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Visual acuity after segmental buckling and non-drainage: a 15-year follow-up

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ABSTRACT: Background: *The question addressed is: how does the postoperative visual acuity in eyes treated with segmental buckling compare over time with the paired fellow eyes?*
Methods: *107 detachments were followed prospectively for 15 years. The eyes were divided into: group I, macula attached (46); group II, macula partially detached (10); group III, macula completely detached (51). Mean preoperative visual acuity was 20/30 in group I, 20/100 in group II, and 20/400 in group III. The operation consisted of segmental buckling without drainage. No eye had cerclage or vitrectomy.*
Results: *The retina remained attached in 99 eyes during the 15-year follow-up. The mean visual acuity of all patients improved six months postoperatively to 20/40 with a maximum of 20/30 at one year. Thereafter there was a linear decrease in all three groups.*
Conclusions: *Visual acuity improved during the first year, followed by a linear decrease of 0.07 line/year. The paired eyes decreased similarly in relation to age. There was no real difference in the visual acuity of the operated and unoperated eyes (P=0.079) during the 15 years of follow-up. Mean visual acuity was 20/40 in the operated eyes of 72 patients who were living after 15 years. These data present a challenge to those surgeons who use techniques that include encircling the eye to review and compare their long-term visual results. (Eur J Ophthalmol 1995; 5: 240-6)*

KEY WORDS: Cerclage, Fellow eye, Long-term visual acuity, Non-drainage surgery, Retinal detachment, Segmental buckling

INTRODUCTION

In a previous paper (1) we reported the long-term anatomical results of 107 retinal detachments treated with segmental buckling and non-drainage. The question posed in that paper was whether late redetachment was more frequent in the absence of cerclage? The answer was no. Between 4 months and 15 years after operation the retina redetached in 6.5%, significantly less than in a comparable series with a ten-year follow-up operated upon with a cerclage (2).

This paper addresses the question: how does the postoperative visual acuity in the eyes treated with segmental buckling compare over time with the paired fellow eyes?

PATIENTS AND METHODS

Between August 6, 1979 and January 23, 1980 107 primary rhegmatogenous detachments were treated at the University Eye Clinic in Tübingen. These patients were selected from 121 consecutive patients with detachments, and according to the protocol 14 were excluded due to perforating injury, giant tear, retinopathy of prematurity, or having had previous sur-

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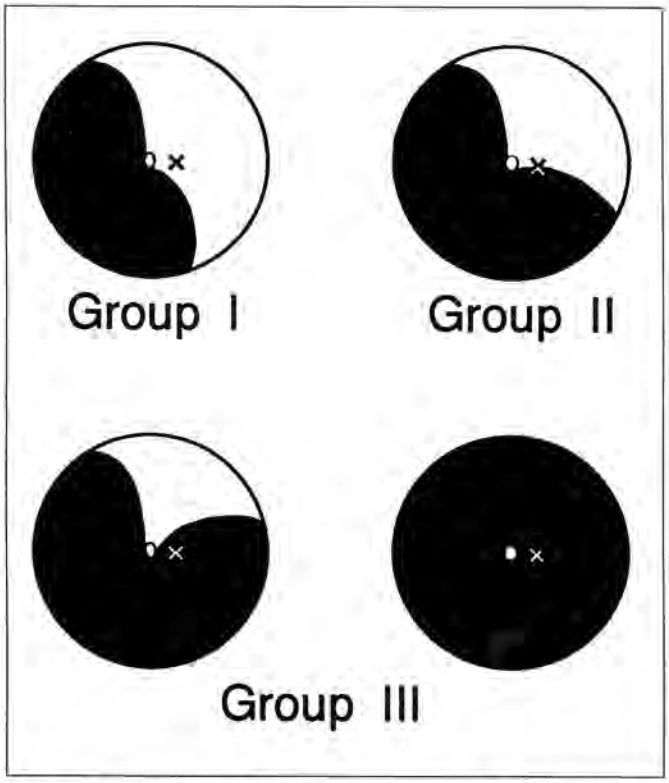

Fig. 1 - *Preoperative macular involvement of 107 retinal detachments: Group I (n=46) macula attached, group II (n=10) macula partially detached, group III (n=51) macula completely detached.*

gery elsewhere.

Aphakia (intracapsular cataract extraction) was present in 21 eyes and pseudophakia in one eye. Seventeen eyes had some hemorrhage in the vitreous; in one it was dense. Sixteen eyes had a proliferative vitreoretinopathy (PVR) stage C1 or C2.

Forty-three eyes had multiple breaks separated by >1 clock hour and 64 one or multiple breaks by ≤1 clock hour (Tab. I).

Preoperatively the macula was attached in 46 eyes and these were designated as group I; in 10 eyes the macula was partially detached and these were designated as group II; in 51 eyes the macula was completely detached and these were designated as group III (Fig. 1). The patients in group I and II were younger by a decade than those in group III. The mean age of the patients was 51 years in group I, 38 years in group II, and 60 years in group III.

Visual acuity was tested with the Snellen chart. The mean preoperative visual acuity (average of the Snellen acuity of all patients) was 20/30 in group I, 20/100 in group II, and 20/400 in group III (Tab. II).

The protocol for follow-up required an examination between one and two weeks after operation, at three and six months and thereafter at yearly intervals. There was a complete follow-up for all 107 patients. Only 72 of the 107 patients had follow-up examinations at 15 years; 35 patients were last examined between 6 months and 14 years and 11 months because they died during that period.

To assess the statistical significance of the results we used the Wilcoxon signed rank test to compare different groups of patients or evaluate the distribution of differences in visual acuity of patients in the same group.

The results within one group were analyzed by comparing each patient's visual acuity at different postoperative times (paired test). The levels of significance, in spite of large individual differences resulting in wide variance and relatively large standard error, are indicated by vertical bars in the time diagram. The data are presented as mean visual acuity either in relation to time in the diagram, or at two different periods in a scattergram. In the scattergrams visual acuity remained stable, if the symbols are located on the diagonal increased if they are above and decreased if they are beneath it.

TABLE I - PREOPERATIVE CHARACTERISTICS OF RETINAL DETACHMENTS (N=107)

State of lens	
Aphakia	21
Pseudophakia	1
Vitreous hemorrhage	17
PVR stage C	16
Stage C1 (12)	
Stage C2 (4)	
Number of breaks	
Multiple separated by > 1 clock hour	43
One or multiple ≤ clock hour	64

TABLE II - PREOPERATIVE CHARACTERISTICS OF 107 PATIENTS WITH RETINAL DETACHMENT DIVIDED INTO THREE GROUPS

Patients	No.	X age years	X visual acuity
Group I (Macula attached)	46	51	20/30
Group II (Macula partially detached)	10	48	20/100
Group III (Macula detached)	51	60	20/400

The operation for all detachments consisted of cryopexy and a sponge or balloon to the retinal breaks without drainage of subretinal fluid. The size of the explant was limited to the extent of the break. Thus, radial sponges were applied in 69 eyes, a temporary balloon in 7 (at that time the balloon operation was just introduced), circumferential sponges in 20, and both radial and circumferential sponges in 11 eyes. No cerclage or vitrectomy was done in any eye.

RESULTS

The anatomical results were described in the previous paper (1): 102 eyes were attached with one operation and 104 after a second operation. During the ensuing 15 years the retina remained attached in 99 eyes.

The data for predicting postoperative long-term visual acuity was obtained by analyzing the visual function of all 107 eyes treated with segmental buckling and the paired eyes. We included the three initial failures and five eyes which subsequently detached. Mean preoperative visual acuity was 20/60 in the operated eye of all 107 patients. It improved to 20/40 during the first six months after surgery and reached its maximum at one year, with a mean of 20/30 (Fig. 2).

Visual acuity of the three groups, defined according to their preoperative macular state, is plotted separately in Figure 3 in relation to time after surgery. At all times visual acuity of group I, the patients with preoperatively attached macula, was better than in the patients with partially or completely detached macula (3). Between the operation and six months postoperatively there was a significant increase in visual acuity in group II ($P = 0.002$) and group III ($P < 0.001$). However, the slight improvement in visual acuity in group I was because of clearing of a vitreous hemorrhage.

After one year there was a linear decrease in all three groups. The changes per interval are significant for group I ($P = 0.007$) and group III ($P < 0.001$). The decrease was larger in group III, the older patients, and among other reasons was age related. If all patients had survived the 15 years after surgery, the mean ages of groups I, II and III would now be 66, 63, and 75 years respectively. Therefore in Figure 4 the visual acuities of the unoperated fellow eye and the operat-

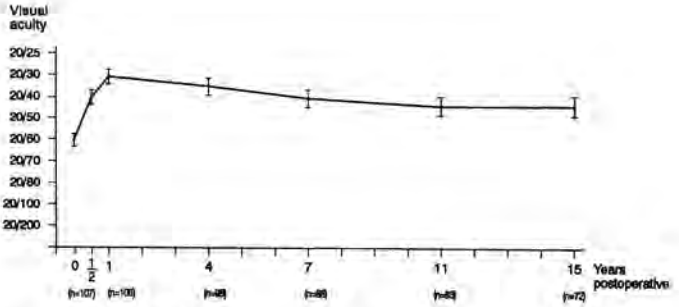

Fig. 2 - *15-year follow-up of mean visual acuity in 107 patients with retinal detachment treated with segmental buckling. Seventy-two patients were living 15 years after operation. The number of patients contributing to each data point (n) is indicated. The vertical bars represent standard error.*

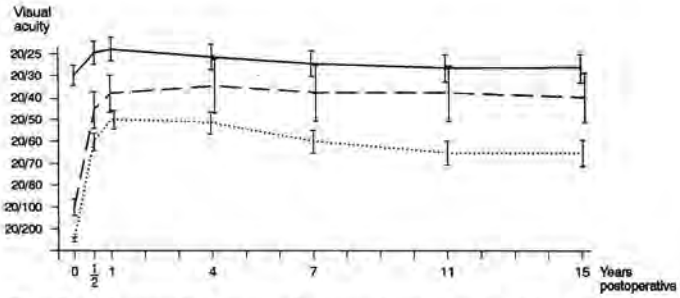

Fig. 3 - *15- year follow-up of mean visual acuity of the same 107 patients as in Figure 2, but divided into three groups according to their preoperative state of macular involvement: Group I (macula attached) is represented by an uninterrupted line, group II (macula partially detached) by an interrupted line, and group III by a dotted line. The vertical bars represent standard error.*

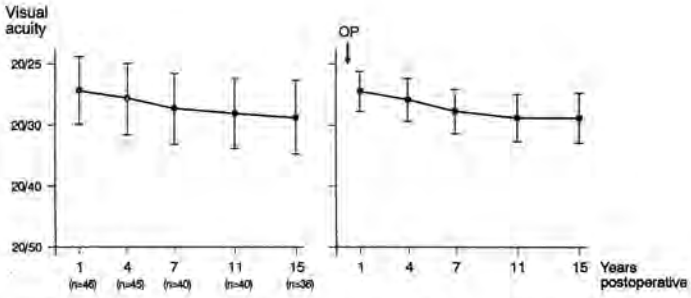

Fig. 4 - *Mean visual acuity of patients with preoperatively attached macula (group I; n=46) during 15 years after treatment with segmental buckling. The number of patients living dropped from 46 to 36. OP indicates the time of operation. Unoperated fellow eyes (left) and operated eyes (right) during long-term follow-up. The difference in decrease of visual acuity in the two groups is not significant at any interval. The vertical bars represent standard error.*

ed eye of all patients with preoperatively attached maculas are plotted at 1, 4, 7, 11 and 15 years after surgery. The difference between visual acuity of the two eyes is not significant at any interval. In the next figure (Fig. 5) the visual acuity of all 107 patients is plotted in a scattergram comparing preoperative visual acuity and six months postoperatively. The shading above and below the diagonal indicates the confidence interval, defined as a change in visual acuity of plus or minus 1 line on the Snellen chart (equivalent to the difference between 20/20 and 20/25). Except in nine patients, visual acuity improved by more than 1 line or is within the confidence interval.

The next scattergram (Fig. 6) depicts visual acuity between 6 and 12 months after operation: 11 patients had continued improvement in visual acuity by more than 1 line and six a decrease because of macular degeneration, cataract, iridocyclitis or a branch vein occlusion.

Thus during the first year after operation there was still some improvement in visual acuity, despite the beginning of some decline. Thereafter there was only a tendency to decrease. Between one and seven years after operation there was only an apparent increase of visual acuity in two eyes as the result of a cataract operation (Fig. 7). However, in 14 eyes visual acuity had decreased by more than 1 line and at 15 years there were already 17 eyes that presented a decrease (Fig. 8). In 14 eyes this was due to cataract, macular degeneration, iridocyclitis or diabetic retinopathy; these findings were similar to the changes in the fellow eye. Only in three eyes was visual acuity lost because of macular distortion, a possible effect of progressive PVR.

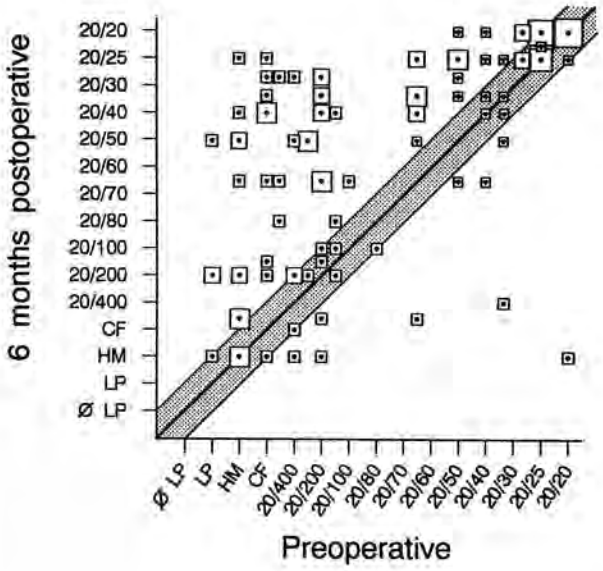

Fig. 5 - *Visual acuity preoperatively and six months after operation in 107 patients with retinal detachment treated with segmental buckling. The shading above and below the diagonal indicates the confidence interval, defined as a change of 1 line on the Snellen chart. Symbols above the diagonal indicate postoperative improvement in visual acuity.*

1 patient *4 patients* *7 patients*
2 patients *5 patients* *8 patients*
3 patients *6 patients* *9 patients*

DISCUSSION

A fact to consider when evaluating long-term visual results is that visual acuity decreases after the age of 60 in normal subjects. This was demonstrated by Slataper (4) who plotted the visual acuity of 17.349 eyes as a function of age. The results of this extensive

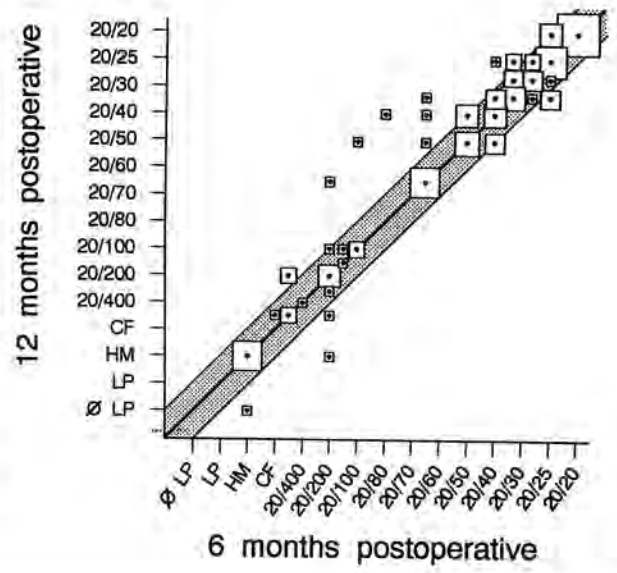

Fig. 6 - *Visual acuity between 6 and 12 months after operation in patients with retinal detachment treated with segmental buckling. Symbols above diagonal indicate improvement in visual acuity. Symbols, see legend to Figure 5.*

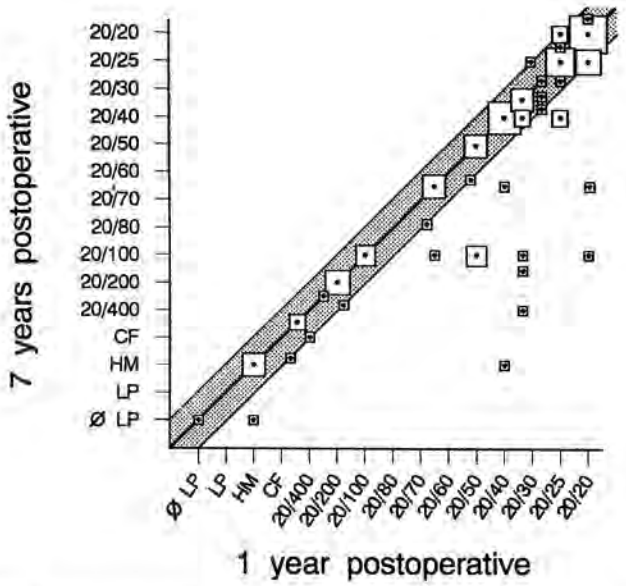

Fig. 7 - *Visual acuity between 1 and 7 years after operation in patients with retinal detachment treated with segmental buckling. Symbols below diagonal (n=14) indicate decrease in visual acuity. Symbols, see legend to Figure 5.*

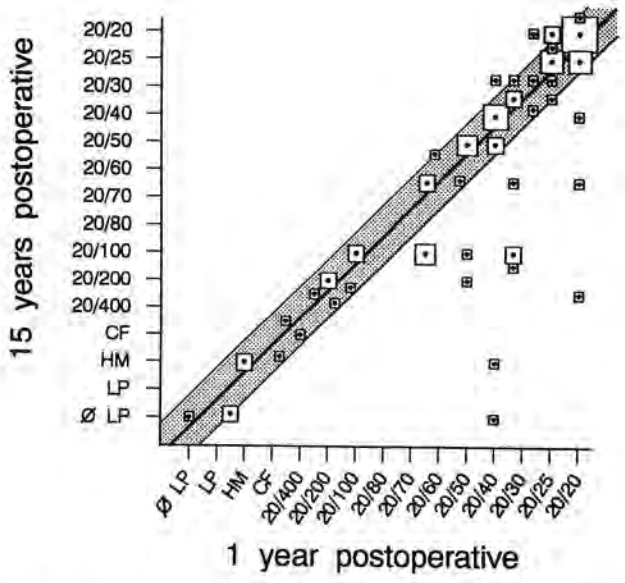

Fig. 8 - *Visual acuity between 1 and 15 years after surgery in patients with retinal detachment treated with segmental buckling; in 17 eyes there was a decrease in visual acuity. Symbols, see legend to Figure 5.*

study are replotted in Figure 9. The curve presents three phases: an increase in visual acuity in childhood, stability during midlife, and a decrease beginning at age 60. A linear fit to the decreasing portion corresponds to the decrease of visual acuity found in our patients in both the fellow and the operated eyes. Mean visual acuity in the fellow eyes of all 107 patients decreased on average by 0.07 lines/year between one and 15 years after operation (Fig. 10). If we take this decrease into account, we would expect that the operated eyes had undergone a similar decrease in visual acuity. That is demonstrated by the plot, where the slopes of the two curves are similar (P = 0.079). The mean visual acuity of the 72 patients who were alive 15 years after operation for a retinal detachment was 20/40. The data thus confirms that minimal surgery, limited to short segmental buckles to close retinal breaks, has no negative effect on visual function.

In our study, postoperative visual acuity of the pa-

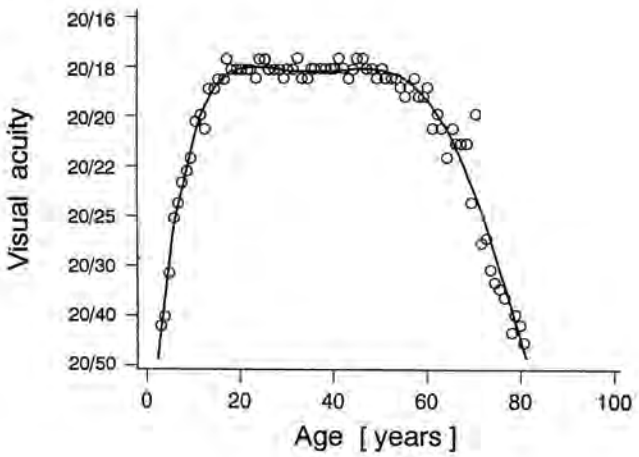

Fig. 9 - *Visual acuity as a function of age in 17,349 individuals, replotted from the cross-sectional study by Slataper (4).*

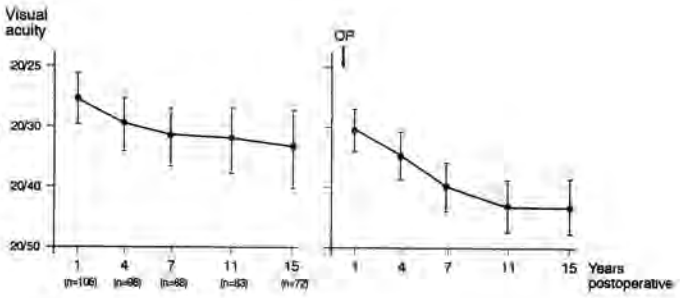

Fig. 10 - *Mean visual acuity of 107 patients with retinal detachment during 15 years after segmental buckling. The number of patients living fell to 72 after 15 years. OP indicates the time of operation. Unoperated fellow eyes (left) and operated eyes (right) during long-term follow-up. The difference in decrease of visual acuity in the two groups is not significant at any interval. The vertical bars represent standard error.*

tients with preoperatively attached macula was better than in patients with partially or completely detached macula. As already demonstrated, the preoperative state of the macula is a prognostic factor for postoperative visual outcome after retinal detachment surgery (Kreissig 3). Grizzard et al (5) evaluated a preoperatively detached macula as a risk factor for anatomical failure.

Sasoh et al (6) analyzed visual acuity and visual field of 44 eyes after buckling procedure. Like many authors, he did not distinguish between encircling and segmental buckling procedures. He classified his patients into preoperative, postoperative, and a group ten years after surgery. Similarly to our results, the postoperative group had a significant increase compared with the preoperative group, but there was no difference between the postoperative group and the group ten years after surgery. The postoperatively restored visual field was also retained ten years after surgery. Sasoh et al (6) did not compare the results of the operated eyes with the fellow eyes. To our knowledge, there is no study in the literature where long-term functional results are compared with the fellow eye and there are few long-term functional studies with significant numbers after segmental buckling (1, 2). Most studies analyze less than 100 patients and do not differentiate between encircling and segmental buckling.

There is evidence that cerclage reduces retinal and choroidal blood flow. Dobbie (7) found that cerclage dampened the ocular pulse. Diddie and Ernest (8), in a rabbit model, observed diminished retinal and choroidal blood flow after a 360° constriction. They also reported that local buckles did not affect blood flow. Yoshida et al (9) confirmed that cerclage diminished retinal blood flow in patients but local buckles did not. Scheider and Korabjelnikoff (10) using ICG angiography found that cerclage also reduced choroidal blood flow.

The mechanism by which an equatorial or anterior cerclage affects posterior retinal and choroidal blood flow is not understood. Prior to these studies, only anterior ischemia was observed with cerclage, presumably an affect of constriction of the posterior ciliary arteries (Lincoff et al 11). Thus, posterior ischemia was not considered a risk factor. Yoshida et al (9) reported that one in five of his patients developed a constricted field and markedly diminished electro-retinographic response. The field improved after the band was removed, but not the electro-retinographic response. They concluded that reduced flow may be common after cerclage - he recorded it in all five of his patients - and may be a significant factor in inexplicable complications. They go on to suggest that reduced flow is apparently not a definite sign of impending complications, but that patients with reduced flow might have a susceptibility to complications.

Winter and Lipka (12), in a study of postoperative retinal function after cerclage, found a reduction in two-point discrimination. One of us (HL) has observed pigmentary dystrophy and diminished retinal sensitivity in the eye with cerclage and not in the fellow eye after 10 to 30 years. He now cuts all of the encircling elements (tubes and bands) placed in former years.

To conclude, cerclage appears to reduce retinal and choroidal blood flow but segmental buckling does not interfere with blood flow. Except for the observation of Winter and Lipka (12), there are only anecdotal reports of diminished function. It is possible that cerclage has a greater detrimental effect than has been recognized so far. The data on function after local buckling in this report challenges those who routinely encircle the eye to review and compare their long-term functional results.

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