



# Pivotal studies in glaucoma in the past 10 years

Karl Mercieca

Augenklinik, Universitätsklinikum Bonn, Bonn, Germany

The options for diagnosis and treatment of glaucoma have expanded exponentially over the past decade, with new imaging techniques, pharmacological treatments, and novel drainage devices. As a result of this extensive choice, it can be quite difficult to decide upon which option is best for each individual patient, particularly with the extensive availability of information provided by manufacturers, researchers, and colleagues via both published and anecdotal experiences. In this *Leitthema*, we have decided to take a look at some of the significant landmark glaucoma studies which have been published over the past 10 years in an attempt to promote the knowledge and use of evidence-based medicine when planning investigations and treatment for our patients.

Glaucoma is a leading cause of irreversible sight loss, with an estimated worldwide prevalence of 64.3 million in 2013, increasing to 76.0 million in 2020 and 111.8 million in 2040 [1]. Because glaucoma is mainly an asymptomatic disease in the early stages, identification of risk factors and prompt diagnosis are crucial to avoid progression of the disease and significant sight loss. Once the diagnosis is made, it is also important to choose the right treatment option for the individual patient. This is usually the initiation of drop treatment and/or laser therapy, depending on various factors. In advanced or progressive disease, surgery may also need to be considered.

A lot has changed since the first large glaucoma trials started to report their findings over 20 years ago. The Ocular Hypertension Treatment Study (OHTS) determined risk factors for glaucoma and also provided the first evidence that lowering intraocular pressure (IOP) was effec-

tive in delaying or preventing the onset of glaucoma in individuals with elevated IOP [2, 3]. Although the original study was designed to look at risk factors for the development of primary open angle glaucoma (POAG) progression, many subsequent analyses provided more details on the nature and evolution of the disease, with new data still being published in recent years [4, 5]. Similar to OHTS, the Collaborative Initial Treatment Glaucoma Study (CITGS) initially set out to examine any differences in the progression of glaucoma patients initially treated either with medical therapy or with early surgery, but subanalyses continued to be reported even as recently as 2020 [6–9]. Studies about glaucoma treatment were rather limited both for laser and surgery. The Glaucoma Laser Trial (GLT) and the Glaucoma Laser Trial Follow-Up (GLTFS) were the first studies to demonstrate the relative effectiveness of laser trabeculoplasty as an alternative to drop treatment [10, 11], whereas the Advanced Glaucoma Intervention Study (AGIS) looked at the long-term outcomes of different intervention sequences involving trabeculectomy and argon laser trabeculoplasty in eyes that failed initial medical treatment for glaucoma [12].

Over the past 10 years, we have witnessed a revolution in glaucoma diagnosis, imaging, and treatment. This reflects the advances that we have made in understanding the disease, and in developing diverse and effective modalities for its treatment. Although initially considered revolutionary, most of these concepts have evolved over the years and are now backed up by strong evidence, which, ultimately, should always guide our decision-making. Studies such as the United King-

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dom Glaucoma Treatment Study (UKGTS) and the Glaucoma Automated Test Evaluation (GATE), have evaluated previously understudied aspects of management and diagnosis, including the effectiveness of specific treatments and the value of imaging in diagnosing and monitoring glaucoma [13–16]. Several key studies, including LiGHT and ZAP, have also emerged, looking specifically at the indications and effectiveness of laser treatment for ocular hypertension and primary open angle glaucoma, and for primary angle closure suspects, respectively [17, 18]. These studies have given us more evidence and confidence in recommending laser treatment for particular patients, although one must also bear in mind real-life evidence which is complementary to these well-planned but more specific studies [19]. Finally, although the primary treatment for glaucoma most often involves use of eye-drops and laser, surgical intervention is still required in those patients with clinically significant progression and uncontrolled disease despite maximum medical therapy. Many surgical studies have now published long-term results which help the glaucoma specialist choose the right balance between risk and effectiveness when considering invasive procedures for their patients. Big studies such as the Tube Versus Trabeculectomy (TVT) and Primary Tube Versus Trabeculectomy (PTVT) studies have given us great insight into what to expect in terms of success rates and complications for the two main glaucoma procedures performed worldwide [20–24]. Furthermore, the Ahmed Baerveldt Comparison (ABC) and the Ahmed versus Baerveldt (AVB) studies have now published 5-year data which also allow a comparison between the types of glaucoma drainage devices used.

Finally, whilst a multitude of studies have reported on various types of glaucoma devices, including the so-called minimally-invasive glaucoma surgeries, proper randomized comparisons comparing them to the “trabeculectomy” gold standard are now starting to emerge, which is important for the clinician to assess the real effectiveness of these devices [25]. Another upcoming important large study on glaucoma surgery in advanced disease, the Treatment of Advanced Glaucoma Study

(TAGS), will be an important determinant of how we treat people presenting with newly diagnosed advanced glaucoma at presentation [26]. In anticipation of these important studies, the aim of this *Leit-thema* is to summarize what we believe are the most relevant glaucoma studies on diagnosis and treatment published within the past decade, in order to promote an evidence-based approach to glaucoma management.

### Corresponding address

**Dr. Karl Mercieca, MD PGCMed FRCOphth FEBOS-GL**  
Augenklinik, Universitätsklinikum Bonn  
Ernst-Abbe-Str. 2, 53127 Bonn, Germany  
Karl.Mercieca@ukbonn.de

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