

MODERN EXTRASCLERAL SURGERY IN THE TREATMENT OF REGMATOGENOUS RETINAL DETACHMENT: EFFICACY EVALUATION AND FUNCTIONAL RESULTS

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✧ The basic principles of extrасcleral surgery, which are currently used in the treatment of regmatogenous retinal detachment (RD), have not changed much since their heyday in the 70–80s of the 20th century, and they remain relevant both as an independent method to treat this disease in certain clinical cases, and in combination with vitrectomy. **The aim** is to evaluate the efficacy of RD extrасcleral treatment methods (anatomical result, visual acuity), as well as the frequency and timing of the relapses. **Materials and methods.** The study was carried out at the vitreoretinal department of the Ophthalmological Center of the City Hospital No. 2 of St. Petersburg. A sample of 466 patients with RD, operated with extrасcleral methods in 2015–2016 has been analyzed. Anatomical results, visual acuity, number and timing of relapses have been assessed. **Results.** The efficacy of extrасcleral surgery reaches 89%, RD recurrence after surgical treatment occurs in 21% of patients.

✧ **Keywords:** regmatogenous retinal detachment; extrасcleral surgery; relapse of retinal detachment.

СОВРЕМЕННАЯ ЭКСТРАСКЛЕРАЛЬНАЯ ХИРУРГИЯ В ЛЕЧЕНИИ РЕГМАТОГЕННОЙ ОТСЛОЙКИ СЕТЧАТКИ: ОЦЕНКА ЭФФЕКТИВНОСТИ ПРИМЕНЕНИЯ И ФУНКЦИОНАЛЬНЫЕ РЕЗУЛЬТАТЫ

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✧ Основные принципы экстрасклеральной хирургии, применяемые на сегодняшний день при лечении регматогенной отслойки сетчатки (РОС), мало изменились со времён своего расцвета в 70–80-х годах XX в. и остаются актуальными до сих пор как самостоятельный метод лечения этой патологии в определённых клинических ситуациях, так и в комбинации с витрэктомией. **Цель:** оценить эффективность использования (анатомический результат, остроту зрения) экстрасклеральных методов лечения РОС, а также частоту и сроки возникновения рецидивов. **Материалы и методы.** Исследование проведено в условиях Офтальмологического центра СПбГБУЗ «Городская многопрофильная больница № 2» Санкт-Петербурга. Произведена выборка больных РОС, прооперированных с применением экстрасклеральной хирургии за 2015–2016 гг. (466 пациентов), проанализированы анатомический и функциональный результаты, частота и сроки развития рецидивов. **Результаты.** Эффективность применения экстрасклеральных методик лечения РОС достигает 89 % при условии отсутствия выраженных проявлений пролиферативной витреоретинопатии. Развитие рецидивов РОС после экстрасклеральной хирургии наблюдается в 21 % случаев.

✧ **Ключевые слова:** регматогенная отслойка сетчатки; экстрасклеральная хирургия; рецидив отслойки сетчатки.

INTRODUCTION

The basic principles of extrascleral surgery used in treatment of rhegmatogenous retinal detachment have not changed much since their heyday in the 1970s and 1980s. They remain relevant as an independent method of treating this severe condition in certain clinical cases, and in combination with vitrectomy. The primary pathways of the historical development and establishment of extrascleral surgery are described below as the pathogenesis of retinal detachment was understood.

Discussing the origin of retinal detachment, Professor P. Römer, in his *Guide to Eye Diseases* (1913), points to the existence of 2 dominant at that time theories of its appearance, which originated in the 19th century. In the exudation theory proposed by the Austrian ophthalmologist Carl Ferdinand von Arlt in the 19th century, the choroid releases serous exudate, and the pressure exerted by this exudate together with the detached retina on the vitreous body leads to its partial condensation. Another theory — the retraction one — was described by an Austrian ophthalmologist, C. Stellwag von Carion, who believed that retinal detachment develops as a result of the vitreous body wrinkling, and subretinal fluid is formed as secondary condition, ex vacuo [2].

The first surgery for retinal detachment was a scleral puncture performed by one of the founders of French ophthalmology, Jules Zichel, in 1859. Its purpose was to release subretinal fluid for retinal reattachment. As a result, a temporary improvement was reported, and later, the retina usually detached again. Albrecht von Graefe modified this surgery by proposing to perform a retinal puncture from the vitreous so that the subretinal fluid could pass through the hole in the retina into the vitreous and cause retinal reattachment. The results of such punctures were temporary, and shortly after this, punctures of sclera or retina were abandoned as independent surgical procedures.

Studies of old chorioretinal foci revealed the presence of a dense fusion of the retina with choroid. This led to the idea of causing the retinal reattachment with the formation of its artificial adhesion with the choroid. For this, various cauterizing means were used, particularly thermo- and galvanocauterization, cauterization by iodine by injecting it into the subretinal space [6].

At the beginning of the 20th century, treatment of retinal detachment was considered one of the “most

ungrateful and unsuccessful tasks” and included only the prescription of bed rest, pressure dressings, diaphoretic agents in the form of hot drink, and subconjunctival injections of a solution of sodium chloride. If the latter did not give results, a puncture of the subretinal fluid was performed through a small incision in the sclera and choroid, followed by cauterization of the incision site and the area around it, with the hope that aseptic inflammation would cause the retina to adhere and merge with the vasculature. Upon treatment, positive results did not exceed 6% to 8%. In 1% of cases, a spontaneous reattachment of a detached retina occurred [2, 3].

In 1903, August Mueller proposed the sclera resection surgery by excision of its flap, believing that reducing the volume of the eye could bring it into line with the remaining volume of the vitreous and would facilitate retinal reattachment. By 1913, he had operated on 15 patients and recorded a positive result in 5 cases, which was considered a great success at that time [4, 6].

The historical background of the retinal detachment treatment is divided into 2 periods: before Gonin and after Gonin, whose surgery made an almost incurable disease curable in a large number of cases. Jules Gonin was one of the first to draw attention to the fact that retinal tears at its detachment, which, according to his data, occur in up to 95% of the times, were a pathognomonic sign of the disease. This pattern led to the assumption that closing the tear was necessary for retinal reattachment. In 1920, Gonin proposed a cauterization method of a tear site after establishing its precise localization and its projection on the sclera, and the subsequent strict bed rest for the patient. Thanks to this approach, positive results of the retinal detachment treatment increased to 40% [4, 5].

According to Professor T. Axenfeld (1930), “If a tear is found in the retina, all our efforts should be focused on closing the open door between the vitreous and the subretinal fluid” [1].

The development of surgery at that time was characterized by the search for new means for cautery, in addition to cauterization. In 1929, Lindner and Gwist proposed the use of potassium hydroxide, which does not coagulate tissues as much as a thermocauter does but causes their swelling and fibrinous exudation. The authors proposed several sclera trepanations around the rupture, isolating it, with cauterization of vasculature with potassium hydroxide and puncture of subretinal fluid.

In 1931, Vevey and Safar also proposed the treatment of retinal detachment with a barrage method, i.e., limiting the area of tear or of several tears using diathermocoagulation of the sclera to induce an adhesive inflammation between the retina and the choroid. The advantage of this method is that its application does not require the exact localization of the retinal tear, as with Gonin's surgery [6]. The idea proposed by Kustodis in 1953, is considered to be a significant achievement, as it consisted in buckling the tear area with extrascleral implants, which allowed for not only blocking the tear, but also weakening the traction by the vitreous. The next milestone in the progress of extrascleral surgery was the development by Skepens and Arrug in the late 1950s of cerclage procedure, or circumferential scleral buckle. This method was subsequently improved by Linkoff, who used silicone rubber. The use of a laser, cryo- or diathermocoagulation for additional retinal fixation, and various materials and techniques for performing scleral buckling allowed extrascleral surgery to reach a new level and achieve success in as many as 80% to 90% of cases [7].

This work aimed to evaluate the efficiency of application (anatomical result, visual acuity) of modern extrascleral methods of treatment of rhegmatogenous retinal detachment (RRD), as well as the frequency and timing of the occurrence of detachment relapse after their use.

MATERIALS AND METHODS

The study was conducted in the Ophthalmological Center of St. Petersburg City Multi-Field Hospital No. 2. Data from the case histories of patients receiving treatment at the Vitreoretinal Department

of the Center from 2015 to 2016 were analyzed. A sample of RRD patients operated on using extrascleral surgery was selected (466 patients). The age of patients ranged from 20 to 89 years, and the average age was 57 years. There were 247 men (53%) and 219 women (47%). Most patients (61.8%) had myopic refractive error (40% had mild and moderate myopia, 21.8% had high myopia), 30% of patients were emmetropic, and 8.2% of patients had mild hypermetropia.

The patients were divided into groups alphabetically according to the first letter of their surnames. This provided a method of establishing the number of repeated hospital admissions over a specified period and the duration of each. Surgical procedures were performed by the same team of surgeons using Lumera 700 and Lumera I microscopes (Carl Zeiss, Oberkochen, Germany), a Constellation combine (the diathermocoagulation function was used), and a Keeler cryo device. Transpupillary laser coagulation of the retina was performed using a Visulas 532 laser (Carl Zeiss) and a head-mounted indirect ophthalmoscope. Figures 1–3 show main materials used to perform extrascleral procedures.

Extrascleral surgery was performed in patients with characteristic clinical manifestations, namely relatively mobile retina with different detachment areas and heights, with one or more tears, and without pronounced signs of proliferative vitreoretinopathy (PVR). The duration of retinal detachment from the start of a patient's complaints to the time of hospitalization ranged from a few days to 2 or 3 months. Moreover, in elderly patients, retinal detachment was often detected in later stages due to the absence of complaints for long periods of time and a delay in seeking medical help.

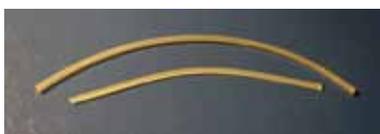


Fig. 1. Encircling silicon band (length 9 cm, width 2 mm), a silicone capillary to form a sleeve that holds the ends of the band (cut off as a 2–3 mm long fragment)

Рис. 1. Циркляжная силиконовая лента (длина 9 см, ширина 2 мм), силиконовый капилляр для формирования муфты, удерживающий концы ленты (отрезается в виде фрагмента длиной 2–3 мм)



Fig. 2. Silicone buckles of large and small sizes with a groove for the band, a tourniquet made of porous silicone sponge

Рис. 2. Силиконовые пломбы большого и малого размеров с канавкой под ленту (АО «МедСил», Мытищи), жгут из пористой силиконовой губки



Fig. 3. Polytetrafluoroethylene plate used as an additional buckle

Рис. 3. Пластика из политетрафторэтилена, используемая в качестве дополнительной пломбы

It seems to us that according to the PVR classification proposed by the American Society of Retina Specialists in 1983 being more descriptive in terms of the detachment configuration, extrascleral procedures are applicable in cases of retinal detachment with PVR of stages A, B, and C1–C3.

RESULTS AND DISCUSSION

In the period from 2015 to 2016, a total of 1502 surgeries were performed in 1170 patients with primary RRD and its relapse in the Ophthalmology Center of St. Petersburg City Multi-Field Hospital No. 2. Among these patients, extrascleral methods were used for surgery in 466 patients (31%). [8] Extrascleral surgeries were distributed according to their main types. Our practice shows that the most effective and universal procedure is the cerclage, if necessary with the use of focal scleral buckle. (1) Circular scleral buckle (cerclage) was used in 344 surgeries (188 in 2015, and 156 in 2016; 73.8%). For this purpose, as a rule, a tourniquet from a porous silicone sponge was used (see Fig. 2). All patients underwent cryo- or diathermocoagulation of the sclera, if necessary, and puncture of subretinal fluid and introduction of C_3F_8 gas into the vitreous chamber. (2) Cerclage with a tape + local scleral buckle was used in 93 surgeries (46 in 2015, and 47 in 2016; 20%). The cerclage was performed using a silicone tape 2 mm wide in combination with focal buckle of the tear site with a wide or narrow silicone splint with a channel for the tape or a polytetrafluoroethylene plate of the required

thickness (see Fig. 3). We also used plates of this material as “pads” for the cerclage tape or tourniquet at the areas of thinned sclera in order to prevent the development of pressure sores in the future (Fig. 4). (3) Additional scleral buckle was used in 29 surgeries (14 in 2015, and 15 in 2016; 6.2%). It was performed in incomplete retinal reattachment, as a rule, in the next days after the first extrascleral surgery. An additional buckle, usually modeled from polytetrafluoroethylene plates of different thickness and area, was positioned under the previously performed cerclage in order to enhance the sclera depression (see Fig. 3).

This measure is effective in cases of insufficient blocking of retinal tear in the early postoperative period, detection of a tear that was not diagnosed at the preoperative stage, and to weaken traction forces. For additional retinal fixation, transpupillary laser coagulation was performed, if necessary, in the areas of tears or along the depression bank.

Anatomical reattachment of the retina with an improvement in visual function was registered in 415 of 466 operated patients, which amounted to 89%, and there was no attachment in 51 cases (11%).

Table 1 shows the visual acuity data of patients at admission and at discharge from the hospital after surgical treatment. As can be seen from Table 1, the visual acuity of most patients before surgical treatment ranged from 0.01 to 0.1. Apparently, this is due to the late diagnosis of retinal detachment at the level of primary ophthalmology care and the late admission of patients to the hospital. After surgery,

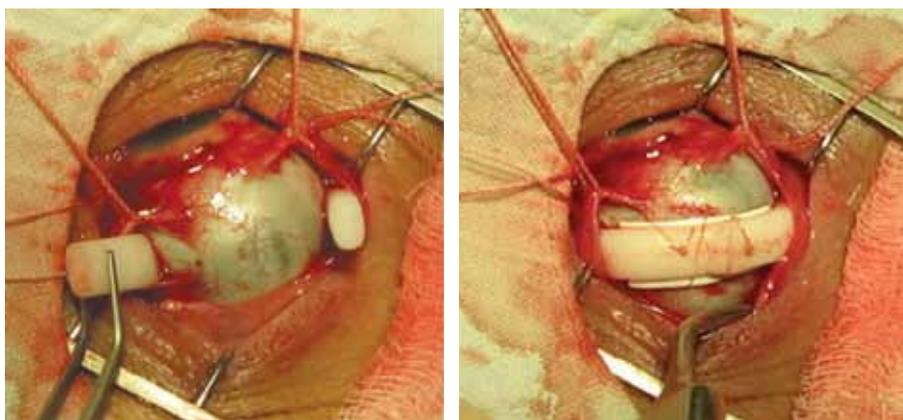


Fig. 4. Patient S., 68 years old. OS. Pseudophakia. Regmatogenous retinal detachment with multiple tears, a combination of plastic of thinned scleral areas with a polytetrafluoroethylene plate and circular buckling with a silicone tourniquet

Рис. 4. Пациент С., 68 лет. OS. Артификация, регматогенная отслойка сетчатки с множественными разрывами. Сочетание пластики истончённых участков склеры пластинкой из политетрафторэтилена и кругового пломбирования силиконовым жгутом. Вырезанная несколько шире пластинка уложена под жгут во избежание пролежня, наложены Х-образные швы. После операции сетчатка прилегла

Table 1 / Таблица 1

Visual acuity of patients before and after extrасcleral surgery
Острота зрения пациентов (с коррекцией) до и после экстрасклеральной хирургии

| Visual acuity | <0.01 | 0.01–0.1 | 0.1–0.5 | >0.5 | Total |
|-----------------------------|--------------|--------------|--------------|-----------|-------|
| Prior to surgery, patients | 225 (48.3 %) | 218 (46.7 %) | 15 (3.3 %) | 8 (1.7 %) | 466 |
| After the surgery, patients | 78 (16.7 %) | 140 (30 %) | 225 (48.3 %) | 23 (5 %) | 466 |

Table 2 / Таблица 2

Terms of development of relapse of regmatogenous retinal detachment in patients after extrасcleral surgery
Сроки развития рецидивов регматогенной отслойки сетчатки у больных после экстрасклеральной хирургии

| Terms of relapse | <1 month | 1–3 months | 3–6 months | >6 months | Total |
|--------------------|----------|------------|------------|-----------|-------|
| Number of relapses | 8 | 56 | 24 | 10 | 98 |
| Patients. % | 8.2 | 57.1 | 24.5 | 10.2 | 100 |

visual acuity increased in 48.3% of patients to a few tenths (0.1–0.5); it was higher than 0.5 in 5%. In 30% of patients, the visual function after surgery increased insignificantly (0.01–0.1), and in 16.7%, it remained low (lower than 0.01). As a general rule, the cerclage procedure leads to a myopic shift in patient's refraction by an average of 1.5 to 2 diopters. The magnitude of induced myopia depends on the amount of the scleral depression and t on the sclera thickness in each case.

We established the characteristic frequency and timing of the development of RRD relapses in the studied patients after successful extrасcleral surgery for a 2-year follow-up period (Table 2). Table 2 demonstrates that RRD relapses occurred in 98 of 466 operated patients (21%). More than half of RRD relapses (56 patients, 57.1%) were detected within a period of 1 to 3 months after extrасcleral surgery. In one-quarter of patients (24.5%), relapses were revealed in 3 to 6 months after surgery. In the early (<1 month) and late terms (>6 months), the number of relapses was relatively low (8.2 and 10.2%, respectively). The causes of detachment relapse were PVR progression, formation of new tears, and the activation of old tears.

CONCLUSIONS

Extrасcleral surgery as an independent and inexpensive method of RRD treatment is relevant and is used in our modern vitreoretinal hospital department in various modifications in about one-third of patients with this condition. Moreover,

the efficiency of extrасcleral methods for the RRD treatment reaches 89%, provided that there are no pronounced PVR manifestations. The development of RRD relapses after extrасcleral surgery is noted in 21% of cases.

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