Communications

Cataract aspiration-irrigation

through separate needles with push-pull syringes

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In recent years, new methods for extracting pre-senile cataracts, particularly congenital ones, have been introduced. Two new basic principles seem to be applied (excluding the standard methods of capsulotomy, and of capsulectomy with irrigation of soft lens matter):

I. ASPIRATION ALONE Scheie (1960), Scheie, Rubinstein, and Kent (1966), Hogan (1966, 1967; Rice, 1967; and others). See also Maumenee and Ryan (1969)

II. IRRIGATION-ASPIRATION

(a) *Equal volumes*

- (i) In and out needles together: Fuchs (1952, 1962), Fink and Weinstein (1964), Atchoo (1968)
- (ii) In and out needles separate: None

(b) *Variable volumes*

- (i) In and out needles together: Ferguson (1964), O'Gawa (1967), Bruun-Jensen (1969)
- (ii) In and out needles separate: Girard (1967).

Ryan, Blanton, and von Noorden (1965) favour repeated aspiration followed by irrigation, and Middleton (1962) aspiration with intermittent filling. Harcourt and Wybar (1969) do repeated irrigation with occasional aspiration when necessary. Drews (1965) describes a special lavage needle which he uses to wash out lens matter.

Our technique fits into category II (a) (ii) in the above tabulation and differs from all the others in two ways:

- (1) Using a different method of irrigation-aspiration which drives in and sucks out exactly equal volumes by means of a reciprocating push-pull arrangement
- (2) Combining this with the use of separate input and output needles.

(1) **Reciprocating push-pull system**

Bill (1965) has devised a method for the complete mixing of solutions in the anterior

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chamber. A very similar system is used in this technique (Fig. 1). Two identical disposable syringes are arranged so that the plunger of each is fixed in positions B and D, while the barrels of each are attached to the moveable plate A. When the handle C of the apparatus is turned in one direction, the screw thread K on the central rod will cause the plate A to move so that *one syringe empties by exactly the same volume as the other syringe fills*; movement of the handle in the other direction reverses the flow. The anterior chamber maintains exactly the same depth in the absence of accidental leakage and to the observer seems remarkably undisturbed although quite large volumes of fluid are passing through it. Of course the two *syringes* must have the same diameter in order to achieve equal exchange of volume but the needles and tubing may have quite different gauges. We have tended to use two 20-ml. disposable syringes.

FIG. 1 *Diagram of push-pull apparatus*

- A Moveable plate with attached barrels of syringes
- B Clamp to hold plunger or irrigation syringe
- C Crank-shaft handle
- D Clamp to hold plunger of aspiration syringe
- E Screw incorporated into clamp B to give independent movement of irrigation syringe
- F Luer fitting of output cannula
- G Narrow lacrimal cannula attaching input tubing to syringe
- H Portex nylon cannula
- J Polythene input tubing
- K Screw-thread on crank-shaft
- L Base plate

When Handle C is cranked, the screw-thread K turns and moves the transverse plate AA in one direction, with the result that exactly the same volume of fluid is aspirated into one syringe as is ejected from the other. Note Screw E

At the beginning of the operation the syringes are fitted to the apparatus as in Fig. 1. The tubing with the needles and adaptors are then attached to the syringes. The system is filled with saline and all air is eliminated. The input syringe should be practically full while the receiving one should be almost empty. A separate screw E has been incorporated into the clamp holding the plunger of the input syringe so that fluid can be ejected or aspirated independently of the movement of the crank handle; accordingly, if the depth of

the anterior chamber should change for any reason, it can easily be restored to normal. The heavy base plate L is useful for stability and the machine rests on a trolley near the head of the patient and is operated by an assistant. The speed of turning the crank-handle can be varied to the order of the operator who sits at the side of the patient's head.

(2) Separate input and output needles

Because security and speed of healing may be improved by the use of two separate small limbal punctures in contrast to the use of one large incision-puncture, a double needle has been avoided. The input needle can have a small gauge and we have used number 25

FIG. 2 *Method of aspirating/irrigating congenital and traumatic cataracts*

(1) Deep limbal fixation sutures inserted temporally and inferiorly followed by limbal scratch incisions (N.B. The sutures should be inserted at right angles to limbus, not tangentially as shown) (3) Aspiration needle inserted temporally into anterior chamber (5) Lens matter aspirated by push-pull	(2) Irrigation needle inserted inferiorly through preliminary limbal scratch incision into anterior chamber (4) Aspiration needle passed through anterior capsule into lens substance (6) Postoperative appearance

standard wire gauge. The output needle need not be large and we have found a number 23 gauge adequate. Two *deep* limbal fixation sutures are inserted inferiorly and temporally (Fig. 2.1). Tiny preliminary grooves are made into peripheral cornea with a broken razor blade or Bard-Parker No. 11 knife on one side of each fixation suture which is held with angled suture-tying forceps (Phillips, 1968). The small input needle is passed into the anterior chamber inferiorly (Fig. 2.2), while the larger output needle is inserted temporally (Fig. 2.3) and pushed through the anterior lens capsule into the lens matter (Fig. 2.4). This manoeuvre can easily be modified to produce any pattern of capsulotomy followed by disruption of lens matter as judged necessary by the state of the lens. The finger and thumb are reasonably convenient for inserting and holding these needles but purpose-designed forceps are being evolved. Each needle is directed towards the centre of the eye during penetration of the cornea, but should be parallel to the iris subsequently. There is danger of engaging iris on the point of the needle during this manoeuvre but it can be minimized if the depth of the anterior chamber is maintained by the use of the separate screw incorporated into the plunger of the input syringe. Soft lens matter is now swept into the output needle by the flow of saline from the input needle, by the turning of the crank handle (Fig. 2.5). When all possible lens matter has been removed, the output needle should be the first to be withdrawn so that the final depth of the anterior chamber can be adjusted *via* the input needle. An operating microscope facilitates the operation.

The "chop-sticks" manoeuvre

Much of the soft lens matter enters the output needle merely with the flow of saline between the two needles, and some lens matter can be "chased" into the output needle by directing the stream from the input needle. It is sometimes surprising how unwilling the lens matter is to enter the output needle; however, the input needle can be used to lever clouds of soft lens matter onto the aspiration needle. For this purpose, the axis of the input needle is best inserted at right-angles to the other. Girard (1967) has described a similar method. It is probably best to carry out this technique while flow is temporarily stopped, as this economizes in fluid.

Technique for making needle-tubing combination

The input needle has a No. 25 gauge and the output needle a No. 23 gauge; they are "disposable". In order to remove the steel needle stem from the plastic Luer end, each is grasped firmly but not tightly with pliers (Fig. 3). An assistant applies the flame of a match or cigarette lighter to the area where the plastic fitting joins the steel needle and the latter is pulled away. The blunt end of the No. 23 gauge output needle is inserted into the distal end of a Portex nylon intravenous cannula of diameter 1.34 mm. and length 30 in., and tied with silk or terylene. The advantage in using the Portex cannula is that the proximal end is a Luer fitting which can be immediately attached to the output syringe.

The blunt end of the 25 gauge input needle is inserted into one end of a 30 in. length of polythene tubing, internal diameter 0.50 mm., and tied. A narrow lacrimal cannula is inserted into the other end of the polythene tubing and this is attached to the input or injection syringe. Saline is therefore injected from the input syringe into the anterior chamber *via* the lacrimal cannula, the polythene tubing, and the input needle.

The push-pull machine and Portex nylon cannula can be autoclaved but the polythene tubing cannot be so sterilized. Polythene tubing with the attached needles should preferably be sterilized by gamma-radiation. As a secondary method it *can* be boiled,

BUT no pressure should be applied during this process or while the tubing is hot as this will cause distortion.

Discussion

With some practice the method described has been found fairly easy to use, safe, and superior to other methods we have used in congenital and traumatic cataracts. We have done fifteen operations so far, after some experiments on rabbit and eye-bank eyes. Only one operation has been regarded as a failure—the unexpected hardness of some parts of a traumatic cataract in a man of 56 years defeated the technique, but conversion to an ordinary extracapsular operation through a small limbal incision was fairly easy. The patients have all had quiet eyes and have been discharged from hospital sooner than usual.

The main disadvantage of a technique of aspiration alone would seem to be the hypotensive distorted eye even if only transient. It seems reasonable to suggest that the addition of an inflow needle with physiological saline has so few disadvantages that they must be far outweighed by the advantages.

Two separate operations, one for capsulotomy followed by one for aspiration and/or irrigation, are a serious imposition, especially in a young child, in spite of modern techniques of anaesthesia. A major advantage of this procedure is that the number of anaesthetics is reduced usually to one because capsulotomy is part of the initial stage in the operation; occasionally a supplementary posterior capsulotomy may be necessary.

Probably a defect in the above method is the absence of an iridectomy. However, this could be done at the end of the aspiration-irrigation. It may be feasible to perform an iridotomy (without iridodialysis) with the point of one of the needles, or the points of both

may be used to achieve a sphincterotomy or sphincterotomies. With the present method of inserting the needles, it would be difficult to fashion a pupil by the Franceschetti corepraxy as discussed by Maumenee and Goldberg (1965).

A satisfactory sector iridectomy would aid the full examination of the retina in the long-term future, when retinal detachment may occur. Chandler (1968) has described good results from the classical extracapsular type of operation and it may be that this well-tried method should remain standard; however, there is probably more potential danger of serious complications than with the method described here—subject to the assessment of a larger series of cases over a longer period than we have done so far.

Some distortion of the lens-suspensory ligament by these manoeuvres is still unavoidable, but it is probably less than in other types of operation. It may well be possible to insert the needles through the cornea with a cannula gun such as that described by Sears (1960).

Possible future developments

Kelman (1967) has described an ultrasonic vibrating probe to disintegrate sclerotic lens matter. An attempt is being made to incorporate a microdrill, preferably rotating at ultrasonic speeds, into our present push-pull apparatus to break up cataracts of the senile type (Phillips, Wang, and Pullan, 1970). Another possible method for applying the aspiration-irrigation principle to senile cataracts would be to add the microexplosion produced by a spark gap (see Watson, 1970).

Summary

A reciprocating push-pull system (see Fig. 1) can achieve exactly equal volumes for irrigation and aspiration of congenital or traumatic cataracts. The two syringes must be identical (*e.g.* disposable 20 ml.). The machine lies on a trolley and is operated by an assistant.

Separate input and output needles, 25 and 23 standard wire gauge respectively, are used. The connection between the irrigating 25 gauge needle and syringe is made by polythene tubing while that between the aspirating 23 gauge needle and syringe is made by a Portex nylon intravenous cannula (30 in.). Disposable needles are detached from their plastic Luer ends by means of heating in a match flame and easily tied into the end of the tubing. The polythene tubing is fed over a lacrimal cannula which in turn is pushed firmly onto the nozzle of the input syringe while the Portex nylon cannula has a Luer end which can be attached directly onto the output syringe.

The advantages of this method as observed in fifteen patients so far treated are:

- (a) Safety in that a more "open" operation is avoided
- (b) Only one definitive anaesthetic and operation is required
- (c) Speedy convalescence and "quiet" eyes with early discharge from hospital.

The main disadvantage may be the absence of a sector iridectomy.

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Addendum

It is possible, especially when first using the push-pull machine, that the operator may use up the saline before all the lens matter has been irrigated-aspirated. A plastic 3-way stopcock (K75 by Pharmaseal Laboratories, Glendale, California 91201) between the nozzle of each syringe and its tubing allows the syringes to be isolated from the eye and emptied (in the case of the recipient) or re-filled (in the case of the donor) if necessary.