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Axial Eye Length after Retinal Detachment Surgery

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A B S T R A C T

Changes in the eye axial diameter were studied to assess the eye globe impact of conventional operation for retinal detachment. The study included 69 eyes in 69 patients operated on for rhegmatogenous retinal detachment. There were 46.4% of men and 53.6% of women, mean age 52.7 (±15.21) years. Results of preoperative and postoperative ultrasonographic measurement of axial diameter are presented. The mean preoperative and postoperative eye axial diamter was 23.69 (±1.84) mm and 24.43 (±1.91) mm, respectively. Postoperative results showed the axial eye length to increase by a mean of 0.74 (±0.44) mm, yielding a statistically significant difference from the preoperative measurement ($p< 0.001$). The mean myopia induced by this eyeball elongation was 1.77 D. The encircling band with and without segmental buckling used in surgical repair of retinal detachment creates circular and segmental indentation of the eyeball, thus increasing its axial length. The myopia induced by elongation of the eyeball results in considerable myopia, which requires appropriate correction in the early postoperative period to achieve favorable vision rehabilitation.

***Key words**: retinal surgery, detachment, eye, axial length*

Introduction

Retinal detachment is pathologic separation of the neural retina from the pigment epithelium, which can develop due to various causes. Retinal detachment is most commonly underlain by retinal breaks (rhegmatogenous retinal detachment), presence of vitreoretinal traction, solid subretinal growths, and less frequently by inflammatory and exudative disorders[1]. Rhegmatogenous retinal detachment leads to the loss of visual function and requires prompt surgical therapy. There are many surgical methods used in the management of rhegmatogenous retinal detachment. In addition to the most widely used technique of scleral buckling, pneumatic retinopexy, and pars plana vitrectomy for specific indications, there also are a number of alternative methods. All these methods yield comparable postoperative results in retinal reatachement after initial procedure, and are associated with some specific complications. By closing retinal breaks and forming chorioretinal adhesions around retinal breaks, the technique of scleral buckling forms a basis for uncomplicated retinal reatachment. Furthermore, this technique is preferable for being restricted to extrabulbar procedure associated with a significantly lower rate of complications unless subretinal fluid drainage is being performed[2]. The present study included patients operated on for rhegmatogenous retinal detachment by the scleral buckling method. This surgical method consists of circular compression of the eyeball with a silicone encircling band or cerclage for the detached retina to approach the supporting layers, insertion of a silicone episcleral buckle for retinal tears closure and exocryopexy. The cerclage and episcleral buckle placement lead to eyeball deformity and decrease its transequatorial diameter[2]. Although many authors report on an increase in axial eyeball diameter following this procedure[3–6], some studies failed to confirm it[7]. Therefore, we embarked upon this prospective study to demonstrate by ultrasound A scan the postoperative change in axial eye diameter in patients operated on for retinal detachment, and consequential refraction change in these eyes.

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Patients and Methods

The prospective study included 69 eyes in 69 patients operated on for rhegmatogenous retinal detachment at University Department of Ophthalmology, Zagreb University Hospital Center, Zagreb. There were 46.4% of men and 53.6% of women, mean age 52.7 (±15.21) years. A silicone encircling band was placed equatorially circularly following conjunctival peritomy, localization of detached retina and retinal breaks. Placement of a silicone encircling band of 1.5 mm in diameter and exocryopexy were performed in all eyes. In most cases, localized compression of the eyeball with a spongy silicone episcleral graft of 5.0x7.5 mm in size was also done for retinal tear closure.

Local cycloplegic (1% atropine) was administered before the preoperative and postoperative measurement. The axial eye diameter was measured in ultrasound A scan mode on a Cilco, CA 91769 device (Pomona, USA) by probe placement directly onto the cornea with due care not to cause corneal deformity. The distance between top of the cornea and the scleral spike on the A scan mode was considered to be axial eye length. In this way we avoided incorrect measurments if macula was detached. The axial eye diameter was measured on two occasions, i.e. on the day before the procedure and on day 7 postoperatively. The mean of five measurements was taken for further analysis.

Data are presented as mean ± standard deviation (SD). Statistical analysis was done by use of *t*-test for dependent paired samples and independent samples. The level of statistical significance was set at $p<0.001$. We used a statistical package StatGraphics, version 4.2 (Wolfram research, Shrewsbury, USA).

Results

The study included 69 eyes in 69 patients operated on for rhegmatogenous retinal detachment. The minimal and maximal preoperative axial eye diameter was 20.70 mm and 32.10 mm, respectively, mean 23.69 (±1.84) mm. Postoperatively, the axial eye diameter ranged from 21.30 mm to 32.70 mm, mean 24.43 (±1.91) mm. Of 69 eyes, the axial eye diameter remained unchanged in only one eye, and increased in 68 eyes. Postoperatively, a statistically significant increase in the eyeball axial length of 0.74 (±0.44) mm was recorded ($p<0.001$) (Table 1).

A silicone encircling band was inserted in all study eyes, whereas a spongy episcleral buckle was additionally placed in 53 eyes in which retinal breaks were visible and precisely localized. In 16 eyes, retinal breaks were too small or invisible for some other reason, thus only cerclage and exocryopexy were performed. Accordingly, study eyes were divided into two groups: 16 eyes treated with encircling band alone and 53 eyes treated with encircling band and episcleral buckle. The postoperative increase in eyeball axial length was 0.61 (±0.22) mm in the former and 0.72 (±0.26) mm in the latter group of eyes. The difference between the two groups of eyes wasn't statistically significant ($p=0.116$) (Table 2).

Discussion

The change in the axial length of eyeball and consequential refraction modification were analyzed by use of direct ultrasound A scan in patients submitted to scleral buckling procedure for retinal detachment. The analysis revealed a statistically significant postoperative difference in the eyeball axial length. A statistically significant difference wasn't found between the group of eyes operated on by cerclage and buckle, and those treated with cerclage alone. Consequently, axial lenghtening was predominantly associated with used of encircling element. Considering Rubin's report (8) and applying his factor of myopia induction of 2.564 D with eye axial length increase by 1 mm to our study, the mean myopia induced in our patients was 1.77 D.

TABLE 1
PREOPERATIVE, POSTOPERATIVE AND CHANGE IN EYE AXIAL DIAMETER (MM) AFTER SCLERAL BUCKLING SURGERY FOR RETINAL DETACHMENT

Eye axial diameter	Minimal diameter	Maximal diameter	Mean in 69 eyes
Preoperative	20.70	32.10	23.69 (±1.84)
Postoperative	21.30	32.70	24.43 (±1.91)
Change	0	1.50	0.74 (±0.44)

Statistics: $t=-13.84$; $p<0.001$

TABLE 2
CHANGE IN EYE AXIAL DIAMETER IN MM ACCORDING TO OPERATIVE PROCEDURE

Operative procedure	No. of eyes	Mean axial diameter preoperatively	Mean axial diameter postoperatively	Mean change
Cerclage	16	23.56 (±1.02)	24.17 (±0.99)	0.61 (±0.22)
Cerclage + buckle	53	23.73 (±2.03)	24.45 (±2.10)	0.72 (±0.26)

Statistics: $t=-1.59$; $p=0.116$ ($p>0.001$)

Some authors report on the results comparable to ours (6), whereas others recorded greater postoperative change in axial length of the eye (5), and thus higher myopia (3). These differences could be explained by the fact that, in contrast to some other institutions, a lower rate of cerclage tightening has been preferred at our hospital. A variable degree of encircling band indentation into the eyeball interior is found in the eyes operated on at different institutions. This could in part be explained by the fact that the measurements were done by placing the probe directly onto the cornea, whereby the cornea may have been impressed in spite of the care exercised, resulting in reduced axial length thus measured. The change in refraction is evident despite this variation, and we believe that the existing myopia should be properly corrected in the early postoperative period to allow for an early vision rehabilitation. Such a protocol should definitely produce a better endpoint result in terms of both improved vision on the operated eye and of binocular vision rehabilitation.

Conclusion

The conventional operative procedure for retinal detachment, performed in 69 eyes, resulted in a mean eyeball axial length increase of 0.74 (±0.44) mm and consequentially a mean myopia induction of 1.77 D. Analysis of the groups of eyes submitted to cerclage alone, and to cerclage accompanied by episcleral buckle placement indicated that the axial lenghtening was predominantly associated with used of encircling element.

REFERENCES

1. GUYER, D. R., L. A. YANUZZI, S. CHANG, J. A. SHIELDS, W. R.GREEN.: Retina-Vitreous-Macula. (Saunders, Philadelphia, 1999). — 2. RYAN, S. J.: Retina. (Mosby, St Louis, 1994). — 3. BEEKHUIS, H., M. TALSMA, W. VREUGDENHIL, F. EGGINK, E. PEPERKAMP, J. VANMEURS, Retina, 13(1993) 120. — 4. SMIDDY, W. E., D. N. LOUPE, R. G. MICHELS, C. ENGER, B. M. GLASER, S. BUSTROS, Arch. Ophthalmol., 107 (1989) 1469. — 5. LARSEN, J. S, P. SYRDALEN, Acta Ophthalmol., 57 (1979) 337. — 6. MALUKIEVICZ-WISNIEWSKA, G., J. STAFIEJ, Eur. J. Ophthalmol., 9 (1999) 115. — 7. BURTON, T. C., B. E. HERON, K. C. OSSOINIG, Am. J. Ophthalmol., 83 (1977) 59. — 8. RUBIN, M. L., Trans. Am. Ophthalmol. Soc., 73 (1975) 452.

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PROMJENE AKSIJALNOG PROMJERA OČNE JABUČICE NAKON OPERACIJE ABLACIJE MREŽNICE

SAŽETAK

U svrhu istraživanja utjecaja konvencionalne operacije ablacije mrežnice na očnu jabučicu istraživali smo promjene aksijalnog promjera. Istraživanje je obuhvatilo 69 očiju od istog broja pacijenata operiranih zbog regmatogene ablacije mrežnice. Bilo je 46,4% muškaraca i 53,6% žena prosječne dobi 52,7 (±15,21) godina. Opisani su rezultati preoperativnog i postoperativnog ultrazvučnog mjerenja promjera očne jabučice. Prosječni preoperativni aksijalni promjer očne jabučice bio je 23,69 (±1,84) mm a postoperativni 24,43 (±1,91) mm. Postoperativna mjerenja pokazuju da je prosječno aksijalna duljina porasla za 0,74 (±0,44) mm što je statistički značajno u odnosu na preoperativna mjerenja ($p<0,001$). Prosječna miopija inducirana promjenom aksijalnog promjera očne jabučice je iznosila 1,77D. Serklaž, sa i bez lokalizirane kompresije očne jabučice sa episkleralnom plombom, izaziva cirkularnu kompresiju očne jabučice povećavajući njezin aksijalni promjer. Kratkovidnost izazvana promjenom aksijalnog promjera očne jabučice je značajna i zahtijeva ranu korekciju da bi se postigla adekvatna rehabilitacija vida.