Comparative Study of Retinal Detachment Surgery Using a Silicone Sponge with and without Tenon's Capsule Covering

Lukpan Orazbekov[1], Elmira Kanafyanova[2], Kairat Ruslanuly[2]

ABSTRACT

Purpose: To perform and compare the results of circumferential buckling using a silicone sponge with and without Tenon's capsule covering.

Materials and Methods: We analyzed cases of silicon sponge rejection after 691 cases of circumferential buckling using a silicone sponge in retinal detachment from 2007 to 2020. Depending on whether a silicone sponge was covered with Tenon's capsule, all cases were divided into two groups: Group A (covered) – 349 cases; Group B (not covered) – 342 cases. The follow-up period was up to 2 years.

Results: In Group A, where a silicone sponge was covered with Tenon's capsule, the rate of silicon sponge rejection was 0.3% (1 case), while in Group B, where the operation was performed classically, the rate of silicon sponge rejection was 5.2% (18 cases) ($p<0.01$).

Conclusions: Our study shows the possibility of minimizing the silicon sponge rejection with a simple method: covering a silicone sponge with Tenon's capsule.

Keywords: scleral buckling, silicone sponge rejection, Tenon's capsule, retinal detachment surgery.

INTRODUCTION

Retinal detachment remains one of the most severe ocular pathologies, leading to persistent disability without proper treatment. Despite significant achievements in modern ophthalmic surgery, the treatment of retinal detachment remains one of the most challenging problems of ophthalmology. The main point of retinal detachment surgery is to find and close leaking retinal tears that cause retinal detachment, whether it is scleral buckling or vitreoretinal surgery.[1]

In extrascleral retinal detachment surgery, a silicone sponge buckle is widely used and rarely causes complications: sclera perforation, pain syndrome, and anterior segment ischemia syndrome.[1,2] Silicon sponge rejection (SSR) is one of the most significant complications in scleral buckling, with a rate of up to 24.4%.[3] Lincoff and Everett suggested that closing Tenon's capsule over the surface of the scleral buckle might prevent its rejection.[3] In the recent classical approach of circumferential buckling using a silicone sponge, there is no obligated step of Tenon's capsule suturing over a silicone sponge buckle to the sclera.[4] Therefore, we found it interesting to perform and compare circumferential buckling using a silicone sponge buckle with and without Tenon's capsule covering.

MATERIALS AND METHODS

We analyzed cases of SSR after 691 cases of circumferential buckling using a silicone sponge buckle in retinal detachment from 2007 to 2020. Depending on whether a silicone sponge buckle was covered with Tenon's capsule, all cases were divided into two groups (Table 1): Group A (covered) – 349 cases; Group B (not covered) – 342 cases. Both groups, in terms of number, age, and gender proportion, were equal. In Group A, the mean age ± standard deviation was 42.1 ± 13.4 years: 161 women (46.1%) and 188 men (53.9%). In Group B, the mean age ± standard deviation was 43.5 ± 12.5 years: 155 women (45.3%) and 187 men (54.7%).

1- Kazakh Eye Research Institute, First Ophthalmology Department, Almaty, Kazakistan

2- Kazakh Eye Research Institute, Postgraduate Education Department, Almaty, Kazakistan

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Correspondence Adress:
Lukpan Orazbekov
Kazakh Eye Research Institute Tole Bi Street 95a,
Almaty, 050012, Kazakhstan

Phone: +7 727 341 0771
E-mail: lukpan.orazbekov@gmail.com

Table 1: *Characteristics of SSR after circumferential buckling using a silicone sponge with and without Tenon's capsule covering. Data in the rows of Groups A and B represented in incidence numbers of total eyes (%).*

Age (years)	16-30	30-50	50+
Group A (covered) ∑ = 349	0/257 (0)	0/68 (0)	1/24 (4.2)
Group B (not covered) ∑ = 342	2/256 (0.8)	7/65 (10.8)	9/21 (42.9)

In the case of SSR, patients underwent buckle removal surgery. 10-14 days before the intended surgery, all patients underwent bacteriological examination of the conjunctival sac and barrage laser along the scleral indentation and around the retinal tear on a silicone sponge buckle to create chorioretinal adhesion. The follow-up period was up to 2 years.

The Institutional Review Board approved the study. All required informed consent was obtained from patients. The study followed the tenets of the Declaration of Helsinki.

Surgical technique

After induction of either general or local anesthesia, we placed a drop of 1% povidone-iodine solution in the conjunctival sac. A 360° limbal peritomy was performed at the limbus and the spaces in the quadrants between the rectus muscles were exposed with blunt scissors. After all four rectus muscles were isolated, a traction suture (4-0 coated black silk) was placed around the muscles using a fenestrated muscle hook. Then we localized retinal break(s) and used diathermy to create chorioretinal adhesion at the sites of retinal break. In the next step, we placed the encircling sponge band (Fig. 1a). A silicone sponge buckle was placed under it and fixed with 4-0 silk sutures over the break projection (Fig. 1b). A silicone sponge buckle was covered with Tenon's capsule (Fig. 1c) and the limbal edge of the last was fixed to the sclera with continuous 8-0 nylon sutures (Fig. 1d). It is worth mentioning that after implanting the silicone sponge, we injected a broad-spectrum antibiotic into it with a prophylactic purpose.

Statistical analysis

An independent statistician performed statistical analysis by GraphPad Prism 8 software program (GraphPad Software Inc., San Diego, CA, USA). A nonparametric test, the Mann–Whitney U test, was used to analyze continuous data. p-value of <0.05 was taken to indicate statistical significance.

RESULTS

SSR was observed in 19 patients (2.7%). There were 1 case (0.3%) in Group A and 18 cases (5.2%) of SSR in Group B ($p<0.01$).

In Group A, a 53-year-old male patient had SSR after 8 months after segmental circumferential buckling; he underwent a silicone sponge buckle removal.

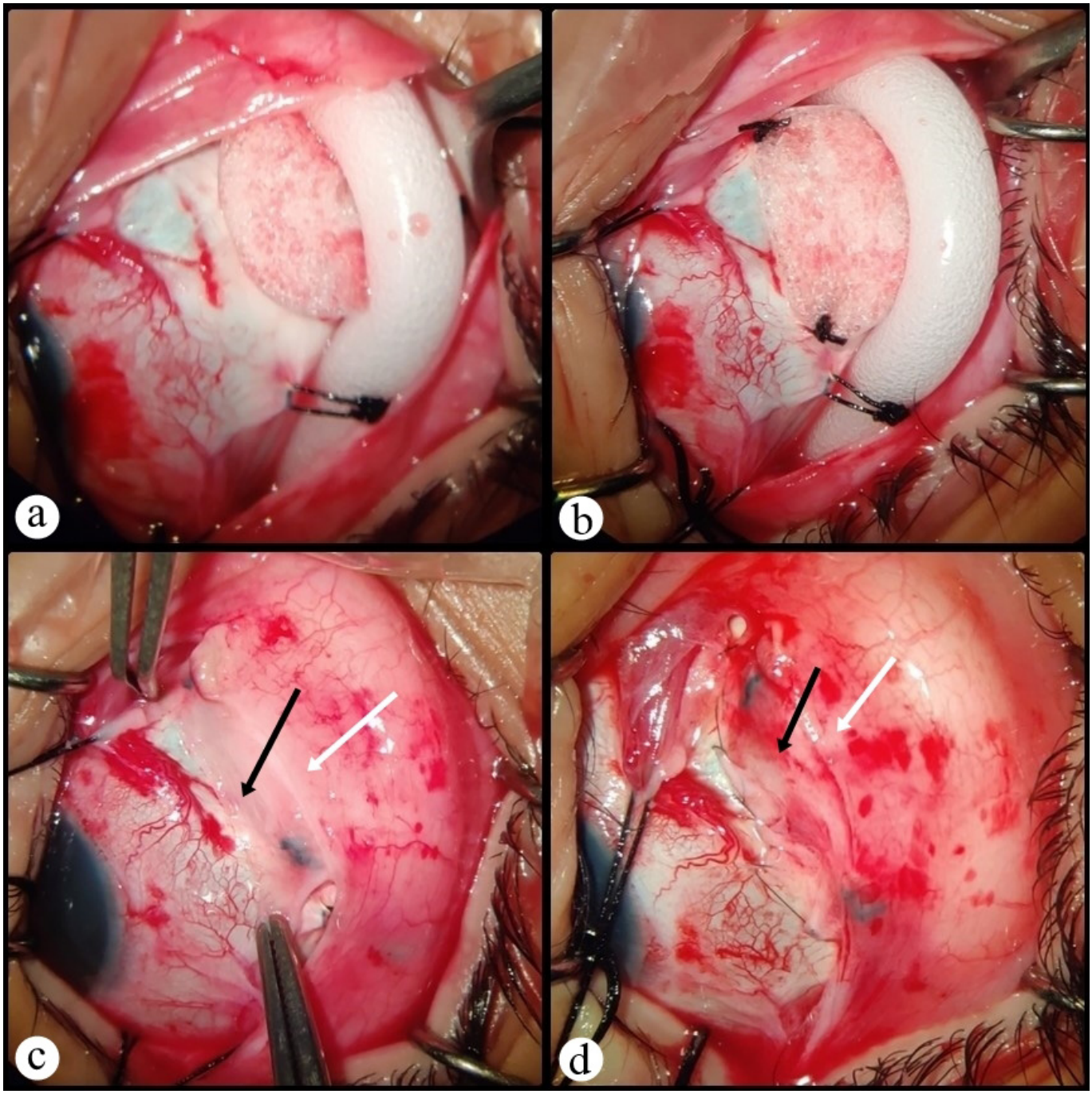
In Group B, the mean age ± standard deviation was 52.2 ± 10.3 years: 8 women (44.4%) and 10 men (55.6%). Depending on the time of SSR occurrence: up to 1 year - 8 patients (44.4%), 1 to 2 years - 5 patients (27.8%), 2 and more years - 5 patients (27.8%). All patients with SSR underwent scleral buckle removal surgery: 13 cases after encircling circumferential buckling and in 5 cases after segmental circumferential buckling; a silicone sponge buckle with encircling band removal in 6 cases and a silicone sponge buckle alone removal in 12 cases. 2 months later, a retinal redetachment occurred in 1 patient; pars plana vitrectomy with silicone oil tamponade was performed.

On slit-lamp examination, we observed a fistula of the Sub-Tenon's space with serous-purulent discharge in all patients, which is 100% of cases, corresponding to the localization of the silicone sponges, indicating that the buckles, rather than the encircling bands, were the source of the infection process.

Bacteriological examination of the conjunctival sac in Group A was smear-negative. In Group B, St. Epidermidis in 2 patients (11.1%), E. Coli in 1 patient (5.5%), and Candida in 1 patient (5.5%) were revealed; the remaining 14 patients were smear-negative (77.8%), which was probably due to preoperative use of topical broad-spectrum antimicrobial agents.

DISCUSSION

According to the literature, SSR rate is 4.3% - 24.4%, and males are more prone, which is consistent with our findings. The majority of rejections, 17.6%-56.2% of the



overall number, occurred within the first 4 months.[3,5,6]

Based on other studies and our experience, SSR occurs not due to the rejection of the silicone sponge material itself, but due to organisms introduced into the silicone sponge's pores during surgery or in the postoperative period.[3,7,8] The silicone sponge material is inert; hence SSR should be considered if the silicone sponge buckle is displaced and causes mechanical irritation to the nearby tissue with or without purulent discharge or localized abscess.[3,8]

In our study, we followed up the results of the surgery and found that in the group where a silicone sponge buckle was covered with Tenon's capsule, the rate of SSR was 0.3%, while in the group where the operation was performed classically, the rate of SSR was 5.6%. The results of our study are explained by the fact that Tenon's capsule is a dense connective tissue, acting as a barrier to prevent the spread of orbital infections into the globe, which theoretically means that a tightly and properly covered buckle with Tenon's capsule prevents SSR.[9] Moreover, in vitro study of the characteristics of Tenon's capsule showed that fibroblasts from young people doubled more quickly and achieved greater cell density than those derived from older people, which means the older the patient, the more

unfavorable the healing process is and more likely to result in SSR.[10] Furthermore, another study reported that conjunctival and Tenon's capsule thickness thins with age from 197.7 µm to 165.7 µm.[11] Another factor contributing to SSR is the cicatrix of conjunctiva.[5,12] In our case series, we encountered challenges in Tenon's capsule suturing over a silicone sponge buckle due to shortening and rigidity of the conjunctiva during surgery in the elderly age group.

Based on these studies and the results of our study, Tenon's capsule suturing is challenging in the following cases: 1. Thin or rigid conjunctiva and Tenon's capsule as the result of older age; 2. Post-traumatic and post-operative cicatrix of conjunctiva.

Our study's limitations are that we did not perform a histopathology examination of Tenon's capsule surrounding a fistula and a silicone sponge buckle; we took smears during antimicrobial therapy.

Our study shows the possibility of minimizing the complication as SSR with a simple method. Perhaps Tenon's capsule suturing over a silicone sponge buckle should be introduced as one of the obligate steps in circumferential buckling using a silicone sponge buckle.

CONCLUSION

There is always the risk of SSR in using a silicone sponge buckle, which could lead to retinal redetachment and severe infectious complications. Covering a silicone sponge buckle with Tenon's capsule is a simple and effective method to prevent the mentioned complications.

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