MULTIPLE METHODS TECHNIQUE FOR INTRA-CAPSULAR CATARACT EXTRACTION*

BY

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COGAN, Symons, and Gibbs (1959), Ainslie (1959), Townes (1960), Murray and Drance (1960), Moore (1961), Pahwa (1961), Barraquer (1961), and others have noticed that, after the use of alpha-chymotrypsin (Barraquer, 1958) in intra-capsular cataract extraction in patients above 25 years of age, although the lens was easily removed, there was an increased incidence of post-operative complications, including delayed healing of the wound, delayed formation of the anterior chamber, and greater liability to iris prolapse, secondary glaucoma, hyphaema, and striate keratitis. These complications are due to the effect of the enzyme on the corneal and sceral lips of the wound, on the cut ends of the blood vessels, and on the corneal endothelium. The use of the enzyme in intra-capsular lens extraction is not advisable in patients under 20 years of age not only on account of these complications, but because there is great liability of vitreous loss in that the enzyme does not affect the strong hyalo-capsular ligament at that age.

To have fewer post-operative complications Arruga (1958), Vail, Schwartz, Schwartz, Sallmann, Maumenee, Troutman, Corwin, and Israel (1960), and others have advised that the enzyme should be used in a concentration of 1:10,000. Barraquer (1961) advised that the enzyme should be quickly washed from the area of the wound and that it should be used for patients over 60 years of age only when the zonule was strong. Paufique (1959) recommended the use of the enzyme only in cases with unusual zonular resistance. Hill and Barraquer (1962) injected under the iris at 6 o'clock two drops of enzyme 1:5000 which was thoroughly washed away after 2 minutes thus giving a limited zonulolysis down to allow an easy tumbling procedure, but it is difficult to understand how 2 drops of the enzyme fluid can affect the zonule down without also affecting the rest of the zonule, corneal endothelium, wound edges, and cut ends of blood vessels.

Experience of one hundred intra-capsular immature and mature cataract extractions in patients between 30 and 70 years of age using the 2 drops of enzyme at 6 o'clock as a routine before the lens extraction was followed by an increased incidence of post-operative complications as will be described later. The Smith expression method increases the incidence of vitreous loss. The non-toothed capsule forceps or suction-cup method increases the incidence of ruptured lens capsules. The following multiple methods technique uses the advantages and avoids the disadvantages of the various lens extraction techniques and so achieves fewer operative and post-operative complications.

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Multiple Methods Technique

A 4-mm. conjunctival flap is dissected attached to the upper part of the limbus. 180° keratome scissors limbal section up is performed. Three border-to-border corneo-scleral sutures are placed at 10, 12, and 2 o’clock but not tied. A key-hole iridectomy is performed. A conjunctival traction suture allows the surgeon to see the anterior lens surface.

As in expression method of Smith (1926) pressure with a strabismus hook is moved along 180° lower limbal arc, and an equal counter-pressure in the opposite meridian is applied to the upper lip of the wound. The degree of pressure and counter-pressure depends on what is occurring to the lens; it gives an idea about the strength of the zonule and effects subluxation of the lens by partial zonulotomy.

1. In 75 per cent. of cases, the upper pole of the lens presents in the wound, denoting a weaker zonule above.
2. In 18 per cent. of cases, the lower pole of the lens presents first, denoting a weaker zonule below.
3. In 1 per cent. the lens capsule ruptures.
4. In 6 per cent., after 3 minutes pressure and counter pressure, the lens shows no tendency to subluxation, indicating a resistant zonule.

Once lens subluxation occurs, the expression extraction method is changed to the non-toothed capsule forceps method. The capsule forceps must not be applied to the lens capsule unless the lens is subluxated and the weaker part of the zonule noted. In case (1) the forceps are applied to hold the upper anterior surface of the capsule (Verhoeff, 1927; Kirby, 1938) to deliver the upper pole first. In case (2) the capsule forceps are applied to hold the lower anterior surface of the lens capsule and the lens is delivered by tumbling (Arruga, 1933). In both cases the capsule forceps held in the surgeon’s left hand are applied transversely to hold the lens capsule, and the strabismus hook is held in the right hand to press the lower limbus. In 10 per cent. of these cases, however, the capsule is slippery and cannot be held by the capsule forceps, and the extraction is then completed by the suction-cup of Barraquer (1921), tumbling the lens or extracting the upper lens pole first according to the site of lens subluxation.

Extraction by forceps or suction cup by either method is performed with the hand movements described by Kirby (1949):

(a) The lens is raised from near the subluxation site. If the capsule is seen to be much stretched, to avoid capsule rupture, less traction is applied to the capsule and more lower limbal pressure is applied to help zonulotomy.

(b) The subluxated pole of the lens being raised, the lens is rotated slowly along its anterior-posterior axis on either side assisted by gentle pressure opposite to the traction force. This gives an idea of the strength of the zonule on either side.

(c) Another important hand movement is the following: The subluxated lens
pole being elevated, the lens, rotated from the weaker to the stronger side of the zonule, is also tilted on its vertical axis thus assisting zonulotomy and hyalocapsular ligament separation.

When half the lens is out of the wound, the conjunctival traction suture is released, strabismus hook lower pressure following the lens becomes minimal, and the lens is delivered by traction as in the third described movement.

In the fourth group of 6 per cent. cases in which the zonule is very resistant to mechanical indirect zonulotomy by external pressure and counter-pressure and when direct zonulotomy (Kirby, 1943) is contraindicated, a minimal amount of a low concentration of alpha-chymotrypsin is used for a very short time. Two drops of 1:7000 enzyme are injected below the iris at 6 o'clock. Immediately lower limbal pressure and upper scleral wound lip counter-pressure are applied to subluxate the lens. Once the lens is subluxated from above or below, the enzyme must be thoroughly washed out and the lens extraction is then continued by the multiple methods technique as described above. The enzyme must not be left in the eye more than 2 minutes.

The operation ends by reposition of the iris pillars and tying the three corneo-scleral sutures.

The incidence of complications in 100 cases treated by the multiple methods technique and 100 cases treated by 2 drops A.C.T. 1:5000 injected below the iris at 6 o'clock, washed out after 2 minutes, followed by extraction with capsule forceps is shown in the Table.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Method</th>
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<tbody>
<tr>
<td></td>
<td>Multiple</td>
</tr>
<tr>
<td>Vitreous loss</td>
<td>4</td>
</tr>
<tr>
<td>Rupture of lens capsule</td>
<td>5</td>
</tr>
<tr>
<td>Delayed wound healing and anterior chamber formation for 3 weeks</td>
<td>3</td>
</tr>
<tr>
<td>Post-operative</td>
<td>Enzyme Only</td>
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<tr>
<td>Prolapse of iris pillar 1st week</td>
<td>2</td>
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<tr>
<td>4th week</td>
<td>0</td>
</tr>
<tr>
<td>Secondary glaucoma</td>
<td>2</td>
</tr>
<tr>
<td>Hyphaema on 6th day, lasting one week</td>
<td>3</td>
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</tbody>
</table>

**Discussion**

In the multiple methods technique for lens extraction in patients above 30 years of age, external pressure and counter-pressure are used as in the Smith method not to extract the lens but only to subluxate the lens and to
find the weakest part of the zonule from which lens extraction is continued by capsule forceps or suction cup. It is important to know the weakest part of the zonule, because if the zonule is weak below lens extraction holding the lens capsule from above becomes more difficult and vice versa; the extraction will need more pressure from below with the possibility of vitreous loss, and more traction on the capsule from above with the possibility of rupture. Alpha-chymotrypsin is not used unless the zonule is very resistant as tested by external pressure.

Summary

(1) A multiple methods technique for intra-capsular cataract extraction in patients above 30 years of age is described. It is superior to other routine methods, including zonulolysis with alpha-chymotrypsin before lens extraction, non-toothed capsule forceps holding the anterior lens capsule from above or from below, suction-cup tumbling, head-first manoeuvres, or the expression technique. The method is decided during the operation after the following have been ascertained:

(a) The resistance of the lens zonule and its weakest part is found by external pressure (indirect mechanical zonulotomy).

(b) Whether the lens capsule is slippery or not is found by trying to hold it from the subluxated side with the non-toothed capsule forceps.

(2) Surgical dexterity is required according to each individual case to apply the necessary external pressure and lens elevation, traction, and rotation to break the lens zonule and hyalo-capsular ligament without rupturing the lens capsule or hyaloid membrane. This cataract extraction procedure is accompanied by the fewest complications.

(3) Alpha-chymotrypsin is only used if the zonule is found to be very resistant during the course of the operation.

REFERENCES