Effect of tonography on facility of outflow

Robert A. Moses

In enucleated stored eyes facility of outflow is diminished by large corneal distortions. The radius of distortion at which decrease in facility is noted is related to the shape of the distortion. Of the three distorting devices tested, a plane surface decreased the facility at the smallest radius of distortion, a convex surface was intermediate in effect, while the Schiotz tonometer allowed the greatest radius of distortion before facility was diminished. At small distortion radii the Schiotz tonometer appeared to increase facility. Poor correlation of \( P_o \) and \( C \) at low \( P_o \) and trend of \( P_t \) to a level higher than \( P_o \) in long-term tonograms may be explained in part by the effect noted.

Tonography is a method of estimating the facility of aqueous outflow from the eye. It is conceivable that application of the tonometer to the eye may alter facility. The present study explores the effect of corneal distortion, as in tonography, on the facility of outflow.

Materials and methods

Human eyes which had been stored no longer than two days after enucleation were perfused at constant pressure with a servo-perfuser of the type described by Armaly. After facility had been determined, corneal distortion was produced by either a Schiotz tonometer, a plane surface, or a steel ball 8.73 mm. radius of curvature. Perfusion at the same pressure was continued for several minutes and facility determined. The distorting object was then removed and a third facility measurement made. The two facility determinations with no corneal distortion were averaged and compared with the facility during corneal distortion. Results are given as the ratio of facility with tonometer \( C_t \) to facility without tonometer \( C_w \).

When the Schiotz tonometer was used, plunger weight was varied. The convex and plane surfaces were mounted so that the force of each on the cornea could be varied. Perfusion pressure was varied as well. Since pressure and effective weight of distorting object were known, radius of corneal contact could be computed from \( P = \frac{W}{\pi r^2} \).

Results

The facility of outflow is undisturbed by small corneal distortions produced by plane or convex surfaces but decreases progressively with increasingly large distortions. When \( \frac{C_t}{C_w} \) is plotted against the radius of corneal distortion, it is seen that facility is reduced to 90 per cent of its uninstrumented value at a radius of 3.4 mm. in the case of the plane, and 3.8 mm. for the convex surface. In the case of the Schiotz tonometer the facility is increased to 105 per cent at 3.2 mm. radius, and falls to 90 per cent at 4.4 mm. radius of contact (Fig. 1).
Fig. 1A. Plane surface distorting cornea.

Fig. 1B. Convex surface, 8.73 mm. radius of curvature.

Fig. 1C. Schiotz tonometer.

Fig. 1. The ratio facility with tonometer \( (C_t) \) varies with the radius of contact between tonometer and cornea. A, Plane surface distorting cornea. B, Convex surface, 8.73 mm. radius of curvature. C, Schiotz tonometer.

Fig. 2. Radius of Schiotz tonometer footplate contact with cornea and effect on facility plotted on Friedenwald nomogram.
Fig. 2 shows the computed radius of distortion for the different total Schiötz tonometer weights plotted on the Friedenwald nomogram.

Discussion

Goldmann² has pointed out that while pressure and tonographically measured facility of outflow correlate well above P₀, 30 mm. Hg, the correlation below 30 mm. Hg is not good. Stepanik³ has called attention to the fact that in tonography over many minutes Pᵣ does not tend toward Pᵣ, but toward a higher level of pressure. Both of these findings may be explained, at least in part, by the present finding that as the scale reading increases facility decreases.

In any further development of facility of outflow measurement, attention must be given to the possibility of the instrumenta-

REFERENCES