege to have Dr GC pen a Guest Editorial for IJO.