Chapter 1

Retinal Detachment Following Cataract Surgery

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Abstract

The technical progress in cataract treatment led to the significant decrease of retinal detachment (RD) following surgery. Globally, the risk for RD, 4 years after cataract surgery is around 0.93%. The strategy to decrease the risk for pseudophakic RD includes: preoperative identification of the retinal lesions predisposing to RD, high quality cataract surgery and efficient resolution of complications (if any). The RD on the pseudophakic eye differs from the one on the pakic eye, by the possible incarceration of the vitreous and the condition of the posterior capsule, which can be present, interrupted or absent. The treatment of pseudophakic RD is surgical. In its absence, vision is lost. With treatment in due time, most cases have a favorable outcome. We present our personal experience in treating pseudophakic RD, with the aim to outline the role of small gauge vitrectomy in preventing visual loss associated with pseudophakic RD. We conducted a retrospective study in which we included all the consecutive cases with pseudophakic RD operated by small gauge PPV (23G, 25G) during 2014. For the statistical analysis, we used the Fisher exact test. During 2014 we operated 53 patients with RD that occurred following cataract surgery. Of these, 38 were males (71.69%) and 15 were females (28.30%). Myopia was present in 9 of the 53 cases (16.98%). In 46 of the 53 cases, intraocular lens (IOL) was correctly positioned, in the bag (86.79%), in 4 cases, the IOL was in the sulcus (7.54%), in 2 cases, it was fixated at the sclera (3.77%) and in one case, it was fixated to the iris (1.88%).

In the majority of cases, preoperative VA was below 1/10 (47 cases - 88.67%). Following surgery, 29 cases (54.71%) recovered VA above 1/10. The final retinal reattachment rate in our series was 81.13%. The statistical tests could not identify any factors associated with poor outcome following pseudophakic RD surgery.

Background

The occurrence of retinal detachment (RD) following cataract surgery is a limiting factor for visual function recovery. Despite the significant progress in the techniques, RD continues to shade the prognosis of cataract surgery, especially in patients with myopia, lattice degeneration and if there has been vitreous loss during cataract removal [1-3]. It is likely that the increasing life expectancy, associated with the increasing popularity of cataract removal and intraocular lens (IOL) implantation will lead to the increasing proportion of pseudophakic RD within the group of RDs [4]. It requires immediate referral to vitreoretinal surgeon.

Epidemiological Data

The technical progress in the treatment of cataract led to the significant decrease of RD following this surgery. The incidence of pseudophakic RD is estimated to range between 0.6 - 1.7% during the first year after surgery and it accounts for 30 - 40% of all RDs [5]. The prevalence of RD in patients previously operated for cataract is about 8

times higher as in the general population [6,7]. The risk for RD increases significantly in eyes with the axial length above 25 mm and if YAG laser capsulotomy for posterior capsular opacification is performed [2].

Pathogeny

Vitreal traction plays a key role in the development of RD following cataract surgery. During cataract surgery, there may be created conditions for the posterior vitreous detachment (PVD) [1]. It may lead to the formation of retinal breaks, in the presence of peripheral retinal degenerative lesions [1]. If cataract surgery is complicated by the rupture of the posterior capsule, the pre-existant retinal degenerative lesions are not mandatory for the formation of the retinal breaks [1-3].

PVD

Cataract surgery itself can accelerate vitreous liquefaction, even if performed with no incident. If a break appears in the posterior vitreous cortex, the liquid passes through it, behind the posterior hyaloid and vitreous separation occurs: the liquid component will occupy the posterior compartment of the vitreous cavity and the solid one, its anterior compartment. The solid vitreous remains attached to the peripheral retina and pulls it during eye movements. At a certain moment, a retinal break can occur, especially if there are peripheral degenerative retinal lesions [2].

The variations of the anterior chamber depth during cataract surgery are transmitted to the vitreous body and can lead to PVD. Therefore, the maintenance of a constant depth of the anterior chamber is an important method to decrease the risk for RRD in the postoperative period [1-3].

Pre-Existant Retinal Lesions

The lesions in the peripheral retina can lead to retinal breaks, in the presence of PVD. Therefore, it is desirable to identify preoperatively, any risky lesion in the periphy of the retina, with the aim to treat it by laser or cryo. In the eyes that carry the risk for RD, it is advisable to look for the retinal lesions prior to cataract surgery, by using wide field lenses [2]. This can be impossible, in the presence of dense peripheral lens opacities [1].

Break of the Posterior Capsule

If there is a break in the posterior capsule, the vitreous will prolapse and incarcerate into it. The retraction of the vitreal fibres induces retinal traction and breaks, even if there are no retinal lesions [2].

For a retinal detachment to occur, 3 factors must act synergically: vitreous liquefaction, the presence of at least one retinal break and the existance of traction at the level of the break [1-3].

Prevention-Strategy

Preoperative Identification of Retinal Lesions Predispozing to Retinal Detachment

This dezideratе may be impended by the peripheral lens opacities that prevent the examination of the peripheral retina.

High Quality Cataract Surgery

One of the goals during cataract removal is to avoid variations in the depth of the anterior chamber during surgery.

Efficient Resolution of Complicaitons (if any)

In the complicated situations, the following maneuvres are advisable:

1. The vitreous must be completely removed from the anterior chamber. The method to check if there are vitreous remnants in the anterior chamber consists in the injection of air (the bubble must be perfectly round) or triamcinolon (it adheres to the vitreous) in the anterior chamber [2].
2. Vitrectomy must be performed with the vitreotome, preferably with the high speed cutter, not with the vitreotome from the phako machine [3].
3. If the vitreous continues to be incarcerated post-

operatively, reintervention is mandatory. The cut of the vitreous with the YAG laser is not an option, because of the tractions on the retina [3].

Differences Between the Phakic and Pseudophakic Retinal Detachment

Afakia and pseudophakia are associated with very peripheral retinal breaks, located at the posterior edge of the vitreous base, near ora serrata.

The RD on the pseudophakic eye differs from the one on the pakic eye, by the possible incarceration of the vitreous and the condition of the posterior capsule, which can be present, interrupted or absent. PsRD is more extensive and it involves the macula more frequently [8].

Normal Posterior Capsule

The degree of fibrosis of the posterior capsule determines the quality of the retina visualization. If the visualization during surgery is poor, retinal breaks may be missed, especially that in the pseudophakic retinal detachment, most of the breaks are very peripheral and small [2].

Absent Posterior Capsule

The absence of the posterior capsule influences the internal tamponade. In the postoperative period, the air or gas in the anterior chamber impends the visualizaiton of the retina. For the prevention of the pupillary block glaucoma, an inferior iridectomy (at 6 o'clock) must be performed [2].

Clinical Examination of the Patient with Pseudophakic Retinal Detachment

Symptoms

Acute PVD is translated into the clinical picture by the sudden perception of floaters or as a mobile cob web.

The symptoms of the retinal detachment are: floaters, flashes, progressive amputation of the visual field and decreased and distorted vision.

Sygns

The fundus biomicroscopy reveals:

Vitreous:

- PVD (Weiss ring - it indicates the vitreous separation around the optic disc), detached posterior hyaloid, vitreous hemorrhage (occasionally);
- "Tobacco dust", Shafer sign: pigmented particles, suspended and mobile in the anterior vitreous;

Detached retina:

- The surface is convex, corrugated
- The retinal pigmented epithelium and the choroid are less visible

- Usually, the retina is detached peripherally, but when the break is macular or posterior, the detachment involves only the posterior pole
- If the detachment is old, the retina is thin, rigid, demarcation lines, intraretinal cysts and proliferative vitreo-retinopathy (PVR) are visible

The retinal break(s):

- The shape of the retinal break is variable: horseshoe, fishmouth, operculated, round, linear;
- Typically, the retinal breaks are small in pseudophakic retinal detachments, but it can be medium or big;
- Most of the retinal breaks are superior (about 60% in the supero-temporal quadrant).

Lincoff elaborated several rules about the localization of the retinal break, according to the topography of the RD [2]:

Superior RD:

1. In the supero-temporal or supero-nasal RD, the break is near the superior border of the detachment;
2. In the symmetric RD, the break is near 12 o'clock position;

Inferior RD:

1. Usually, the break is located in the sector where more fluid is accumulated; however, two observations have to be made:

- The break may not be near the superior border of the detachment;
- The breaks that are not located on the median line may produce symmetric RD, because of the slow accumulation of fluid;

2. If the detachment is bullous, the break is above the median line.

- Signs of anterior uveitis may be associated, expecially in ancient retinal detachments.
- Intraocular pressure can be low, normal or high.

It is very important to remember that the identification of one retinal break does not exclude the presence of multiple breaks. About 50% of all RDs have more than one retinal break [1-3].

Sometimes, we cannot identify the break preoperatively, especially that in pseudophakic RD, the breaks are usually small and peripheral. This does not mean that there is no break, but that we could not see it before surgery (so called rhegmatogenous RD "without break").

Ultrasound Examination of the Eye with Pseudophakic RD

In the presence of vitreous hemorrhage or significant posterior capsular opacification, B ultrasound examination is indicated. Detached retina appears as a hyperreflective, convex and irregular membrane. Eye movement induces the ondulatory displacement of this membrane [2].

Treatment of Pseudophakic RD

The treatment of pseudophakic RD is surgical. In its absence, vision is lost. With treatment in due time, most cases have a favorable outcome.

The Moment of Surgery

Surgery for pseudophakic RD must be urgent:

- If the macula is not yet detached, especially in the presence of U-shaped break, surgery must be performed as soon as possible;
- If the macula is already detached, there is evidence that surgery can be performed anytime, within 7 days from the diagnosis, with the same prognosis.

The Positioning of the Patient

The goal of patient's positioning is to keep the fluid away from the macula, until the moment of surgery.

Surgical Techniques

Currently, several techniques are available for the treatment of RD: pars plana vitrectomy (PPV), scleral indentation and pneumatic retinopexy. Typically, in pseudophakic RD it is indicated to perform PPV.

PPV eliminates the tractions on the retina, it allows the drainage of the subretinal fluid and the injection of tamponade agents inside the vitreous cavity. It also permits the identification of the retinal break (s) that could not be identified preoperatively, because of the specific conditions of the pseudophakic eye with retinal detachment: small, peripheral break (s), difficulty to examine the retinal periphery, because of the peripheral capsular fibrosis [1-3].

The technique consists in performing several steps:

- Creation of 3 scleral entry sites in pars plana (27G/25G/23G/20G);
- Vitrectomy - as complete as possible, up to the periphery, helped by scleral indentation during surgery;
- Drainage of the subretinal fluid: either through the retinal break, simultaneously with air injection, or by injecting heavier than water liquids (perfluorodecaline/ perfluorooctane);
- Treatment of the retinal break, by cryo or endolaser around it;

- Injection of the tamponade agent: silicone oil/expansive gas.

Complications

- Intraoperative: iatrogenic retinal break, retinal hemorrhage, choroidal hemorrhage
- Postoperative: cataract, glaucoma, inflammation, hypotony, sympathetic ophthalmia
- Related to the tamponade agents: intraocular hypertension, anterior displacement of the intraocular lens, keratopathy, retinal fibrosis.

Prognosis

Anatomic success (retinal reattachment) after surgery for pseudophakic RD is around 90%.

Personal Experience in the Treatment of Pseudophakic RD

Purpose

The purpose of our study was to outline the role of small gauge vitrectomy in preventing visual loss associated with pseudophakic RD.

We set the following objectives:

- To evaluate the anatomical results following surgery

- To assess the functional results following surgery
- To outline the prognostic factors

Material and Methods

We conducted a retrospective study in which we included all the consecutive cases with pseudophakic RD operated by small gauge PPV (23G, 25G) during 2014. In order to identify the prognostic factors, we use the statistical tests (Fisher exact test). We analyzed the following factors: the timing of surgery (within 14 days or after more than 14 days after the onset of RD), the condition of the macula (on/off), the number of the retinal breaks (one or more), the size of the retinal break (small, medium or large), myopia, initial visual acuity.

Results

During 2014, we operated 53 patients with RD that occurred following cataract surgery. All the cases had been operated by phacoemulsification. Of these, 38 were males (71.69%) and 15 were females (28.30%). The age distribution of the patients is presented in figure 1. Most of our cases were in the 8th decade of life and the mean age was 66.67 years.

The interval between cataract surgery and the onset of RD varied between 2 days and 19 years, with a mean of 27.7 months. The interval between the presumed onset of RRD and its surgical treatment varied between 2 days and 4 months, with a mean of 18.4 days.

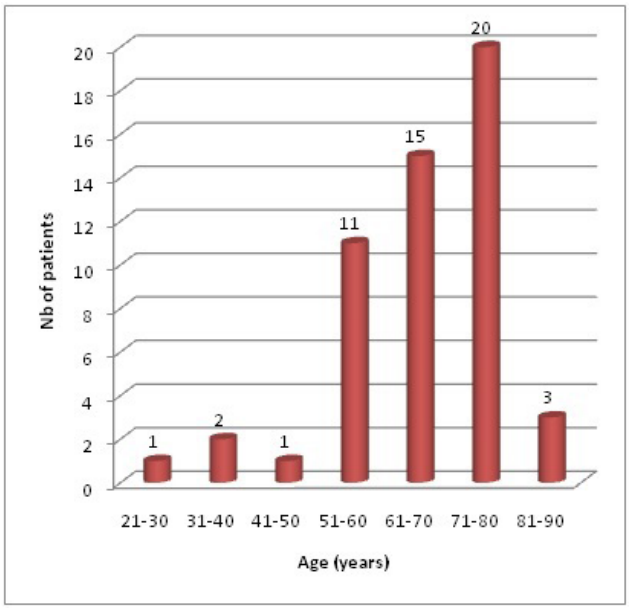

Figure 1: Age distribution of the patients with pseudophakic RD.

Myopia was present in 9 of the 53 cases (16.98%). The position of the IOL is presented in table 1.

The macula was off in 28 cases (52.83%). We identified one retinal break in 34 cases (64.15%) and multiple retinal breaks, in 19 cases (35.84%). We present the size of retinal breaks in table 2 and the location of the retinal breaks, in table 3. The visual acuity prior to surgery for RD is illustrated in table 4.

Retina was attached after the first surgery (under silicone oil) in 45 cases (84.90%). The retina remained attached after silicone oil extraction in 42 cases (79.24%). In the recurrent cases, a new surgery was carried out. The final anatomical outcome consisted in the attachment of the retina in 43 of the 53 cases (81.13%).

The final visual acuities are illustrated in table 5.

The cases that we operated within 14 days from onset did not have a better anatomical outcome as compared to the cases that we operated more than 14 days from onset in our series, according to the statistical tests ($p = 0.27$). The macula on was not associated with a better reattachment rate ($p = 0.58$) and the presence of myopia did not influence significantly the final result ($p = 0.06$). The cases with preoperative VA $\geq$ 1/10 did not have a better final outcome as compared to the ones with preoperative VA < 1/10 ($p = 0.68$). The multiple and the large retinal breaks were not associated with a significantly worse outcome in our series ($p = 0.89$ and 0.07, respectively).

Table 1: The position of the IOL.

The position of the IOL	Number of cases	%
In the bag	46	86.79
In sulcus	4	7.54
Scleral fixation	2	3.77
Iris fixation	1	1.88
TOTAL	**53**	**100**

Table 2: Size of the retinal breaks.

Size of the retinal break	Number of cases	%
Small	25	47.16
Medium	23	43.39
Large	5	9.43
TOTAL	**53**	**100**

Table 3: Location of the retinal breaks.

Location of the retinal breaks	Number of cases	%
Supero-temporal	30	56.60
Infero-nasal	11	20.75
Supero-nasal	8	15.09
Infero-temporal	4	7.54
TOTAL	**53**	**100**

Table 4: Preoperative VA.

Preoperative VA	Number of cases	%
LP*	3	5.66
HM**	15	28.30
≤ 1/50	21	39.62
> 1/50 > 1/10	8	15.09
≤ 1/10 > 4/10	3	5.66
≤ 4/10 > 8/10	2	3.77
≤ 8/10 ≥ 10/10	1	1.88
TOTAL	**53**	**100**

*LP = light perception
**HM = hand motion

Table 5: Final visual acuities.

Final VA	Number of cases	%
No LP*	1	1.88
LP*	2	3.77
HM**	6	11.32
≤ 1/50	7	13.20
> 1/50 > 1/10	8	15.09
≤ 1/10 > 4/10	24	45.28
≤ 4/10 > 8/10	4	7.54
≤ 8/10 ≥ 10/10	1	1.88
TOTAL	**53**	**100**

Discussion

Epidemiological Characteristics of the Study Sample

We cannot make a statement regarding the risk for RD following cataract surgery in our series, because we are a referral center for vitreo-retinal surgery and most of the patients with pseudophakic RD came from other centers.

Men were significantly more numerous than women in our series, but since we do not have data regarding the gender-related cataract surgery in the centers where this was performed, we cannot conclude about the gender-related risk of retinal detachment following cataract surgery.

RD occurring on the pseudophakic eye touches older

population as compared to RD on an eye that was not previously operated for cataract, according to our results. The medium interval of time between cataract surgery and the onset of RD was 27.7 months. Thus, we fall within the interval reported in the literature that shows a maximum risk for RD within 4 years after surgery.

Position of the IOL

The IOL was not in the right position in 7 cases (13.20%). In these cases, the occurrence of intraoperative complications during cataract surgery is certain. However, in most cases (86.79%), the IOL was well centered, in the bag. The presence of a well centered, properly located IOL is not always a sign of a perfect cataract surgery. The variations of the anterior chamber depth during surgery can be a risk factor for the development of RD in the postoperative period. During these variations, the vitreous pulls the peripheral retina, increasing the risk for RD in the postoperative period. Therefore, one of the important goals during cataract surgery, is to maintain the anterior chamber depth constant, throughout the procedure.

Rationale for PPV in the Repair of Pseudophakic RD

PPV not only addresses the cause of RD directly, by releasing all the vitreo-retinal tractions that led to retinal break and subsequent RD, but it also allows to identify retinal breaks that could not be seen preoperatively.

The periphery of the retina is difficult to examine in an eye that was previously operated for cataract. Many factors contribute to the poor complete visualization of the posterior segment after cataract surgery: the anterior and posterior capsular fibrosis, cortical remnants, poor pupillary dilatation, vitreous opacities and optical aberrations secondary to the IOL itself [4]. Also, the retinal breaks in pseudophakic RD, usually are small and located very anteriorly. To sustain this theory, we could identify the retinal breaks preoperatively, in only 43 cases (81.13%). In the remaining 10 cases (18.86%), we discovered the retinal breaks during PPV and in each situation it was a small one, located in the far periphery of the retina, near ora serrata. Other authors reported that they did not identify any retinal break, prior to PPV, in 29.8% [9] or 25% [10] of their cases. This is a strong argument in favor of PPV to treat pseudophakic RD, as the missed retinal break is one of the major causes of failure in RD surgery [11,12]. In our series, we had no case with non- identified retinal break.

Another argument in favor of PPV in pseudophakic RD is that it improves the visualization, by removing posterior capsular and vitreous opacities [4]. PPV eliminates the disadvantages related to the scleral buckle procedures: change in eye refraction, motility impairment, infection and extrusion of the buckle, anterior ischemia [13-15].

Timing of Surgery

The mean of the interval between the onset of RD and its surgical repair was 18.4 days. Ideally, a macula on RD must be operated as urgently as possible and a macula off RD can be operated with good chances for recovery within 7 days from onset. If not operated promptly, the prognosis of RD is worsening , because of PVR that installs rapidly: the retinal pigmented epithelial cells that escape into the vitreous cavity through the retinal break promote the proliferation of cells and fibrous tissue on the surface of the retina, which makes it rigid and impossible to be reattached [1-3]. The cases operated later had a worse anatomical and functional outcome in our series, but this observation could not be proved statistically ($p>0.05$).

Preoperative VA

In the majority of cases, preoperative VA was below 1/10 (47 cases - 88.67%), meaning the touch of the macula. If such is the case, the postoperative recovery of the VA cannot be maximal. In this context, 54.71% of cases (29 of 53) recovered VA above 1/10.

Final Reattachment Rate

Our final reattachment rate (81.13%) is below the results reported in the literature, which vary between 88% - 100% after one or more surgeries [4,10, 16-22]. This situation could be partly explained by the long intervals of time between the onset and the repair of the RD: in 10 cases (18.86%), this was above 4 weeks.

A potential complication of PPV is endophthalmitis. We report no such case in our series.

PVR

PVR complicated the evolution of 10 cases (18.86%) within our series and it was the main cause of failure. PVR rates cited by other authors are lower, ranging from 3%-16% [4,5,16,18,21]. This may be related to the late initiation of surgery in these cases. PVR is induced by the retinal pigmented epithelial and inflammatory cells within the vitreous cavity [23,24].

Conclusion

Small gauge PPV proved its efficacy in preventing visual loss associated with pseudophakic RD. Statistical analysis could not identify any prognostic factors in our series. Larger series and more refined statistical tests are mandatory to reach significance.

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