Biomedical Research 2017; 28 (10): 4413-4416 *ISSN 0970-938X*
www.biomedres.info

The effect of pterygium on corneal refractive state and the therapeutic effect of corneal limbal stem cell transplantation.

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Abstract

Objective: To study the effect of pterygium on corneal refractive status and therapeutic effect of autologous corneal limbus stem cells transplantation on refractive status and vision of patients in clinical treatment of pterygium.

Methods: 80 cases of patients with pterygium in our hospital from June to September in 2014 were chose, with a total of 96 suffering eyes, to be randomly divided into observation group and control group (n=40). The control patients underwent pterygium excision surgery, while observation group were treated with excision surgery combined with autologous corneal limbus stem cell transplantation. Corneal refractive status and naked-eye eyesight of patients of two groups before and after surgery were compared and analysed.

Results: After surgery, corneal refractive status and naked-eye eyesight of patients of two groups were improved than that before, as well as a significant improvement of corneal photometric (P<0.05); At 1, 2, 3 and 4 weeks after operation, the naked eye eyesight of patients in observation group were (0.48 ± 0.07), (0.65 ± 0.13), (0.94 ± 0.11) and (1.12 ± 0.13), respectively, with significant statistical difference compared with the control group contemporaneity (P<0.05); The diopters of observation group were respectively (2.89 ± 0.48), (1.63 ± 0.52) before and after operation, suggesting great decline to the control group ((2.72 ± 0.56)v (1.93 ± 0.49)) with the significant difference (P<0.05).

Conclusion: Pterygium excision combined with autologous limbal stem cell transplantation treatment can effectively improve the astigmatism of the patients, enhance the naked eyesight and reduce the disease recurrence, which is worthy of promotion and application.

Keywords: Pterygium, Corneal refractive status, Autologous corneal limbus stem cell transplantation.

Accepted on February 23, 2017

Introduction

Pterygium is a relatively common ophthalmic disease in clinic in humans that is attributed to chronic ultraviolet-B exposure and can result in vision loss [1]. It is generally believed when the eye is subject to external stimuli to directly impact the normal physiological environment of the eye, thereby making the eye conjunctival vascular tissue into inflammatory lesions to invade the cornea, eventually leading to the pterygium formation. The negative impact on the patient's corneal refractive results in decreased visual acuity of the naked eye and a lot of inconvenience in life [1,2]. Pterygium excision surgery is applied commonly for the disease in clinic, but the single use of resection makes the recurrence rate high. However, Pterygium is characterized by high vascularization, proliferation, invasive ocular surface lesions, and aberrant Extracellular Matrix (ECM) remodeling [3]. As a consequence, surgical excision is the standard treatment for a pterygium, but despite advances in surgical techniques, the pterygium recurrence rate is high.

As a result, a variety of surgical treatment based on the specific situation of patients is the key to ensure improvement of the life quality as soon as possible3. 80 patients in our hospital were treated with pterygium excision combined with autologous limbal stem cell transplantation; the desired results are achieved and reported below.

Materials and Methods

General information

80 cases of patients with pterygium in our hospital from June to September in 2014 were chose, with a total of 96 suffering eyes, to be randomly divided into observation group and control group (n=40). The control group includes 21 cases of male patients with 26 suffering eyes and 19 cases of female

with 22 eyes, aged from 45 to 75 (average age of 57.7 ± 7.8), while in the observation group, there were 20 males (25 suffering eyes) and 20 females (23 suffering eyes), aged from 48 to 77 (average age of 59.1 ± 8.2). There is no statistically significant difference in gender, number of eyes, age and other general information of the two groups (P>0.05). This research was approved by the ethical committee of Shanghai Tenth People's Hospital.

Criteria of inclusion and exclusion

Inclusion criteria: (1) Pterygium in both sides of the nose; (2) pterygium invasing into the limbus of 1~5 mm [4].

Patients with any of the following problems will be excluded: (1) Allergic conjunctivitis, trachoma and other eye diseases; (2) hyperthyroidism and other systemic diseases; (3) connective tissue diseases; (4) long-term history of ophthalmic drugs [5].

Methods

Control group: Patients underwent pterygium excision surgery. Specific surgical procedures are as follows: After epidural anesthesia, the doctor does eyelid-open treatment to the patients, and applies 2% Riccardo for local anesthesia. The head of pterygium and limbal tissue were separated under the microscope (Olympus, Japan). The neck of pterygium was picked with the knife blade for blunt dissection to achieve complete separation of pterygium from corneal tissue, and residual pterygium was scraped off. The subconjunctival tissue of the patient was isolated and pterygium and local distorted conjunctival tissue were in complete excision. Finally, the use of cautery device, the scleral surface was in burning treatment with cautery to complete the surgery [6,7].

Observation group: On the basis of the treatment of the control group, the autologous limbal stem cell transplantation was in combined application. Specific operation is as follows: At the edge of the cornea of the suffering eye, 1 mm of incision as the base, 1 mm of bulbar conjunctival flap separation operation was conducted. The conjunctival flap was flipped for blunt treatment. Incise with 15th knife form the limbal position forward to the edge of the corneal epithelium. The corneal conjunctival flap was cut and moved to the exposed sclera. Finally, it was in suture treatment with 10/0 nylon line in a position of upper, down and inner. After 2 weeks of operation, suture was taken out [8].

Observation targets

Corneal refractive status (including refraction, corneal curvature, etc.) and uncorrected visual acuity before and after surgery of the two groups were compared and analysed to summarize the specific effect of pterygium on corneal refractive status.

The uncorrected visual acuity and refractive status of the patients before and after operation were checked with computer optometry, strip retinoscopy, integrated refractometer owning to our department. The specific influence factors of pterygium on corneal refractive status were investigated by "Questionnaires for the influence factors of visual changes after pterygium excision surgery" designed based on "health and health system responsiveness" by the World Health Organization [9].

Efficacy evaluation criteria

After treatment, the disappeared ocular symptoms, the normal appearance and visual acuity to the level before suffering, can be judged as cure; improved symptoms of suffering eyes, the almost normal appearance and improved visual acuity are determined to be effective; while the serious symptom, abnormal vision and appearance, and postoperative recurrence are considered invalid [10].

Statistical analysis

The statistical analysis was conducted with SPSS 19.0 software, quantitative data was presented as mean $\bar{x}$ ± standard deviation ($\bar{x}$ ± s). Comparison between the two groups and within the group was conducted with t test, P<0.05 means the difference with statistical significance.

Results

After surgery, corneal refractive status and naked eyesight of patients of two groups were improved than that before, as well as a significant improvement of corneal photometric (P<0.05); At 1, 2, 3 and 4 weeks after operation, the naked eye eyesight of patients in observation group were (0.48 ± 0.07), (0.65 ± 0.13), (0.94 ± 0.11) and (1.12 ± 0.13), respectively, with significant statistical difference compared with the control group contemporaneity (P<0.05); The diopters of observation group were respectively (2.89 ± 0.48), (1.63 ± 0.52) before and after operation, suggesting great decline to the control group ((2.72 ± 0.56)v (1.93 ± 0.49)) with the significant difference (P<0.05) (Tables 1-3).

Table 1. Comparison of uncorrected visual acuity before and after operation of the two groups ($\bar{x}$ ± s).

Groups	Number of cases	Before operation	After operation			
			1-week	2-week	3-week	4-week

Observation group	40	0.26 ± 0.07	0.48 ± 0.07	0.65 ± 0.13	0.94 ± 0.11	1.12 ± 0.13
Control group	40	0.24 ± 0.06	0.29 ± 0.11	0.34 ± 0.08	0.48 ± 0.13	0.65 ± 0.11
t value		0.537	2.132	4.157	4.366	9.182
P value		0.814	0.047	0.032	0.046	0.017

Table 2. *Comparison of corneal curvature before and after operation of the two groups ($\bar{x} \pm s$).*

Groups	Number of cases	Before operation	After operation			
			1-week	2-week	3-week	4-week
Observation group	40	40.37 ± 1.6	41.4 ± 1.3	41.9 ± 1.2	42.2 ± 1.2	42.8 ± 1.5
Control group	40	40.40 ± 1.3	40.7 ± 1.4	41.2 ± 1.2	41.7 ± 1.3	42.1 ± 1.4
t value		0.371	3.374	4.469	3.783	4.019
P value		0.725	0.037	0.043	0.043	0.031

Table 3. *Comparison of astigmatism before and after operation of the two groups ($\bar{x} \pm s$).*

Groups	Number of cases	Before operation	After operation			
			1-week	2-week	3-week	4-week
Observation group	40	40.37 ± 1.6	41.4 ± 1.3	41.9 ± 1.2	42.2 ± 1.2	42.8 ± 1.5
Control group	40	40.40 ± 1.3	40.7 ± 1.4	41.2 ± 1.2	41.7 ± 1.3	42.1 ± 1.4
t value		0.216	7.468	11.364	10.924	11.336
P value		0.644	0.013	0.009	0.012	0.010

Discussion

Pterygium has the high incidence in clinical ophthalmology, but at present, the academic are still unable to reach a consensus on the pathology of this disease. In general, the cause of this disease is mainly the external factors stimulating the eyes, including sand environmental, ultraviolet radiation, but also is closely related to patient's eye-dry, eye inflammation and so on. In the current relevant studies, this disease mainly exists in the coastal and plateau areas, and the pathological changes are in concentrated expression of chronic inflammation of limbal tissue and extracellular matrix damage [11]. When eye conjunctival blood vessels tissue of patient occurs inflammatory lesions, the formed pterygium will keep invasion into the cornea. On the one hand, the normal physiological shape of the cornea is changed, leading to increasing the radius of horizontal curvature; On the other hand, pupil is blocked to decreased vision. Although the educational circles declared the pathogenesis of this disease still needs further study, the destruction of limbal stem cell is generally considered as an important factor [12]. At the early phase of pterygium, the cornea is affected by traction, which makes the patient prone to astigmatism; at the late phase, pterygium intrudes into the cornea, followed by declined and blurred vision, resulting in inferior life quality of patients.

Clinically, the conventional pterygium excision surgery is applied in the treatment of this disease. By the way of excision, the pupil blockage will be ameliorated to improve vision. However, the single use of resection brings about the high rate of recurrence after surgery, and the corneal wound is prone to corneal morphological deformation in the future repair process, thereby affecting the patient's vision recovery [13]. As a result, a variety of surgical treatment based on the specific situation of patients is the key to ensure improvement of the life quality as soon as possible. In recent years, researchers have discovered limbal stem cell transplantation has a high value in the clinical diagnosis and treatment of the disease. The combination treatment of pterygium excision and corneal limbal stem cell transplantation is helpful to move the pterygium limbal stem cells effectively to cover the lesion location [14]. Besides, corneal limbus stem cells can ensure the normal function of corneal recovered as soon as possible, so as to avoid postoperative astigmatism.

Some scholars have pointed out that there is a close relationship between pterygium and refractive status that is when pterygium ≥ 2.5 mm, the patients are prone to cause astigmatism [15]. In this study, in the preoperative examination, pterygium of some patients have invaded into limbus (<2.5 mm) without astigmatism; astigmatism of the patients with pterygium invasion ≥ 2.5 mm will be significantly improved after surgery, suggesting that the actual size of pterygium can be considered as an important basis for surgical treatment options in clinic. If the pterygium has not yet invaded into corneal, the surgery can be suspended [16].

In summary, pterygium invasion into the cornea easily leads to astigmatism, and the degree of astigmatism of patients is closely related to the size of the pterygium. The treatment of pterygium excision combined with autologous limbal stem cell transplantation can effectively improve the astigmatism of the patients, enhance the naked eyesight and reduce the disease recurrence, which is worthy of promotion and application.

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