Case Reports

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Vitrectomy with internal limiting membrane peeling for stellate nonhereditary idiopathic foveomacular retinoschisis: a case report

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Purpose: *To report a case of a rare disease, stellate nonhereditary idiopathic foveomacular retinoschisis (SNIFR), its clinical course and the results of vitrectomy with internal limiting membrane (ILM) peeling.*

Material and Methods: *Comprehensive ophthalmological examination (including visual acuity testing, biomicroscopy, ophthalmoscopy, tonometry, Goldmann kinetic perimetry and imaging with ocular ultrasound, optical coherence tomography (OCT), and fluorescein angiography (FA)) was performed before surgery and 1 month, 3 months and 12 months thereafter.*

Results: *The patient had no somatic comorbidity and complained only of a gradual deterioration in vision over two years. She experienced an improvement in vision after vitrectomy with ILM peeling. This treatment contributed to a substantial reduction in retinal thickness and the restoration of macular vitreoretinal interface.*

Conclusion: *This case indicates the efficacy and safety of surgical treatment for SNIFR, because this treatment contributed to the restoration of macular vitreoretinal interface and no recurrence was observed over a 1-year follow-up period.*

Introduction

Stellate nonhereditary idiopathic foveomacular retinoschisis (SNIFR) is a rare disorder characterized by splitting of the retina at the macula (namely, within the outer plexiform layer) [1].

Bloch and colleagues [1] have shown that SNIFR accounted for up to 2% of all recorded cases of foveomacular retinoschisis (FRS) [1]. Females are more commonly affected and the majority of SNIFR cases are unilateral, but bilateral cases have been also reported.

FRS is characterized by the presence of a localized separation of retinal layers affecting the central macula. Although FRS is typically associated with congenital X-linked retinoschisis (XLRS) [2], it is observed in other inherited disorders, such as enhanced S-cone syndrome and CRB1-associated maculopathy [3, 4].

Atypical FRS is commonly congenital, but sometimes idiopathic.

In 2014, Ober and colleagues [5] coined the term 'stellate nonhereditary idiopathic foveomacular retinoschisis' (SNIFR), in an attempt to provide a unifying classification under which to categorize unusual cases, without an explanatory pathophysiological mechanism.

The pathoanatomic mechanism of tractional abnormalities in the macula involves the impact of epiretinal membranes and/or vitreomacular tractions, which result in foveomacular retinoschisis.

It is proposed that, under normal conditions, the combined action of a specialized Müller cell (MC) subpopulation in the foveola (termed the 'Müller cell cone') and 'typical' z-shaped parafoveal MCs, forms and maintains the foveal ultrastructure [6]. The outer processes of the z-shaped MCs run in Henle's fiber layer with the photoreceptor axons in a horizontal orientation, thereby rendering this layer mechanically vulnerable to separation in response to inward tractional forces [7, 8].

In fact, the morphology of these MCs appears to provide a degree of anatomical compliance, allowing the retention of function in the presence of significant foveal deformation. On optical coherence tomography (OCT), anteroposterior and tangential traction (such as those observed in tractional disorders of the vitreoretinal interface) appear to manifest with progressive beveling

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of columnar retinal elements (thought to be the MC processes), which obliquely span the schisis cavity. This anatomical phenomenon is thought to be responsible for the radiating 'spoke-wheel' pattern, as seen on en face imaging [7-9]. Visual acuity is preserved at the point that the MC processes are in a beveled orientation, only deteriorating once the processes become fully verticalized [8]. This results in fluid imbalance in the interstitial retina, potentially leading to mechanical disruption of the fovea.

Because of the benign course of SNIFR, most cases do not need surgery. However, patients with SNIFR do require once-a-year monitoring visits with OCT evaluation. The cases with the presence of a tangential traction due to the thickened internal limiting membrane (ILM) along with progressive retinoschisis and reduced visual acuity require surgery.

The purpose of the study was to report a case of a rare disease, SNIFR, its clinical course and the results of vitrectomy with ILM peeling.

Case description

A 62-year-old woman presented to the Department of Vitreoretinal Diseases, SI "The Filatov Institute of Eye Diseases and Tissue Therapy of the National Academy of Medical Sciences of Ukraine", complaining of a gradual deterioration in vision over two years. Her past medical history, ophthalmic history and family history were unremarkable, and the patient had no somatic comorbidity.

The diagnosis was established after comprehensive ophthalmological examination including visual acuity testing, biomicroscopy, ophthalmoscopy, tonometry, Goldmann kinetic perimetry and imaging with ocular ultrasound ACCUTOME® B-Scan Plus (Accutome Inc., Malvern, PA), OCT (Optopol Technology Sp, zo.o, Zawiercie, Poland), and fluorescein angiography (FA).

The patient was informed about the course and potential complications of surgery, and informed consent was obtained from the patient.

She underwent a standard three-port 25-gauge pars plana vitrectomy using the Constellation vitrectomy system (Alcon, Inc., Hünenberg, Switzerland). Surgery was performed using a standard operating microscope (Haag-Streit Surgical, Wedel, Germany) with EIBOS (Haag-Streit, Zug, Switzerland) attachment for non-contact fundus viewing.

Operative technique

Antiseptic solution was used to prepare the surgical field, epibulbar anesthesia with proximetacaine hydrochloride 0.5% was applied, and the patient received a sub-Tenon injection of 5 ml of lidocaine 2% for nerve block anesthesia. The cornea was covered with 1.0 ml of Cellugel, Ophthalmic ViscoSurgical Device (Alcon, Switzerland). The EIBOS indirect wide-viewing system was helpful for performing a three-port subtotal vitrectomy of the central and peripheral vitreous with cutting rates of 20000 cuts/min, aspiration pressure of 300-650 mm Hg, and irrigation pressure of 30 mm Hg. The ILM was stained with TWIN (trypan blue 0.18% and blulife 0.03%, Alchimia srl, Padova, Italy) prior to ILM removal.

Postoperatively, the patient was treated with ophthalmic tobramycin, nepafenac, sodium hyaluronate 0.4%, and 0.5 ml of parabulbar dexamethasone once daily, 2.0 ml of intramuscular etamsylate once daily, and 2.0 ml of intramuscular dexketoprofene once daily. Outcome measures included anatomical success, defined as the recovery of vitreomacular interface anatomy and retinal profile, and visual acuity, and the patient was followed up on an outpatient basis for a year after surgery.

Preoperative visual acuity was 20/45 (0.55) in the right eye and 20/100 (0.2) in the left eye, and pneumotonometer intraocular pressure (IOP) readings, 15 mm Hg and 16 mmHg, respectively. In addition, there was preoperative biomicroscopic evidence of mild lenticular opacity. Fundus OU showed vitreous destruction, a pale pink optic disc with clear margins and surrounding vessels of normal caliber, no pathological inclusions in the macula, and the pathological reflex in the form of glistening throughout the retinal surface. Preoperative ocular ultrasound showed attached retina. OCT OU showed retinal splitting in the central retina with expansion to the peripheral retina, no evidence of vitreomacular traction, with a retinal macular thickness of 328 μm in the right eye and 533 in the left eye (Fig. 1). FA showed no abnormality in retinal and choroidal circulation. Biometry showed an axial length of 24.01 mm in the right eye and 23.80 mm in the left eye.

After a core vitrectomy was performed, the posterior hyaloid membrane was detached by active aspiration from the surface of the retina, the retinal surface in the posterior pole was stained with TWIN, and the thickened ILM was removed within the macula. The operation was completed with sterile air tamponade. In three weeks, vitrectomy in the fellow eye was performed in a similar manner than that performed previously.

The postoperative period was unremarkable. One month after vitrectomy, there was OCT evidence of disease regression and partial macular profile restoration in both eyes. In addition, visual acuity was 20/30 (0.7) in the right eye and 20/35 (0.6) in the left eye.

Three months after vitrectomy, OCT OU showed foveal depression, almost complete relief of cystoid macular edema, and the preservation of retinal splitting outside the macula (i.e. in the region where the ILM had not been removed). The pathological reflex in the form of glistening of the retinal surface appeared to be preserved outside (but not within) the region of ILM peeling.

There has been no recurrence of retinoschisis in this case for 12 months. Twelve months after vitrectomy, OCT OU showed complete restoration of the normal macular profile and regression of cystic macular edema (Fig. 2). Retinal macular thickness within the region of ILM peeling substantially decreased compared to previous follow-up, to 274 μm in the right eye, and 222 μm in the left eye, which resulted in improved visual acuity of 20/25 (0.8) and 20/30 (0.7), respectively.

Discussion

Since the disease is relatively rare, no universal guidelines exist for the diagnosis and management of SNIFR. It is a disease with a female predominance. A retrospective study by Ober and colleagues [5] included 17 patients with SNIFR, 16 of which were females with a mean age of 61 years. Another study [1] included 24 patients with SNIFR, 15 of which were females with a mean age of 63 years. Retinoschisis affecting the macula may have various etiologies, but, in all cases, the mechanism involves posterior hyaloid contraction and protein synthesis abnormalities [10, 11].

Congenital X-linked retinoschisis (CXLRS) is commonly bilateral and occurs mostly in males, and it is challenging to differentiate between this disease and SNIFR.

SNIFR is a new classification relatively recently introduced by Ober MD and colleagues to describe cases with foveomacular retinoschisis without hereditary background or other predisposing conditions. SNIFR can look similar in the clinical picture to patients with CXLRS, but the two diseases are different from each other in terms of the location of relinal splitting. Retinoschisis in XLR occurs primarily in the inner nuclear layer, whereas the stellate clinical appearance in SNIFR relates to splitting in Henle's fiber layer at the posterior border of the outer plexiform layer [12]. Fragiotta and colleagues [12] explored the structural differences between XLR and SNIFR using swept-source optical coherence tomography angiography (SS-OCTA). In the eye with XLR, OCTA flow data superimposed on the structural slab demonstrated flow signal within numerous bridging structures connecting the inner and outer plexiform layers containing the intermediate and deep capillary plexuses. In contrast, the same technique applied to the eye with SNIFR demonstrated an absence of flow signal in the cystic retinal spaces within Henle's fiber layer [12]. Therefore, evaluation of the retina with OCT and OCTA is important in the diagnosis of SNIFR.

When it comes to managing SNIFR, most patients maintain stable visual acuity and only require annual monitoring. However, significant deterioration of visual acuity and the development of subretinal fluid indicate the need for surgery.

Several studies [1, 13-15] reported on conservative treatment (such as topical Dorzolamide treatment and intravitreal bevacizumab) of SNIFR. Ajlan and colleagues [16] reported the complete resolution of SNIFR in response to topical dorzolamide hydrochloride 2% therapy.

In the case reported here, the patient noted a gradual but significant deterioration in vision. Because diagnostic evaluation found abnormal vitreoretinal interface, thickened ILM and the pathological reflex over the retina, vitrectomy with ILM peeling was the treatment option of choice for this patient.

The ILM is composed of Müller cell processes and the basement membrane; the latter is the structural interface between the retina and the vitreous and is composed of collagen fibers, glycosaminoglycans, laminin and fibronectin [17]. The macular ILM is thickest, measuring 2.5 μm and progressively thins to 0.5 μm at the vitreous base. Müller cells connect and support the photoreceptor cells in the fovea; at the center of the fovea, a thickening of the Müller stratum connects ILM with the external limiting membrane (ELM). Some authors advocate for fovea-sparing ILM peeling (leaving a portion of the ILM in the center of the fovea) to preserve the anatomical integrity of the central fovea [18, 19].

In the case reported here, however, ILM peeling within the vascular arcade contributed to the restoration of vitreomacular interface anatomy due to the stimulation of Müller cell processes that are a component of the ILM. In addition, in the case reported here, ILM thickening acted as the traction component leading to the development of FRS. If no vitrectomy has been done, then the strained ILM and the traction from the vitreous would put pressure on the macula, leading to splitting of retinal layers, fluid accumulation between them, and subsequent macular hole formation. ILM peeling stimulates glial cell proliferation and ELM recovery with subsequent migration of these cells to inner retinal layers. ELM integrity plays an important role in the restoration of photoreceptor microstructure [20].

Although ILM peeling may produce iatrogenic retinal damage, most clinicians support the use of ILM peeling because vitreomacular traction removal is characterized by a lower rate of late recurrence [21].

Conclusion

This case indicates the efficacy and safety of surgical treatment for SNIFR, because this treatment contributed to the restoration of macular vitreoretinal interface and no recurrence was observed over a 1-year follow-up period.

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Disclosures

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All authors reviewed the results and approved the final version of the manuscript.

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Abbreviations: *ELM, external limiting membrane; FA, fluorescein angiography; FRS, foveomacular retinoschisis; ILM, internal limiting membrane; OCT, optical coherence tomography' SNIFR, stellate nonhereditary idiopathic foveomacular retinoschisis*

Figures to the article titled *Vitrectomy with internal limiting membrane peeling for stellate nonhereditary idiopathic foveomacular retinoschisis: a case report.* Authors: Pyrozhkova O. S., Umanets M. M.

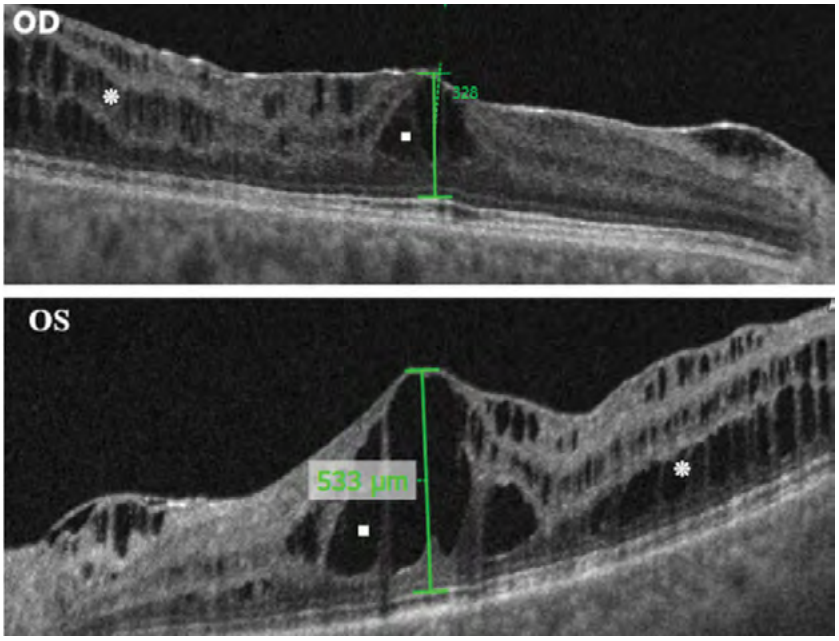

Fig. 1. Optical coherence tomography of the macula OU in a patient with stellate nonhereditary idiopathic foveomacular retinoschisis before vitrectomy. Note a thickened internal limiting membrane, cystic cavities (denoted with a "■" sign) and stretched glial cell processes (denoted with an asterisk *)

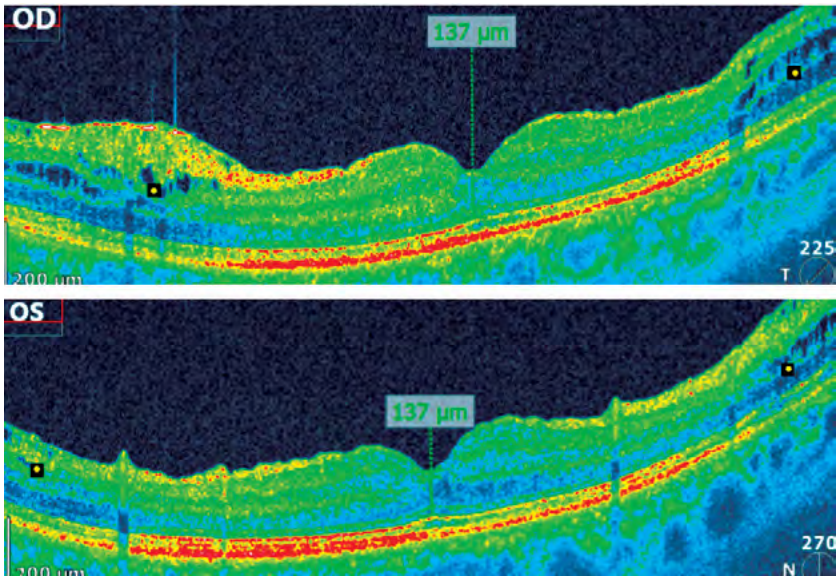

Fig. 2. Optical coherence tomography of the macula OU in a patient with stellate nonhereditary idiopathic foveomacular retinoschisis 12 months after vitrectomy. Note the preservation of retinal splitting (denoted with) outside the region of internal limiting membrane peeling