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THE FILTERING OPERATIONS SOME HISTORIC GLIMPSES

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The origin of the filtering operations, in 1869, in the cystoid cicatrices following von Graefe's iridectomy operation, has been admirably described by Kronfeld.[1] The reader is urged to refer to his paper and especially to note the photographs and brief biographical sketches of some famous pioneer glaucoma surgeons.

Von Graefe believed that the excision of iris was responsible for lowering of intraocular pressure after iridectomy and that filtering cicatrices were an undesirable complication of the operation.[2] He even advised that they be excised when thin or inflamed and thus vulnerable to intraocular infection.

De Wecker, in 1867 and 1871, introduced the idea of a sclerotomy in the chamber angle area with an overlying conjunctival bridge flap as a means of producing a filtering cicatrix through which the intraocular fluid might leave the interior of the eye.[3] In 1894 de Wecker added iridodialysis to the sclerotomy.[4] In many cases the sclerotomy procedures were followed by digital massage and miotics but,

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in spite of these aids, the use of the operation as a primary procedure declined so that it was used by less than 15 percent of ophthalmologists in the first decade of the 1900's.[5] Successful results a year or more after the operation were few. Observations on successful or, at least temporarily successful, cases of iridectomy or sclerotomy led to observations of conjunctival and iris inclusions in the wound. These led to attempts to make fistulas through use of conjunctival infolding into the anterior chamber,[6] various setons and iris inclusion.

In 1907 Herbert Herbert introduced his small flap sclerotomy in which s rectangular trap door of sclera with its base attached to the cornea was formed.[7] Later (1913) he isolated a wedge of sclera attached only to conjunctiva to produce fistulization through shriveling of the isolated wedge.[8]

In 1906 Félix Lagrange presented his "sclerecto-iridectomy"[9] which had a rather decent success rate and has been used to the present time, especially in Europe. A later study by Meller of 11 eyes enucleated after the Lagrange operation indicated that successful filtration occurred when iris was incarcerated in the scleral wound.[10]

Ophthalmic surgeons continued to use the sclerectomy idea. As a matter of fact, we still do, with a long series of modifications of all kinds, but with the ultimate aim of achieving a permanent fistula through which aqueous permeates the subconjunctival tissue and is absorbed or filtered through the epithelium.

Holth (1906) used a punch forceps to produce his sclerectomy.[11] Over the years modifications of the Lagrange type of operation were made (Griscom[12], Spratt's "pocket flap iridectomy"[13], Curdy[14], Berens' "iridocorneosclerectomy"[15]).

The first iris inclusion sclerectomy operation was introduced in 1857 by Critchett, who used a broad needle to make a tiny incision through the corneolimbal margin and, after allowing aqueous to escape, drew out a portion of the iris with a blunt hook and left it in the wound.[16] It was not very effective but was followed by better techniques such as that of Herbert in 1903 in which prolapsed iris was allowed to remain in the sclerotomy wound.[17] He called the operation "subconjunctival prolapse of the iris". In 1906 Holth, who had the advantage of using newly available Schiotz tonometry, reported on the procedure, which he called "iridencleisis antiglaucomatosa".[18] It was based on the premise that effective conjunctival covering over the iris was essential to preserve the integrity of the eye. He made his scleral keratome incision through a sub-Tenon's tunnel with the conjunctival opening some 8–10 mm distant from the scleral wound which was 1 mm from the corneolimbal junction. The iris sphincter was drawn into the wound and a meridional cut made through it on one side of the forceps. In spite of a high success rate (86 percent), professional opposition to the operation led Holth to use a modified Lagrange sclerectomy in which a punch instead of a scissors was used for the

sclerectomy.[19] Later, in 1915, he again returned to the iridencleisis operation. In 1911 Borthen introduced a modification of the iridencleisis operation in which the iris was incarcerated but the sphincter remained uncut. This procedure was called "iridotasis".[20] An important variation in the iridencleisis operation technique was that introduced by Weekers in which the prolapsing iris is torn between two iris forceps and the two iris tongues are incarcerated into the respective ends of the limbal incision.[21]

A type of sclerectomy which was well received and shared popularity with Scheie's thermal sclerotomy was the posterior lip sclerectomy, described by Iliff and Haas.[22] A punch forceps was used to excise the posterior lip of the sclerotomy, producing much the same result as the Holth sclerectomy.

The final modification of the early sclerectomy operation came in 1909 with the introduction of the trephining operation by Fergus and Elliot. A one-twelfth inch cornea trephine had been used by Argyll Robertson in 1874[23] to make a fistula through the pars plana. The operation was only used on four eyes with inconclusive results.

Fergus has never received adequate credit for his pioneer work, overshadowed as he was by Elliot. It is interesting that Kronfeld even referred to Fergus as Fergus Freeland instead of Freeland Fergus. At any rate, Fergus introduced his operation in January 1909.[24] He prepared a large conjunctival flap and then used a 3 mm Bowman's trephine to make a sclerectomy as close to the cornea as possible. He claimed that "the operation does not involve the ciliary body at all but lays it bare". He modified the technique to add the introduction of the point of a fine iris repositor through the sclerectomy into the anterior chamber, thus causing Elliot[25] to describe the modified Fergus operation as a combination of trephining and cyclodialysis. Elliot's emphasis on the cyclodialysis was, in my opinion, incorrect since it is doubtful that a true separation of the ciliary body insertion was obtained. Fergus[26] accepted the designation of a portion of the operation as cyclodialysis but his own descriptions indicate that the concept of cyclodialysis held at that time differed from that held today.

Elliot introduced his trephining operation in August 1909 and described its use in 50 cases.[27] He prepared a large triangular flap based at the limbus and used a 2 mm trephine placed as close to the corneolimbal junction as possible. An iridectomy was made in about a fifth of the cases. In subsequent operations Elliot greatly modified his procedure into the corneoscleral trephining.[25] He made the flap large with the conjunctival incision running concentric with the limbus 8 mm from the limbus. It was continued into the cornea by splitting the latter for a distance of 1 mm. The 2 mm trephining was thus half in cornea and half in limbus. An iridectomy was usually made and the flap was then replaced and sutured. Elliot stressed

the importance of removing a complete disc of Descemet's membrane and not involving the trabecular area.

The Elliot operation became the most popular antiglaucoma operation throughout the world until about 1940 when, because of a relatively high incidence of bleb rupture and late infection, it began to decline in use. In 1913, when iridectomy was still being used in chronic glaucoma, trephining was done in 47 percent of operations in England.[5] In 1931, at the Illinois Eye and Ear Infirmary in Chicago, the Elliot procedure was used in 60 percent of operations for chronic simple glaucoma. In 1945, its use had dropped to 5 percent[28] while iridecleisis increased to 62 percent and continued to be popular to about 1957.

In 1960, as a result of dissatisfaction with the procedures then in use, I decided that if corneal splitting were avoided and the conjunctival-Tenon's capsule junction at the limbus were left intact the trephining operation might serve well as a safe, reproducible filtering procedure.[29] In surveying the literature I found a statement by Sobhy Bey in 1921[30] where he found, by studying eyes which had been operated according to Elliot's technique

> "... the splitting or the cutting of the cornea during the operation (to be) unnecessary and the hole could have been in the right place without it. ... I was always tempted to stop the corneal dissection in my technic for Elliot's trephining and owing to the lack of experiments. ... I dared not stop it and feared touching the ciliary body by being so peripheral."

I introduced a non-corneal-splitting trephining technique as limboscleral (later as limbal) trephining, with modifications to limit the fistula to 1 sq. mm and to make possible final evaluation of the patency of the fistula and the leak-proofness of the conjunctival flap. The results in 317 limbal trephinings observed up to 16 years were better than I had experienced with other procedures in older adults with chronic open-angle or chronic angle-closure glaucoma.

In 1958 Scheie introduced a filtering operation which was the most popular between that time and the present period of popularity of trabeculectomy.[31] The operation is based on the use of thermocautery to form a fistula on a line parallel to the limbus and 1 mm behind it. After making a conjunctival flap and starting the cautery a scratch incision is made through this area and cautery is applied again until the anterior chamber is entered. After a peripheral iridectomy the conjunctival flap is sutured.

A direct cautery type of filtering operation had been described previously by Preziosi in which the cautery point was applied obliquely to enter the anterior chamber after preparation of a conjunctival flap.[32]

The trabeculectomy operation is the present surgical fad and is proving to be a popular filtering procedure. It was started with the intention of producing a direct opening from the anterior chamber into two open ends of Schlemm's canal. The first procedure describing a scleral lamellar flap and trabeculectomy was described by me in 1961 as "experimental trabeculectomy".[33] The scleral flap was carefully sutured so as to prevent filtration and failed. Another description of trabeculectomy was in the Greek language by Coryllos in 1967.[34] A paper by Cairns[35] reported such good results that the procedure became widespread but its effectiveness was then attributed to filtration. I have found it best in all younger individuals below 55 to 60 years of age.

The technique includes an 8 mm conjunctival flap which is reflected back onto the cornea. A half-thickness lamellar corneoscleral flap (5 x 5 mm rectangle or 4–5 mm triangle with its base at the cornea) is dissected toward the limbus and 1 – 1 1/2 mm into the cornea. The deep layer is then incised as far forward as possible and the area of the trabecular wall is excised. I prefer a triangular flap and a 2 mm trephining of the deep layer, much as described by Fronimopoulos[36] and Dellaporta[37]. The scleral flap is replaced and sutured loosely at the corners or apex and then the conjunctiva is closed with a running silk suture. In all filtering procedures the use of a Wheeler knife incision in the lower temporal quadrant of the cornea permits filling of the chamber with balanced salt solution after the operation, as well as ascertaining the patency of the fistula and the leak-proofness of the conjunctival flap.

It is likely that the ultimate filtration procedure will continue to be sought after. We have, however, come a long way since von Graefe's observations a little more than a century ago.

Summary

The author relates the history of the filtering operations from von Graefe's iridectomy to Cairns' trabeculectomy: sclerotomy with iridodialyses of De Wecker, sclerectomy of Herbert, sclerecto-iridectomy of Lagrange, iridencleisis of Critchett and Holth, trephining of Fergus and Elliot, modified by Sugar, thermocautery operation of Scheie.

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SUGAR, H.S. – Les operations fistulisantes: Aspects historiques

Resumé

L'auteur écrit l'histoire des opérations fistulisantes depuis l'iridectomie de von Graefe jusqu'à la trabéculectomie de Cairns: sclérotomie avec iridodialyse de De Wecker, sclérectomie de Herbert, scléro-iridectomie de Lagrange, iridencleisis de Critchett et Holth, trépanation de Fergus et Elliot, modifiée par Sugar, thermocautérisation de Scheie.

SUGAR, H.S. – Die Filteroperationen. Ein Blick in ihre Geschichte

Zusammenfassung

Die Autoren berichten über die Geschichte der Filteroperationen von Graefes Iridektomie bis zu Cairns Trabekulektomie: Sklerektomie mit Iridodialyse von De Wecker, Sklerektomie von Herbert, Sklerektomie mit Iridektomie von Lagrange, Iridenkleisis von Critchett und Holth, Trepanation von Fergus und Elliot, modifiziert von Sugar, die Scheie-Operation, Gewebstrennung mittels Thermokauter.

SUGAR, H.S. – Las operaciones filtrantes: Aspectos históricos

Resumen

El autor escribe la historia de las operaciones filtrantes después de la iridectomía de von Graefe hasta la trabeculotomía de Cairns: esclerotomía con iridodiálisis de De Wecker, esclerotomía de Herbert, escleroiridectomía de Lagrange, iridoencléisis de Critchett y Holth, trepanación de Fergus y Elliot, modificada por Sugar, termocauterisación de Scheie.

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