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Tevrat Usupovych Gorgiladze: a brilliant surgeon who contributed to further advances in the Filatov's method of penetrating keratoplasty

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The present article reports on the life and scientific and clinical activities of Prof. Tevrat Usupovych Gorgiladze and his contributions to further advances in the Filatov's method of partial penetrating keratoplasty (PPK). T.U. Gorgiladze, a Filatov's pupil and a brilliant surgeon, was heading the Corneal Transplantation Department for 20 years. During this period, he elucidated various problems in, and proposed many techniques for the diagnosis and treatment of anterior segment pathology. The Corneal Transplantation Department was the first department established by Acad. Filatov at the institute that now bears his name.

Born in a village of Gorgadznebi, South Eastern Georgia, in 1926, Tevrat Usupovych Gorgiladze (Fig. 1) was the eldest among eight siblings. With a passion for learning since his early years, he needed to travel a long way to the local school. During World War II, being a teenager, he already worked at that school as a teacher, because he was almost the only literate person in the neighborhood. Now that school in the town of Chakvi bears his name.

He failed twice to pass entrance examinations for Tbilisi medical institute, so he went to Odesa to make his next attempt to pass and at once succeeded in entering Odesa medical institute. Tevrat Usupovych got to know his future wife at that institute, they were study group mates. Despite having some difficulties with the language, he was academically successful and was a study group monitor. His interest in ophthalmology began as early as his student years; he became a leader of a circle of students interested in eye diseases. In 1954, he graduated cum laude from Pirogov Odesa medical institute, and joined the Acad. Filatov Ukrainian Research Institute of Eye Diseases and Tissue Therapy as a resident; later he became a researcher at the institute.

He worked at the Corneal Transplantation Department under Prof. Bushmych and was engaged in the work to improve partial penetrating keratoplasty (PPK, Filatov's technique). Both the teacher and the pupil were concerned with opacified corneal grafts in post-PPK eyes. The causes of graft failure are quite varied. In the opinion of many surgeons that have mastered PPK (Filatov's technique), the technique is perfect as it enables congruence between the graft and the recipient cornea.

The young surgeon conducted experiments on 480 human cadaver eyes; in addition, 245 rabbit eyes received PPK in an experimental study. The corneal button was trephined with FM-III and FM-IV trephines at the side of the corneal epithelium, and with a specially devised electric trephine at the side

Fig. 1. Professor Tevrat Usupovych Gorgiladze

of the corneal endothelium, and the edges of the trephine opening were histologically examined in each case. Attention was given to the formation of profiles of edges of corneal buttons and trephine opening, with a focus on the state of the Descemet membrane and endothelium [1].

The sample sizes (i.e., the numbers of isolated cadaver human and rabbit eyes) involved in the Gorgiladze's Cand Sc (Med) thesis experimental research were impressive. It is therefore no surprise that, on completing his thesis, T.U. Gorgiladze became a technically brilliant surgeon, and gained recognition by national and international visitors of the institute for his surgical skills.

Not only did he master the PPK technique, but he identified a number of factors contributing to the success of the technique seemingly not very difficult to perform (at that time, the technique was mastered and performed by many eye surgeons). He studied corneal host and graft tissue dissection profiles and compatibility of these profiles with each other, and concluded that the severity of surgical trauma to the graft and recipient cornea was important for graft transparency.

First, manual trephination with FM-III trephine was found to be the best and least unsafe trephination method that produced an even edge profile, whereas trephination with an electric trephine produced a tapered edge profile. Second, it was proposed to position the eye as vertical as possible using a level-type device to avoid a tapered edge profile [2]. Third, using corneal scissors for graft cutting was categorically not recommended, and it was concluded that the grafts obtained in this way must not be used because they are associated with severe trauma to the posterior surface of the donor cornea. Fourth, it was found that intraocular pressure (IOP) has an effect on the graft edge profile and contour lines of trephination edges (at a low IOP, the edges appeared skewed towards the endothelium; at a high IOP, corneal button edges were affected by trauma and appeared skewed in different directions; at an IOP of 50-60 mmHg, corneal buttons had an even edge profile). Finally, partial displacement of the graft, delayed restoration of the anterior chamber and other postoperative complications after PPK in rabbits were mostly due to deviations in surgical technique [3, 4].

The thesis [5] was evaluated by influential reviewers, Professor S.F. Kalfa and Cand Sc (Med) S.B. Rozovska from the Eye Clinic at Odesa medical institute, and was successfully defended. That work had clinical and scientific value, is still relevant today, and may be considered a step in further improvement of the PPK technique.

Femtosecond laser-assisted trephination of an opaque cornea is currently considered a trephination technique allowing for the best edge matching between the trephination opening and the graft. In addition, femtosecond laser-assisted trephination of an opaque cornea is performed during vacuum docking, with the eye positioned as vertical as possible and with the IOP increased to 60 mmHg. These devices the young scientist could only dream about in the 1960s-1970s, but his conclusions made at that time were found to be correct and supported by further research in our technological twenty-first century.

Tevrat Usupovych Gorgiladze also began to study secondary glaucoma developing in eyes with an opaque cornea and after PPK. Secondary glaucoma is still the leading cause of irreversible blindness and disability. The causes of secondary glaucoma are quite varied and include e.g. cicatricial adhesion between the iris and corneal leukoma. In addition, secondary glaucoma may develop after PPK and undermine the optical outcome of PPK. Medical records of more than 3.5 thousand patients with corneal leukoma and their healthy fellow eyes were reviewed by T.U. Gorgiladze to determine secondary glaucoma incidence, causes and treatment and prevention methods. Moreover, 350 rabbits were used in experimental studies of glaucoma, and their eyes were clinically and histologically examined. Eyes with leukoma enucleated from patients with absolute glaucoma were also histologically examined.

The first problem the researcher had to solve was finding a method for measuring IOP in eyes with leukoma, because due to altered corneal configuration, the area of contact between the Schiötz tonometer (or the Maklakow tonometer) and the cornea is small, and the sensitivity of scleral tonometer in detecting IOP in glaucomatous eye is low. In order to remove this disadvantage, he changed the shape of the foot plate of the Schiötz tonometer to crescent shape, which allowed installing the tonometer on an unaltered peripheral corneal site.

In eyes with adherent corneal leukoma, secondary glaucoma mostly spread gradually without being noticed, or rarely acutely. Therefore, the author made an important conclusion that keratoplasty should be preceded by glaucoma fistulizing surgery for IOP control even in the eyes with pharmacologically well-compensated IOP.

This conclusion was supported by histological findings in animal eyes and enucleated human eyes with absolute glaucoma. Pathological findings in all cases included severe changes in the anterior eye, particularly in the aqueous outflow apparatus, which was considered the pathogenetic basis for the development of glaucoma in such eyes. This conclusion is still valid in eyes with glaucoma secondary to corneal leukoma.

The author also conducted animal studies to assess (1) morphological and histochemical changes in the setting of IOP affected by low temperatures, and (2) the effect of low temperatures on some types of fistulizing operations. Ciliary body exposure to ultralow temperatures was found to have a hypotensive effect, whereas iris exposure to ultralow temperatures resulted in iris atrophy and coloboma [6]. This, however, resulted in no loss in corneal or lens transparency. Findings of these studies allowed the author to recommend cryosurgery in iris rubeosis and hemorrhagic glaucoma, which is still relevant today and has been included in routine ophthalmological practice.

Gorgiladze's study findings on the incidence of secondary glaucoma after PPK are of particular interest.

Secondary glaucoma developed early postoperatively in 11.4% of 1146 eyes that received PPK. The disease was mostly caused by intraoperative and postoperative complications (lens capsule injury, inadequate graft fixation, delayed restoration of the anterior chamber, synechia, anterior uveitis, etc.).

The author took into account study findings and developed a graft securing technique using biological sutures and fibrin film that dissolve within a week. The application of the technique enabled reliable graft fixation, whereas graft fixation with the conjunctival flap by the Filatov's method was not always reliable. 10/0 atraumatic nylon sutures (a wonderful suture material) were not yet available at that time.

The author identified and recommended optimal time periods (at the end of the second month following PPK) for filtration surgery in eyes retaining a transparent graft.

T.U. Gorgiladze also gave attention to the need for curative keratoplasty in corneal inflammatory disorders like persistent keratitis, corneal ulcers, perforations, etc. [7]. Therefore, this was a breakthrough in the treatment of torpid corneal inflammation that was poorly responding to pharmacological treatment and commonly resulting in secondary glaucoma and subsequent visual loss. The curative keratoplasty is now widely applied worldwide, enabling fast resolution of corneal inflammation through the removal of affected tissue, and allowing preserving the eye and optic function.

At late follow-up 1 to 20 years after PPK, elevated IOP developed in 28.4% of cases; consequently, the author recommended such patients to receive regular prophylactic eye examination with IOP monitoring for early diagnosis of and treatment for secondary glaucoma.

Acad. N.O. Puchkovska, Professor D.G. Bushmych, and Professor V.V. Voino-Yasenetskyi served as academic advisors for the doctoral dissertation research by T.U. Gorgiladze [5], and the dissertation was successfully defended, significantly contributing to science and clinical practice [8]. Therefore, the dissertation continued the line of research on corneal transplantation by the method of Acad. Filatov; the key points of the dissertation are still important today.

Gorgiladze's academic and clinical credentials enabled him to become doctor of science in medicine and professor. In 1976, he began heading the Corneal Transplantation Department that was later renamed to the Corneal Pathology and Microsurgery Department (Fig. 2). This was the first department established by Acad. Filatov at the institute that now bears his name.

In addition to corneal transplantation, T.U. Gorgiladze was interested in research in other fields of eye surgery: he published an article on the technique for the resolution of lagophthalmos [9], and developed a method of enucleation of the globe including evisceration, neurotomy and implanting indifferential tissue into the scleral ring for forming a stump [10]. This technique is widely used today.

Some of the professor's younger colleagues became his pupils.

Z.F. Veselovska studied the role of endothelium in the process of engraftment of native and cryopreserved corneal grafts [11]. V.L. Ostashevskyi investigated the effect of protease inhibitors in the treatment of purulent ulcerative keratitis [12]. O.V. Ivanovska and T.U. Gorgiladze studied the clinical characteristics, diagnosis and classification of anterior segment cysts and the method of their cryogenic treatment [13]. A study by O.I. Kochkariova [14] examined the relationship between the transplantation features of donor cornea and the outcome of penetrating keratoplasty [14]. N.A. Adamova investigated the effect of fibronectin in the treatment of corneal ulcers and viral keratitis [15, 16]. T.B. Gaĭdamaka proposed a method of treatment of flu-associated anterior segment lesions with specific sera and titrated gamma globulines [17]. O.D. Rudkovska and T.U. Gorgiladze studied binocular vision and visual space perception in patients with intraocular lens and astigmatism and the possibility for increasing pseudo-accommodation in the artiphakic eye through the formation of the focus area [18]. G.I. Drozhzhyna investigated the efficacy of lamellar keratoplasty in patients with hereditary corneal stromal dystrophies and developed a differential approach to selecting the type of keratoplasty taking into account the presence of inflammation in the course of corneal dystrophy [19]. B.M. Kogan developed a new method for the treatment of keratoconjunctivitis sicca in Sjogren's syndrome [20].

When on business trips to foreign countries (Kuwait, Iraq, Yugoslavia, Western Europe), T.U. Gorgiladze always promoted the Filatov's method of penetrating keratoplasty (Figs 3 and 4). He even was awarded with an order of the Tunisian Republic for performing the first PPK in that country and his two year's work for introducing this surgery in the country (Fig. 5).

Keratoplasty remained his major focus of interest. T.U. Gorgiladze reviewed the Filatov-Bushmych classification of leukomas and proposed to complement it with a number of indications for keratoplasty, taking into account the changeable etiological causes (viral keratitis, ulcers, etc.) of the disease and the nature of the corneal lesions requiring penetrating, lamellar or curative keratoplasty [21]. He also considered the issues of combined surgical procedures (keratoplasty combined with cataract extraction and intraocular lens implantation and keratoplasty for traumatic anterior segment injury).

The advent of immunological studies allowed for HLA antigen-based donor graft selection for keratoplasty, which was reported in an article by professors T.U. Gorgiladze and N.S. Shulgina and the Bulgarian post-graduate student T.V. Mitov [22].

The development of bullous keratopathy in the artiphakic eye required devising a new surgery (posterior penetrating keratoplasty, with preservation of the anterior corneal layers) for the resolution of the disease. This surgical procedure became a prototype of what later was

Fig 2. Group photograph of the staff of the Corneal Transplantation Department, with T.U. Gorgiladze standing fourth from the left in the first row

known as Descemet's membrane endothelial keratoplasty (DMEK) that allows the replacement of the Descemet's membrane and endothelium [23, 24].

Professor T.U. Gorgiladze passed away on 7 March, 1996, after completing his working day. His sudden death from thromboembolism interrupted a brilliant career of a follower of Acad. Filatov, the follower who admired penetrating keratoplasty, the brainchild of Filatov.

Tevrat Usupovych was an intellectual and a soft-hearted person. He was a member of the Academic Council of the Filatov institute and editorial board member of the Ophthalmological Journal (Oftalmol Zh), and a frequent reviewer of articles, academic works, theses and dissertations. Tevrat Usupovych was often more sympathetic while reviewing the works of others, and sometimes could work together with a dissertation or thesis author on finding that special something that would set it apart from other dissertations or works.

He authored or co-authored 290 publications, including two monographs [25, 26] and an atlas, had 12 certificates of authorship for invention, and was awarded with titles of Honored Doctor of the Adjarian Autonomous Soviet Socialist Republic and Honored Worker of Science and technology of Ukraine.

He had no hobby but his work and not enough time for his family he loved dearly.

Tevrat Usupovych taught his young colleagues to perceive responsibility for a patient, telling them, "Do not do any operation that you would not do on your mother, wife or child". We will remember him as a sincere gentleman with a kind smile (Fig. 6).

Very many people, institute colleagues, patients and relatives, came to pay their last tribute of respect to Professor Gorgiladze, and the institute assembly hall of 500 seats could not accommodate all those people. Tevrat Usupovych was buried at one of the central alleys of

Fig. 3. T.U. Gorgiladze (second from the left) with Egyptian doctors (April, 1966)

Fig. 4. A group of Filatov institute ophthalmologists attending International Odesa-Genoa Ophthalmological Conference, hosted by Prof. Mario Zingirian (Genoa, Italy), with T.U. Gorgiladze sitting third from the left

Fig. 5. The Order of the Tunisian Republic awarded to T.U. Gorgiladze

Odesa's Second Christian Cemetery; his grave is located near that of Acad. Filttov. The colleagues from the institute including those from the department he worked at, remember and respect the memory of their teacher, and visit his grave on memorial days.

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Fig. 6. Professor T.U. Gorgiladze at the examination room at the department (1990)

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