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Ocular Irrigating Solutions: A Comparison Between Balanced Salt Solution and L-410 (PO-EIS)

Philip C. Hessburg, MD,* and Paul M. Johnston, MD†

The ability of two ocular irrigating solutions to reduce postoperative corneal edema after intracapsular cataract extraction was compared using ultrasonic pachymetry. All patients had anterior chamber intraocular lenses implanted. The solutions were balanced salt solution and solution L-410 (PO-EIS), an eye irrigation solution containing dextran 40 and bicarbonate. Corneas irrigated with either solution showed no significant difference in postoperative edema. The use of L-410 (as an alternative to balanced salt solution) may not be necessary in intracapsular cataract extraction. (Henry Ford Hosp Med J 1987;35:262-3)

In each of over 1 million intraocular surgical procedures performed annually in the United States, some manipulation of the cornea (and trauma to the endothelium) occurs. Mild damage may be partially overcome by repair of the endothelial cells, but extensive cell loss can lead to corneal decompensation. Maintaining viable endothelial cells during and after intraocular surgery has great importance.

A variety of solutions have been used for extraocular or intraocular irrigation or for infusion during ophthalmic surgery (1-5). A physiologic saline solution containing essential cations plus glucose is adequate for short-term maintenance of corneal endothelial function. A bicarbonate buffer appears helpful, but other additives such as glutathione and adenosine are not yet of proven importance.

Immersion of donor corneas in 5% dextran (molecular weight 40,000) solution (McCarey-Kaufman medium TC-199) is far more effective than conventional techniques in preserving endothelial cells. Viability has been assessed by temperature reversal studies, electron microscopy (6,7), vital staining (8), metabolic studies (9), and survival of corneal grafts in rabbits (10) and cats (11). The clinical value of this dextran solution has been demonstrated in eye bank corneas prior to their use in keratoplasty (12-15).

The addition of dextran to physiologic saline solution containing glucose, calcium, and bicarbonate significantly lessened cornea and lens damage when used for irrigating or infusion in animals (16-20). A similar solution containing dextran, L-410 (PO-EIS) (Pharmacia Pharmaceutical, Inc, Piscataway, NJ), was compared to a balanced salt solution (355) (Alcon Laboratories, Inc, Fort Worth, TX) for ability to reduce corneal swelling after cataract extraction and lens implantation.

Materials and Methods

In these studies, the composition of these solutions is noted in Tables 1 and 2. Dextran is included for the potentially beneficial effect of its oncotic properties. Bicarbonate buffer may help maintain the integrity of the membrane pump. Ingredients such as sodium, potassium, calcium, and magnesium are essential cations of inorganic salts.

The study was randomized and double-masked. All patients presenting with an operable cataract were screened to determine eligibility, and informed consent was obtained. Routine preoperative and postoperative antibiotics, mydriatics, and steroids were used. Forty patients were studied.

An intracapsular cataract extraction was performed by using a cryoprobe after a shelved incision. After two peripheral iridotomies were performed, a Hessburg anterior intraocular lens was implanted using a Hessburg Lens Glide and Healon™. An average of 10 mL of irrigating solution was used on the external cornea during the procedure, while an average of 2.5 mL was used to expel Healon™ from the anterior chamber at the conclusion. Thus, the average internal and external exposure of the cornea to either of these solutions was 12.5 mL.

Central corneal thickness was measured using the same ultrasonic pachymeter. Measurements were made preoperatively and on the first and seventh postoperative days. The results were evaluated statistically using Student's t test. Because of the sample size, the sum of the squares of deviations from the two groups were combined to construct a pooled sample estimate 0j.

The pachymeter used, the Jedmed Pachysonic Ultrasonic Biometric Ruler, automatically calculates corneal thickness and averages a number of separate measurements. The instrument
automatically rejects measurements inconsistent with the majority of readings and accepts no readings until the probe is properly positioned as indicated by an audible signal.

Results

The average preoperative central corneal thickness was 0.556 mm. In patients receiving balanced salt solution during surgery, central corneal thickness increased by an average of 0.130 mm on the first postoperative day. By the seventh postoperative day, the average increase in central corneal thickness measurements was 0.086 mm (Table 3).

When L-410 (PO-EIS) was the irrigating solution used during surgery, central corneal thickness increased by an average of 0.151 mm on the first postoperative day. By the seventh postoperative day the average increase in central corneal thickness was 0.081 mm over preoperative measurements. No statistically significant difference was observed between the two groups at day one or day seven (Table 3).

Discussion

The use of PO-EIS during intracapsular cataract extraction with the implantation of an anterior chamber lens failed to reduce postoperative corneal edema.

Theoretically, the addition of dextran to irrigating solutions should produce beneficial effects because of its oncotic properties. Moreover, bicarbonate buffer in the solution should help maintain the integrity of the membrane pump. Perhaps a certain critical exposure time or volume of solution is required for these additives to produce a measurable benefit. Extracapsular cataract extraction or corneal transplantation involves a longer time of corneal exposure, as well as a larger volume of irrigating solution than does the intracapsular surgery of these patients. Conceivably, a considerably greater difference could be demonstrated for the two solutions in extracapsular cataract surgery.

References