EVALUATION OF MODIFIED TECHNIQUES OF IRIDENCLEISIS*

BY

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Introduction

An excellent review of the origin and early evolution of operation for iridencleisis has been given by Allen (1944). It was, however, left to Herbert (1903) in India and Holth (1907) (cited by Allen, 1944) in Scandinavia formally to introduce this operation as an effective and scientific anti-glaucoma procedure.

After an initial setback in its fight for supremacy with corneoscleral trephining—its contemporary—during the first three decades of the present century, it has rapidly and largely replaced the latter as an operation of choice in most types of glaucoma whenever a filtering procedure is indicated.

Since its introduction over half a century ago, this operation has been subjected to numerous modifications, although essentially the principle of the operation remains the same. The number and nature of these modifications will not be gone into, but it may be stated that most of these concern, in effect, refinements or additions, mostly unnecessary, in the original Holth technique, namely, methods of preparing conjunctival flap; making a limbal incision; the method of incarceration of one or both pillars of the iris; or merely its peripheral slip leaving the sphincter intact, or combining iris inclusion with sclerectomy; sclerectomy, iridodialysis; and cyclodialysis; etc. The very fact that the iridencleisis operation has had so many modifications suggests that no single technique may be the answer to the problem in all cases. However, very few comparative studies have been reported in the literature, evaluating different modifications of iridencleisis in the hands of the same surgeon employing the same criteria of success or failure, with the result that it is difficult, if not impossible, to compare the results of glaucoma operations from the enormous amount of literature available on the subject. This study was undertaken to find out whether different modified techniques of iridencleisis were equally safe and effective for all grades of glaucoma or could be employed selectively with greater benefit.

The modified techniques studied were: (1) one-limb iridencleisis with iridodialysis; (2) two-limb iridencleisis; (3) peripheral iridencleisis; and (4) iridencleisis with sclerectomy.

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Material and Methods

Selection of Cases

The 64 cases (106 eyes) included in this study were all consecutive cases of adult primary glaucoma admitted to the wards of the R.L. Eye Hospital, Amritsar, from March, 1961, onwards. Cases of juvenile and infantile glaucoma were excluded. A detailed examination, including tonometry, gonioscopy, charting of peripheral and central visual fields, and recording of visual acuity and lenticular opacities, was carried out in every case. Ocular tension was recorded a number of times pre-operatively in each case by Schiötz tonometer (1955 calibration) and maximum tension recorded before operation was taken as pre-operative tension. Due note was taken of gross variation in ocular rigidity by the two plunger weights method. Gonioscopy was done in 98 of the 106 eyes (in the remaining 8 eyes corneal opacities precluded gonioscopy) and repeated whenever necessary to establish the state of the angle and to classify the cases between the two main primary types of glaucoma. Peripheral fields were taken by Pflunger’s dome-shaped perimeter and central fields by Juler’s projection scotometer at one metre distance.

After the establishment of full diagnosis and assessment of the case, selection of the operative technique to be employed in each case was made in such a way as to have, as far as possible, an equal number of cases of both open- and closed-angle variety operated on by each technique. An attempt was also made to ensure that as far as possible in each operative technique cases of all grades of tension were included to make the observations comparable. The technique of iridencleisis with sclerectomy was, however, abandoned after six cases had been operated on by this method, as the results were not very satisfactory.

Surgical Techniques Employed

Miotics were stopped two days before surgery and crystamycin drops only were instilled 4 times a day before operation. Anaesthesia employed in each technique was the same, i.e., premedication with Phenergan and Largactil 25 mg. each intramuscularly half an hour before operation, anethaine 1 per cent. drops topically 3 times, followed by 2–3 drops of adrenaline hydrochloride 1 : 1000; facial akinesia of van Lint or O’Brien, and superior rectus and retrobulbar infiltration with 2 per cent. novocaine. A superior rectus stitch was used to keep the eye steady in a slightly downward position. Preparation of the conjunctival flap and the limbal incision were made in the same way in all techniques. No prior infiltration under the conjunctiva was used. A limbal-based conjunctival flap 7–8 mm. broad, including Tenon’s fascia, was fashioned and blunt dissection stopped at the point where conjunctival epithelium becomes adherent to subepithelial tissue, i.e., at the anterior limit of the external limbus (Clark, 1959). Bleeding points, if any, were touched with light thermocautery, which was also passed lightly over the proposed line of limbal incision. An ab externo vertical scratch incision starting at 12 o’clock and extending for 4 mm. towards the nose was made with a Bard-Parker knife parallel to the limbus at the level of the posterior limit of the external limbus, i.e., at the junction of the translucent band of limbus and opaque sclera. The posterior lip of the wound was pressed a little to obtain a spontaneous prolapse of the iris knuckle. The procedure thereafter varied according to the technique employed, as follows:

1. In one-limb iridencleisis the iris knuckle was held by means of a fine toothed iris forceps on the side nearer the pupillary margin and gently pulled out to expose the latter. A radial cut was made on the right side of the iris forceps through the pupillary margin towards the root of iris. The iris pillar was grasped in iris forceps, gently pulled to the left, and allowed to remain in the wound as such. The right pillar often replaced into the anterior chamber spontaneously. If not, it was stroked back into the anterior chamber by
an iris repositor. The conjunctival flap was replaced and sutured with a black silk running stitch, including both conjunctiva and Tenon's capsule. The anterior chamber remained partially intact in most cases during surgery, and in those cases in which it collapsed initially it partially re-formed by the time the conjunctival flap had been sutured.

(2) In two-limb iridencleisis the iris knuckle was caught by two pairs of iris forceps, one held by the surgeon and the other by the assistant, and a radial cut was made between the two through the pupil, extending to the root of iris. The two iris forceps were very slightly pulled apart and the iris pillars left in the wound without further manipulation. The conjunctival flap was replaced and stitched as mentioned above.

(3) In peripheral iridencleisis just enough pressure was applied to the posterior lip of the limbal wound to obtain a smaller knuckle of iris, which was held in fine forceps on the side away from the pupil. A small cut was made through the iris on the right of the forceps and then below it and the small slip of iris in the iris forceps was allowed to remain in the wound while the rest of the iris was stroked back into the anterior chamber. As we had stopped using miotics pre-operatively, the pupils were not contracted and some difficulty was felt in fashioning a satisfactory slip of iris for incarceration, while keeping the pupil intact, with the result that in most cases the incarcerated iris slip was very thin and tenuous.

(4) In iridencleisis with sclerectomy after the limbal incision, the left end of which was placed a little anterior to its right end, a narrow triangular piece of sclera was excised from the left end of the posterior lip of the wound and one-limb iridencleisis performed as described above, leaving the incarcerated pillar in the area of sclerectomy. The conjunctival flap was then replaced and sutured in the same way as in other techniques.

After operation Achromycin in oil suspension and hydrocortisone ointment 0·5 per cent. were instilled into the cul-de-sac and both eyes bandaged.

Post-operative Observations

The wound dressing was changed after 48 hours and atropine 1 per cent. drops instilled if there was any sign of undue iris irritation, otherwise crystamyacin drops only were used post-operatively. Dressings were changed every alternate day and patients were usually discharged on the eighth to tenth post-operative day. At the time of discharge notes were taken of post-operative complications, the condition of the filtering bleb, the anterior chamber visual acuity, and ocular tension. Gonioscopy and perimetry were done again at a later date when patients were examined on follow-up, which ranged from three to nine months. Long-term follow-up of some of these cases is in progress and will be reported in due course.

Unfortunately, functional assessment of glaucoma operations is handicapped by the high incidence of lenticular opacities in our part of the world. In our series of cases, moderate to advanced lenticular opacities were present in 69 (65 per cent.) of the 106 eyes. As visual acuity and visual fields are seriously affected by lenticular opacities, the employment of visual fields and visual acuity in the assessment of results of glaucoma surgery is not useful. Already existing field defects may be significantly aggravated merely by increase in lenticular opacities in the absence of any progress of organic glaucomatous process. Therefore in the present study, although vision and visual fields were recorded with meticulous care, they turned out to be of little value in a general way in the assessment of progress of the case after surgery. In our study we have employed control of intra-ocular tension as the main criterion of success or failure of the operation, although our observations on vision, visual field defects, and lenticular opacities have also been recorded. Glaucoma has been considered controlled if after surgery the maximum ocular tension recorded has been 21 mm. Hg or below without miotics.
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Observations and Discussion

Altogether 106 eyes in 64 cases were operated upon by the four techniques. Of these, 70 eyes in 43 cases were of angle-closure glaucoma and 36 eyes in 21 cases were of open-angle glaucoma. Break-up of these cases into males and females and the average age in each group is given in Table I. Table II gives the distribution of eyes with different tension groups operated on by different techniques.

<table>
<thead>
<tr>
<th>Table I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGE AND SEX DISTRIBUTION OF CASES</strong></td>
</tr>
<tr>
<td><strong>Glaucoma</strong></td>
</tr>
<tr>
<td><strong>Open-angle</strong></td>
</tr>
<tr>
<td><strong>Angle-closure</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DISTRIBUTION OF PRE-OPERATIVE TENSION-GROUPS IN VARIOUS TECHNIQUES</strong></td>
</tr>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Pre-operative tension groups (mm. Hg)</strong></td>
</tr>
<tr>
<td><strong>One-limb iridencleisis</strong></td>
</tr>
<tr>
<td><strong>Two-limb iridencleisis</strong></td>
</tr>
<tr>
<td><strong>Peripheral iridencleisis</strong></td>
</tr>
<tr>
<td><strong>Iridencleisis with sclerectomy</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

A. Operative Difficulties and Complications

Except in peripheral iridencleisis no technical difficulty was encountered in any of the techniques used. A combination of iridencleisis with sclerectomy does require additional instrumentation, with the likelihood of trauma to the ciliary body. In peripheral iridencleisis it was frequently difficult to obtain a sizeable slip of iris for incarceration. As miotics had been stopped before the operation we had almost to deal with a moderately dilated pupil and it was a problem at times to save the pupillary margin and prepare a good-sized flap of iris for incarceration. Epithelial pigment from the iris slip was frequently dispersed during its manipulation. These two reasons, i.e., insufficient incarceration and pigment dispersion, were perhaps responsible for the lack of formation of adequate filtration channels and the low rate of control of ocular tension with this technique. In retrospect, it is believed that had we continued miotics up to the time of surgery we would have succeeded in fashioning thicker iris slips for incarceration with better results. In the case of two-limb
iridencleisis, as the two pillars were left as such in the wound after radial incision of the iris, one of the pillars occasionally slipped back into the anterior chamber either on the operation table or immediately afterwards. This happened in 4 of the eyes in which two-limb iridencleisis was planned. Thus it was observed that one-limb iridencleisis was technically the simplest of the four techniques. There were no operative complications, such as injury on the operating table to the lens or ciliary body or hyphaema. This is in contrast to the high incidence of operative hyphaema, injury to the iris, lens, or ciliary body reported by Stallard (1953), Mackie and Rubinstein (1954), and Agarwal (1958). One factor common to the techniques employed by these authors was the slanting incision starting well back from the limbus and entering the anterior chamber in the region of the anterior trabeculae. A slanting incision (Fig. 1B) has to pass through the intrascleral plexus of blood vessels, which may result in profuse bleeding immediately after section. Also, a little mistake in judging the slant of the keratome may lead to entry into the posterior chamber, thus inviting disastrous complications. Such mishaps are unlikely to occur in an ab externo scratch incision (Fig. 1A) made vertically with the edge of a Bard-Parker knife. The incision, being vertical, can be placed accurately over the spot where it is intended to enter the anterior chamber. Intrascleral plexus is avoided by making a vertical entry through the anterior trabeculae.
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Button-holing of the conjunctival flap occurred in 3 eyes, but this accident was unrelated to any particular technique. This complication can happen in any operation where a conjunctival flap is made. All these cases were of open-angle glaucoma, and the conjunctiva in all of them was very thin and atrophic. This operative complication resulted in lack of control of tension in 2 eyes, and in the third case the site of iris incarceration was changed so that inclusion was covered by an uninjured conjunctival flap. It is thus a very serious operative complication and must be avoided. If it does occur, it should be promptly recognized and the site of the iris incarceration changed.

B. Post-operative Complications (Table III)

<table>
<thead>
<tr>
<th>Complication</th>
<th>One-limb Iridencleisis</th>
<th>Two-limb Iridencleisis</th>
<th>Peripheral Iridencleisis</th>
<th>Sclerectomy with Iridencleisis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Eyes</td>
<td>Per cent.</td>
<td>No. of Eyes</td>
<td>Per cent.</td>
</tr>
<tr>
<td>Hyphaema</td>
<td>3</td>
<td>8.3</td>
<td>4</td>
<td>11.4</td>
</tr>
<tr>
<td>Iritis</td>
<td>3</td>
<td>8.3</td>
<td>10</td>
<td>28.5</td>
</tr>
<tr>
<td>Late anterior chamber formation</td>
<td>11</td>
<td>30.5</td>
<td>18</td>
<td>51.4</td>
</tr>
<tr>
<td>Malignant glaucoma</td>
<td>1</td>
<td>2.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypotony</td>
<td>11</td>
<td>30.5</td>
<td>11</td>
<td>31.4</td>
</tr>
<tr>
<td>Lenticular increased opacities</td>
<td>7</td>
<td>19.4</td>
<td>9</td>
<td>25.7</td>
</tr>
<tr>
<td>Visual loss</td>
<td>7</td>
<td>19.4</td>
<td>7</td>
<td>20.0</td>
</tr>
<tr>
<td>Visual field loss</td>
<td>6</td>
<td>16.7</td>
<td>7</td>
<td>20.0</td>
</tr>
<tr>
<td>Drawn pupil</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Total no. of eyes</td>
<td>36</td>
<td>35</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>

(1) Late Formation of Anterior Chamber or Collapse of Anterior Chamber in the Immediate Post-operative Period.—This occurred in 11 of the 36 eyes (30.5 per cent.) with one-limb iridencleisis technique, 18 of the 35 eyes (51.4 per cent.) with two-limb iridencleisis, 3 of the 29 eyes (10.3 per cent.) with peripheral iridencleisis, and 3 of the 6 eyes (50 per cent.) with iridencleisis with sclerectomy. Late formation of the anterior chamber was not related to the height of pre-operative tension but was apparently due to early leakage of aqueous through the incision. In peripheral iridencleisis, the amount of iris tissue in the wound being small, there was less separation of the wound and hence less incidence of late formation of anterior chamber. The separation of the wound was maximal in iridencleisis with sclerectomy because of the sclerectomy, and in two-limb iridencleisis because of the two thick slips of iris tucked in at either extremity of the limbal incision. Incidence of late anterior
chamber formation was maximal in these two techniques, i.e., 50 per cent. and 51·4 per cent. respectively. This complication per se did not seem to affect the ultimate outcome in so far as the control of ocular hypertension was concerned, although this definitely contributed to extension of pre-existing goniosynechiae or formation of fresh goniosynechiae. Thus out of 35 cases of late formation of anterior chamber in the whole series tension was normalized in 30, while in 4 out of the 5 failures there were other reasons contributing towards lack of control, namely, button-holing of the conjunctiva, malignant glaucoma, hyphaema, and iritis. Apparently the new filtration channels produced were sufficient to take care of the drainage, even if goniosynechiae increased. Nevertheless, it is better to avoid late formation of anterior chamber and further extension of goniosynechiae, so that the embarrassment of the angle is not worsened, should the artificial filtration channels be blocked.

(2) Hyphaema.—Hyphaema was encountered in 3 eyes (8·3 per cent.) with one-limb iridencleisis, in 4 eyes (11·4 per cent.) with two-limb iridencleisis, and in one eye (3·4 per cent) with peripheral iridencleisis. Hyphaema was usually noticed on the third to the sixth day after operation. In all except 2 eyes it reabsorbed spontaneously. In these two eyes paracentesis had to be done on the sixth and eighth days after operation. All eyes belonged to the chronic angle-closure glaucoma group.

In 4 of the 8 eyes tension failed to be controlled post-operatively. Thus hyphaema contributed significantly to the incidence of failures. Excluding iridencleisis with sclerectomy, its incidence was least in peripheral iridencleisis and maximal in two-limb iridencleisis. This suggests that irritation of the iris and separation of the lips of the wound are factors in the causation of hyphaema. The fact that all cases were of chronic angle-closure glaucoma may also have some significance.

(3) Iritis and Drawn Pupil.—Incidence of post-operative iritis was 3 eyes (8·3 per cent.) with one-limb iridencleisis, 10 eyes (28·5 per cent.) with two-limb iridencleisis, 3 eyes (10·3 per cent.) with peripheral iridencleisis, and one eye (16·6 per cent.) with iridencleisis with sclerectomy. Incidence of iritis was thus significantly high in two-limb iridencleisis. In 5 of the 17 eyes showing post-operative iritis tension failed to be controlled, although other factors contributing towards failure were also present, such as hyphaema, too-thin incarceration, and late formation of the anterior chamber. There were 2 cases of updrawn pupil in the group operated on by two-limb iridenclisis, but there was none in the other groups.

(4) Lenticular Opacities, Visual Acuity, and Visual Fields.—Pre-existing lenticular opacities progressed appreciably, or fresh lenticular opacities appeared where none existed pre-operatively; in 7 eyes (19·4 per cent.) with one-limb iridencleisis, in 9 eyes (25·7 per cent.) with two-limb iridencleisis, in 5 eyes (83·3 per cent.) with iridencleisis with sclerectomy. In peripheral iridencleisis no case showed appreciable progress of existing lenticular opacities and no fresh lenticular opacities appeared in any case. Incidence of visual field loss, as also the loss of visual acuity following operation, more or less corresponded with that of progression of lenticular opacities. One significant observation, however, was that amongst the eyes included in this series there were 5 eyes with extremely contracted visual fields, with the nasal limit reaching to within 10° of the fixation and with only residual temporal islands of visual field.
left. All of these eyes except one retained their pre-operative vision and visual fields after surgery.

This is contrary to the fear generally entertained in operating on extremely advanced cases (Hill, 1956) because of the danger of sudden loss of residual field in such cases, due to macular oedema or haemorrhage after surgery. While there is no doubt that such a fear is not unfounded, if the tension cannot be controlled medically the outcome is obvious, and it is always better to take the risk rather than to wait for inevitable blindness. Our experience in this has been encouraging and confirms the views expressed by Chandler (1960), and Laval (1960).

(5) Malignant Glaucoma.—There was one case (2·8 per cent.) of malignant glaucoma in the group operated on by one-limb iridencleisis. It is impossible to account for the occurrence of malignant glaucoma with this particular technique. In fact, this condition is believed to be precipitated by sudden decompression of the eyeball at the time of surgery in a case of chronic angle-closure glaucoma which has failed to respond to miotics (Bangerter, 1958), and its occurrence cannot usually be predicted. In fact, this serious complication can develop after any anti-glaucoma operation from sudden opening of the eye and movement of the lens iris diaphragm forwards (Clark, 1959). The incision in both one-limb and two-limb iridencleisis is similar, and if anything, the magnitude of immediate post-operative hypotony is found to be greater with two-limb iridencleisis than with one-limb iridencleisis. Hence we can safely assume that the occurrence of malignant glaucoma with this technique was just a misfortune which may happen after any anti-glaucoma operation.

C. Control of Tension

Pre-operative ocular tension varied from 27 mm. Hg to 80 mm. Hg in the 36 eyes operated on with one-limb iridencleisis. In all these cases except one, which developed malignant glaucoma, tension dropped to 17 mm. Hg or below, as measured at the time of the patient’s discharge from hospital. In some cases there was marked hypotony in the immediate post-operative period, tension being less than 10 mm. Hg in as many as 18 cases and less than 5 mm. Hg in 4 of them. This dramatic crash of intra-ocular pressure (Fig. 2) was obviously unrelated to the height of pre-operative tension, thus indicating either free leakage of the anterior chamber or marked traumatic inhibition of aqueous formation.

The finally stabilized level of ocular tension was definitely higher at the end of the observation period than that obtained at the time of discharge from hospital in 30 eyes. In 5 eyes tension remained at the same low level as at the time of discharge, and in one case malignant glaucoma developed. In this case tension shot up to 69 mm. Hg, but was brought down to 14 mm. Hg after lens extraction, and was finally stabilized at 22 mm. Hg. At the final check-up ocular tension was 21 mm. Hg or below in 33 eyes (out of 36) and above 21 mm. Hg in 3 eyes. Post-operative tension in these eyes was 24, 37, and 22 mm. Hg, showing a fall from the pre-operative level by 19, 13, and 23 mm. Hg respectively. Probable causes or factors associated with failure in these three eyes were button-holing of the conjunctiva in one, localized cystic transparent bleb in another, and malignant glaucoma in the third case. In the second case the filtering capacity of the bleb was limited by fibrosis around it. It is possible that this resulted from foreign body reaction to some cotton fibres from
the swab retained under the conjunctiva. The third case developed malignant glaucoma and did not respond to cyclodialysis and air injection into the anterior chamber and the lens had to be removed on the seventeenth post-operative day. In 11 eyes hypotony persisted during the time of observation, but there was no papilloedema or choroidal detachment in any of them. In two-limb iridencleisis the pre-operative tension again ranged from 27 to 80 mm. Hg and the same type of crash of ocular tension was noted at the time of the patient’s discharge from the hospital (Fig. 3), as many as 25 patients recording tension less than 10 mm. Hg. At the final follow-up 4 eyes had tension above 21 mm. Hg. In one case hyphaema, iritis, and forward displacement of the lens and ciliary processes in the region of the wound were associated with lack of control of tension. In the second eye there had...
been iritis with late formation of the anterior chamber. Another factor in this case was iris incarceration in front of the line of Schwalbe, as seen on gonioscopy. Hyphaema in the third eye and iritis and hyphaema with late formation of the anterior chamber in the fourth eye were associated with failure of control of ocular tension. There were 11 cases of hypotony at the final follow-up in this group.

The group operated on by the peripheral iridencleisis technique included 9 eyes with subacute angle-closure glaucoma in which tension had been controlled by miotics pre-operatively. In all these cases tension remained under control post-operatively. Perhaps peripheral iridectomy would have been adequate in these cases as most of the angle had opened out by medical treatment. In the remaining 20 eyes, which were of chronic angle-closure and simple glaucoma, tension failed to be controlled in 11 (55 per cent.). The pre-operative range of tension in this group also was 27 to 80 mm. Hg. The immediate post-operative fall of tension was, however, not as dramatic as in the first two techniques (Fig. 4). The most obvious cause of more failures with this technique was very thin iris incarceration as found on gonioscopy. There was only one case of hypotony in this group at the final check-up.

With the fourth technique, i.e., iridencleisis with sclerectomy, only 6 eyes were operated upon and as the incidence of post-operative complications was found to be high, this technique was not pursued further. Tension failed to be controlled in 2 of the 6 eyes (23.3 per cent.), late formation of the anterior chamber and button-holing of the conjunctiva being the apparent causes of failures. In 3 eyes (50 per cent.) hypotony persisted throughout the period of observation and lenticular opacities progressed rapidly in 5 cases (83.3 per cent.).

D. Filtering Blebs

For the purposes of description filtering blebs were divided into five types according to their appearance. Diffuse oedema of the conjunctiva over the iris inclusion was called type I. A well-functioning succulent bleb with definite though still-sloping margins was called type II. Type III bleb was a strictly localized multiloculated transparent bleb. In type IV, marked cicatrization over the bleb, which had a thick roof, was evident. Type V meant no apparent bleb at all. The state of filtration bleb obtained with different techniques is given in Table IV.
TABLE IV
STATE OF FILTERING BLEBS IN DIFFERENT TECHNIQUES

<table>
<thead>
<tr>
<th>Bleb Types:</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-limb iridencleisis</td>
<td>1</td>
<td>26</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>36</td>
</tr>
<tr>
<td>Two-limb iridencleisis</td>
<td>1</td>
<td>24</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>Peripheral iridencleisis</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Iridencleisis with sclerectomy</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>58</td>
<td>5</td>
<td>4</td>
<td>34</td>
<td>106</td>
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<tr>
<td>Tension controlled</td>
<td>5</td>
<td>58</td>
<td>4</td>
<td>1</td>
<td>18</td>
<td>86</td>
</tr>
<tr>
<td>Tension uncontrolled</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

With the first and second techniques, i.e., one- and two-limb iridencleisis, good succulent blebs (types I and II) were obtained in a large majority of eyes (27 and 25 eyes respectively). Lack of formation of any apparent bleb was encountered only in 7 and 5 eyes respectively in the two techniques. In peripheral iridencleisis, however, good succulent blebs were obtained only in 8 of the 29 eyes and no blebs were evident in as many as 20 eyes operated on by this technique, indicating that this technique in our hands did not achieve sufficient filtration.

E. Post-operative Gonioscopy

Gonioscopically the most common factors associated with failure were: (1) too thin and too tenuous inclusions, as seen in most of the cases of peripheral iridencleisis (Table V), and (2) too forward an inclusion. Extension of goniosynechiae or formation of fresh goniosynechiae was almost always associated with late formation of anterior chamber, but it did not appear to affect the ultimate outcome so far as control of tension was concerned.

Regarding our observations on the relation of the site of iris incarceration with the lack of tension control, although in individual cases we could not form any opinion by considering the series as a whole and disregarding the other contributing factors, we found (Table VI) that the incidence of failure was higher (47 per cent.) with inclusions taking place in front of the line of Schwalbe than it was (12.3 per cent.) in those where iris inclusion was at or behind the line of Schwalbe. Thickness of inclusion was found to play a significant part, as discussed already. Patent clefts

TABLE VI
RELATIONSHIP OF SITE OF INCARCERATION AND LACK OF TENSION CONTROL

<table>
<thead>
<tr>
<th>Gonioscopy not Done</th>
<th>Site of Incarceration</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At or behind Schwalbe's Line</td>
<td>In front of Schwalbe's Line</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>81</td>
</tr>
<tr>
<td>Tension uncontrolled</td>
<td>2</td>
<td>10 (12.3 per cent.)</td>
</tr>
</tbody>
</table>
### Table V
**Details of Cases in which Tension remained uncontrolled**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Eye</th>
<th>Age</th>
<th>Sex</th>
<th>Glaucoma</th>
<th>Operation</th>
<th>Tension in mm. Hg</th>
<th>Complications</th>
<th>Bleb Type</th>
<th>Gonioscopic Inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>R</td>
<td>40</td>
<td>F</td>
<td>Closed angle</td>
<td>One-limb Iridencleisis</td>
<td>45</td>
<td>Malignant glaucoma</td>
<td>V</td>
<td>Thin at Schwalbe’s line</td>
</tr>
<tr>
<td>26</td>
<td>L</td>
<td>60</td>
<td>M</td>
<td>Open angle</td>
<td>One-limb Iridencleisis</td>
<td>50</td>
<td>Button-holing conjunctivitis</td>
<td>V</td>
<td>Thick at Schwalbe’s line</td>
</tr>
<tr>
<td>44</td>
<td>R</td>
<td>55</td>
<td>M</td>
<td>Closed angle</td>
<td>One-limb Iridencleisis</td>
<td>43</td>
<td>Iritis</td>
<td>III</td>
<td>Thick at Schwalbe’s line</td>
</tr>
<tr>
<td>27</td>
<td>R</td>
<td>50</td>
<td>F</td>
<td>Closed angle</td>
<td>Two-limb Iridencleisis</td>
<td>80</td>
<td>Hyphaema</td>
<td>IV</td>
<td>Thick behind Schwalbe’s line L6, ciliary processes displaced forwards</td>
</tr>
<tr>
<td>34</td>
<td>L</td>
<td>70</td>
<td>F</td>
<td>Open angle</td>
<td>Two-limb Iridencleisis</td>
<td>42</td>
<td>Iritis, late anterior chamber formation, diabetes</td>
<td>IV</td>
<td>Thick in front of Schwalbe’s line</td>
</tr>
<tr>
<td>40</td>
<td>R</td>
<td>50</td>
<td>F</td>
<td>Closed angle</td>
<td>Two-limb Iridencleisis</td>
<td>45</td>
<td>Hyphaema</td>
<td>IV</td>
<td>Thick at Schwalbe’s line</td>
</tr>
<tr>
<td>62</td>
<td>R</td>
<td>60</td>
<td>M</td>
<td>Closed angle</td>
<td>Two-limb Iridencleisis</td>
<td>52</td>
<td>Hyphaema, iris, late anterior chamber formation</td>
<td>V</td>
<td>Gonioscopy not done</td>
</tr>
<tr>
<td>4</td>
<td>R</td>
<td>55</td>
<td>M</td>
<td>Closed angle</td>
<td>Peripheral Iridencleisis</td>
<td>55</td>
<td>Hyphaema</td>
<td>V</td>
<td>Thin in front of Schwalbe’s line</td>
</tr>
<tr>
<td>24</td>
<td>R</td>
<td>55</td>
<td>F</td>
<td>Open angle</td>
<td>Peripheral Iridencleisis</td>
<td>29</td>
<td></td>
<td>V</td>
<td>Thin at Schwalbe’s line</td>
</tr>
<tr>
<td>3</td>
<td>R</td>
<td>50</td>
<td>F</td>
<td>Open angle</td>
<td>Peripheral Iridencleisis</td>
<td>55</td>
<td></td>
<td>V</td>
<td>Thin at Schwalbe’s line</td>
</tr>
<tr>
<td>34</td>
<td>R</td>
<td>70</td>
<td>M</td>
<td>Open angle</td>
<td>Peripheral Iridencleisis</td>
<td>45</td>
<td>Iritis</td>
<td>V</td>
<td>Thin in front of Schwalbe’s line</td>
</tr>
<tr>
<td>35</td>
<td>R</td>
<td>38</td>
<td>M</td>
<td>Closed angle</td>
<td>Peripheral Iridencleisis</td>
<td>40</td>
<td></td>
<td>V</td>
<td>Thin in front of Schwalbe’s line</td>
</tr>
<tr>
<td>37</td>
<td>L</td>
<td>48</td>
<td>F</td>
<td>Closed angle</td>
<td>Peripheral Iridencleisis</td>
<td>47</td>
<td></td>
<td>V</td>
<td>Gonioscopy not done</td>
</tr>
<tr>
<td>49</td>
<td>R</td>
<td>58</td>
<td>F</td>
<td>Open angle</td>
<td>Peripheral Iridencleisis</td>
<td>35</td>
<td></td>
<td>V</td>
<td>Thin at Schwalbe’s line</td>
</tr>
<tr>
<td>51</td>
<td>L</td>
<td>65</td>
<td>F</td>
<td>Open angle</td>
<td>Peripheral Iridencleisis</td>
<td>38</td>
<td></td>
<td>V</td>
<td>Thin behind Schwalbe’s line</td>
</tr>
<tr>
<td>55</td>
<td>L</td>
<td>50</td>
<td>M</td>
<td>Closed angle</td>
<td>Peripheral Iridencleisis</td>
<td>43</td>
<td></td>
<td>V</td>
<td>Thin in front of Schwalbe’s line</td>
</tr>
<tr>
<td>58</td>
<td>R</td>
<td>60</td>
<td>F</td>
<td>Open angle</td>
<td>Peripheral Iridencleisis</td>
<td>35</td>
<td></td>
<td>V</td>
<td>Thin in front of Schwalbe’s line</td>
</tr>
<tr>
<td>59</td>
<td>R</td>
<td>50</td>
<td>F</td>
<td>Closed angle</td>
<td>Peripheral Iridencleisis</td>
<td>44</td>
<td></td>
<td>V</td>
<td>Thin in front of Schwalbe’s line</td>
</tr>
<tr>
<td>9</td>
<td>R</td>
<td>80</td>
<td>M</td>
<td>Open angle</td>
<td>Sclerectomy Iridencleisis</td>
<td>42</td>
<td>Button-holing conjunctivitis, late anterior chamber formation</td>
<td>V</td>
<td>Thick in front of Schwalbe’s line</td>
</tr>
<tr>
<td>13</td>
<td>R</td>
<td>55</td>
<td>M</td>
<td>Open angle</td>
<td>Sclerectomy Iridencleisis</td>
<td>55</td>
<td>Late anterior chamber formation</td>
<td>V</td>
<td>Thick at Schwalbe’s line</td>
</tr>
</tbody>
</table>
in the region of the limbal wound were seen gonioscopically only in 6 eyes and in all of these tension was controlled. Presence of demonstrable gonioscopic cleft, however, is not essential for the tension to be controlled.

Conclusion

We could find only two reports in the literature on comparative evaluation of different techniques of iridencleisis operations. Van Beuningen and Gunther (cited by Lugossy, 1960) carried out different modifications of iridencleisis in 163 patients. The techniques employed were: (1) Holth’s and Pillat’s iridencleisis in 55 eyes; (2) peripheral iridencleisis in 28 eyes; and (3) one-limb iridencleisis in 80 eyes. Both ab externo and keratome incisions were employed. They found that the success rate with all techniques was almost the same, but came to the conclusion that the ab externo approach for the limbal incision was the best. They also considered the presence of a gonioscopically visible cleft at the site of the incision to be necessary for successful results. Troutman (1955) compared one- and two-limb iridencleisis and found that of 159 eyes in which iridencleisis was performed, tension was controlled in 90 per cent. of cases of the 54 eyes with two-limb iridencleisis and in only 69 per cent. of 105 eyes in which one-limb iridencleisis was done. We have arrived at the following conclusions from our observations:

(1) Technically, one-limb iridencleisis was the easiest, and peripheral iridencleisis the most difficult operation to perform. The main problem with peripheral iridencleisis was the difficulty in fashioning an adequately thick peripheral slip of iris while preserving the pupil, which was semi-dilated. This difficulty should diminish if miosis is maintained up to the time of surgery.

(2) Control of tension. It is the general impression that peripheral iridencleisis should be performed when the degree of rise of tension is small, one-limb iridencleisis when it is of moderate degree, and two-limb iridencleisis when tension is very high (Topalis and Roussos, 1959). In this series we have not been able to confirm this view. We have observed no relation between the failures with different techniques and the level of pre-operative tension. One-limb iridencleisis could deal effectively with a tension range of 27–80 mm. Hg. The average degree of fall of intra-ocular pressure obtained with one-limb and two-limb iridencleisis was almost the same, being 26.7 mm. Hg and 27.1 mm. Hg respectively. The rate of control of ocular tension in one-limb and two-limb iridencleisis was 91.7 per cent. and 88.6 per cent. respectively. As far as the average fall of tension and success rate is concerned there is nothing to choose between the two techniques. Figures for iridencleisis with sclerectomy are not reliable, as only 6 cases were operated on by this technique. In peripheral iridencleisis success rate was very low—45 per cent. Thus, from the point of view of success rates, cases of one-limb and two-limb iridencleisis fared equally well, but far better than cases of peripheral iridencleisis.

(3) Post-operative complications. On the whole, incidence of serious post-operative complications was much less with peripheral iridencleisis than with other techniques (see Table III), and but for the inadequacy of filtering channels achieved, this technique would have been the most desirable one. Of the one-limb and two-limb iridencleisis, the incidence of complications, for example, of iritis, updrawn
MODIFIED TECHNIQUES OF IRIDENCELISIS

pupil, hyphaema, late formation of anterior chamber, visual deterioration, and progression of lenticular opacities, was definitely higher with the latter technique. Thus, considering all the factors, including technical difficulties, rate of control of tension, and post-operative complications, one-limb iridencleisis was found to be the best of the techniques studied in the series.

Taking the series as a whole, we have made certain additional observations which can be summed up as follows.

Complications encountered at the operation table were negligible in all the techniques employed, as compared with reports of other authors. We believe that an ab externo vertical scratch incision given at the posterior limit of the external limbus was responsible for the operative safety of the procedures. Button-holing of the conjunctiva was the only operative complication worth mentioning, and this can happen in any operation requiring preparation of a conjunctival flap. This complication, nevertheless, is a very serious one, and is one main cause of failure of the operation. An analysis of the causes of operative failures in the series as a whole (see Table V) showed that the commonest complications were associated with incarceration of the iris, hyphaema, button-holing of the conjunctival flap, iritis, and late formation of the anterior chamber.

In our experience extreme constriction of the visual fields, even to the point of involving loss of fixation, is no contra-indication to anti-glaucoma surgery if tension cannot be kept down to a safe level with miotics.

Summary

Results of four different modifications of the iridencleisis operation in 106 eyes with primary glaucoma have been compared. The modified techniques employed are one-limb and two-limb iridencleisis, peripheral iridencleisis, and iridencleisis with sclerectomy.

Technically, one-limb iridencleisis is much simpler than the other techniques. The rate of control of tension is almost the same with one-limb and two-limb iridencleisis, i.e., 91.7 per cent. and 88.6 per cent. respectively, while the success rate with peripheral iridencleisis is much lower. The incidence of post-operative complications, however, is greater in two-limb iridencleisis than in one-limb iridencleisis. Therefore one-limb iridencleisis has been found to be the best out of the techniques employed and can deal effectively with tension ranges of 27–80 mm. Hg.

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