·Clinical Research·

Vitrectomy combined with silicone oil tamponade in the treatment of severely traumatized eyes with the visual acuity of no light perception

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Abstract

• AIM: To evaluate the efficacy of surgical treatment of vitrectomy combined with silicone oil tamponade in the treatment of severely traumatized eyes with the visual acuity of no light perception (NLP).

• METHODS: This was a retrospective uncontrolled interventional case-series of 19 patients of severely traumatized eyes with NLP who underwent vitrectomy surgery at the Affiliated Hospital of Medical College, Qingdao University (Qingdao, China) during a 3-year period. We recorded perioperative factors with the potential to influence functional outcome including duration from the injury to intervention; causes for ocular trauma; open globe or closed globe injury; grade of vitreous hemorrhage; grade of endophthalmitis; grade of retinal detachment; size and location of intraocular foreign body (IOFB); extent and position of retinal defect; grade of proliferative vitreoretinopathy (PVR); type of surgery; perioperative complications and tamponade agent. The follow-up time was from 3 to 18 months, and the mean time was 12 months.

• RESULTS: After a mean follow-up period of 12 months (3-18 months) 10.53% (2/19) of eyes had visual acuity of between 20/60 and 20/400, 52.63% (10/19) had visual acuity less than 20/400 but more than NLP, and 36.84% (7/19) remained NLP. Visual acuity was improved from NLP to light perception (LP) or better in 63.16% (12/19) of eyes and the rate of complete retinal reattachment was 73.68% (14/19). Good visual acuity all resulted from those patients of blunt trauma with intact eyewall (closed globe injury). The perioperative factors of poor visual acuity prognosis included delayed intervention; open globe injury; endophthalmitis; severe retinal detachment; large IOFB; macular defect; a wide range of retinal defects and severe PVR.

• CONCLUSION: The main reasons of NLP after ocular trauma are severe vitreous hemorrhage opacity; refractive media opacity; retinal detachment; retinal and uveal damages and defects, especially defects of the macula; PVR and endophthalmitis. NLP after ocular trauma in some cases does not mean permanent vision loss. Early intervention of vitrectomy combined with silicone oil tamponade and achieving retinal reattachment of the remaining retina, may make the severely traumatized eyes regain the VA of LP or better.

• KEYWORDS: vitrectomy; silicone oil tamponade; severely traumatized eyes; no light perception

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INTRODUCTION

Serious eye injury is very common in clinical practice, often causing great damage to visual function, generally resulting in poor visual and anatomic outcomes despite surgical intervention [1], or even the loss of the eye. The conventional wisdom is that post-traumatic eyes with no light perception (NLP) have lost the value of surgical treatment. However, with the development of modern ophthalmic technology and equipment, the progress of microsurgery, especially pars plana vitrectomy (PPV) for open eye injury after trauma [2], the traumatized eyes with no hope originally also have a chance of survival. Some severely traumatized eyes with no light perception can restore vision to some extent [3], at least to retain the eye. We performed vitrectomy combined with silicone oil tamponade for 19 cases of severe ocular trauma patients with no light perception between January 2007 and December 2009, and achieved some good results.

SUBJECTS AND METHODS

General Information From January 2007 to December 2009, 19 cases (19 eyes) of severe ocular trauma patients with no light perception had undergone a detailed strict examination in a dark room. With candle, or bright

flashlight, or indirect ophthalmoscope light source, the other eye with close eye cover, in absolute darkroom environment, from all angles, distances, projection on the injured eye, the patients all showed that their visual acuity was no light perception. Among them 16 were males; 3 were females. The mean age of patients was 43.84 ±14.08 years (range 16-19 years). The mean post injury presentation time was 13.37±12.98 days (range 1 to 48 days) (Table 1). Among 19 cases, corneoscleral rupture was in 9 eyes, scleral rupture in 5 cases, and blunt trauma with the intact eyewall in 5 cases (Table 2). Before surgery, injured eyes all underwent CT examination, and some patients had B-ultrasound, and MRI. Although some of the fellow eye of patients had different degrees of damage, they all had some vision, not within the scope of this study. All patients underwent routine preoperative examination, including blood, urine, stool, liver and kidney function, HBsAg, anti-HCV, anti-HIV, anti-PT, ECG, chest X-ray examination, *etc*,to exclude complications and systemic surgical contraindications.

Table 1 Clinical data of 19 patients of severely traumatized eyes with no light perception

Patient No.	Age(a)/sex	Eye	Duration($^{1/2}$) (days)	Causes for trauma
1	37/M	L	2/2	Rupture (contusion)
2	24/M	L	1/1	Rupture (contusion)
3	50/M	R	5/5	IOFB
4	51/F	L	2/2	Blast injury
5	58/M	R	9/9	Contusion
6	69/M	L	26/28	Road accident
7	42/M	L	48/50	Contusion
8	24/M	L	1/1	Nail stabbed
9	29/M	R	31/34	Knife wounds
10	40/M	L	8/8	Needle-stick injuries
11	59/M	R	21/21	Rupture (contusion)
12	46/F	L	12/12	IOFB
13	50/M	L	33/36	Rupture (contusion)
14	44/M	R	15/15	Contusion
15	36/M	L	6/6	Knife wounds
16	55/F	R	13/13	Contusion
17	41/M	L	9/9	Chopsticks stabbed
18	16/M	R	1/1	Blast injury
19	62/M	L	11/11	Contusion

$^{1/2}$ from injury to presentation/from injury to vitrectomy surgical intervention; IOFB: Intraocular foreign body.

Surgical Methods Fourteen patients with penetrating injury underwent debridement and suturing surgery at local hospitals or our hospital on the same day or the next day. In our hospital, the severe traumatized eyes with ocular rupture, no clear optic nerve avulsion by CT or MRI examination, underwent wound debridement. The wound was checked carefully. The incarcerated uvea and retina were washed with diluted gentamycin and pushed back into the globe (eyeball). After obtaining haemostasis, scleral tissues and corneal conjunctival tissues were sutured tightly, and intravitreal injection of sterilized air or viscoelastic substances such as hyaluronic acid and vancomycin+ gentamycin or vancomycin+ceftazidime was performed. One week after injury, systemic corticosteroids were started, with the subconjunctival injection of gentamycin+dexamethasone or juxtaglobe injection of methylprednisolone 20mg. All the patients underwent vitrectomy at the same time or at the second time. The operative time was 1 day-50 days after the injury, an average of 13.89±13.88 days (Table 1). Operation in a conventional procedure involved lensectomy, vitrectomy, removal of vitreous hemorrhage and proliferative fibers, peeling of the epiretinal proliferative membrane, cutting the retina open, peeling subretinal proliferative membrane, removal and release part of the retina, retinal reattachment, laser photocoagulation or cryocoagulation to seal retinal holes, silicone oil tamponade, in some cases combined with scleral buckling.

Intraoperatively, the vitreous hemorrhage was very dense in 17 eyes. Very thick vitreous empyema with some hemorrhage was found in 2 eyes with endophthalmitis. In 5 patients with some degrees of proliferative fibers, the treatment time was later than 20 days. Fifteen eyes had retinal detachment, and 8 eyes were associated with choroidal detachment. Retina broken in 5 eyes was curled, overlapped, adhesive, like permed hair curls; in 3 eyes the retinal defects were larger, close to or more than two quadrants and in 1 eye retina was almost completely destroyed. Intraocular foreign body was noted in 6 eyes, of which 2 were large size foreign body in the macula region, resulting macular damage. In 1 eye, the long rod-shaped nail resulted to penetrating ocular trauma including the corneoscleral wound and the macular wound (Table 2). If the lens was left, it was removed during vitrectomy, including 5 eyes of blunt trauma with intact eyewall. The lens was removed in the operation or lost during the injury in the remaining patients with open injury. One eye underwent scleral buckling, and intraocular foreign body removal was performed in 6 eyes. Silicone oil tamponade was performed during the last phase of the vitretomy procedure (Table 3).

Postoperative Treatment The routine postoperative intravenous antibiotics and corticosteroids were given to all patients, such as penicillin 8 million U, or cefuroxime 3.0g, or levofloxacin 0.3g, and dexamethasone 10mg into the intravenous infusion. Other drugs such as Vitamin B, C, E and Hemostatic drugs (Browed Hemocoagulase, Etamsylate, Aminomethylbenzoic Acid, Vitamin K1) were also given when needed. Antibiotics and corticosteroids eye drops were applied 4 times per day.

Follow-up Time Out-patient follow-up after discharge was conducted on a regular basis, from 3 to 18 months, an average of 12 months.

Statistical Analysis The statistical analysis Software SPSS12.0 was used for statistical analysis. Count data was analyzed by Chi-square test. $P<0.05$ was considered statistically significant.

Table 2 Clinical data 2 of 19 patients of severely traumatized eyes with no light perception

Patient No.	CSW (mm)	SW (mm)	Clinical signs								
			CGI	Lens	VH	VE	RD	CD	IOFB	Defects	PVR
1	10			Lost	++++		+++	++			
2		7			++++		++++				
3	6			Opaque	+++				6mm	Macular 6mm	
4	13			Lost	++++		++++	+++	Multiple	1/4	
5			√	Opaque	++++		++				
6		8		Opaque	++++		++++	++++	4mm	1/3	++
7			√	Opaque	++++		+	++			++++
8	5			Opaque	+++		++		[1]length 30mm	5mm	
9	11			Lost	++++		++++	++++		1/2	++
10		1		Opaque	++	++++					
11		6			++++		+++	+++			+++
12		4			++++				4mm	Macular 4mm	
13	15			Lost	++++		++++			2/3	++
14			√	Opaque	++++		+++				
15	12			Lost	++++		++++	++		1/4	
16			√	Opaque	++++		+				
17	5			Opaque	+++	++++					
18	9			Lost	++++		+		Multiple		
19			√	Opaque	++++		+++	+			

CSW: Corneoscleral wound; SW: Scleral wound; CGI: Closed globe injury; VH: Vitreous hemorrhage; VE: Vitreous empyema; RD: Retinal detachment; CD: Choroidal detachment; IOFB: Intraocular foreign body; PVR: Proliferative vitreoretinopathy; [1]Long rod-shaped nails.

RESULTS

Visual Acuity Post operatively, 12 patients (63.16%) achieved the best corrected visual acuity (BCVA) of light perception (LP) or better, in which 52.63% (10/19) had visual acuity less than 20/400 but more than no light perception (NLP), 10.53% (2/19) of eyes had visual acuity of between 20/60 and 20/400. LP in 3 cases, hand motion (HM) in 1 case, finger count (FC) in 2 cases, 20/2000-20/500 in 4 cases, 1 case 20/100, 1 case 20/66 (Tables 3,4). Good visual acuity was achieved in patients of blunt trauma with intact eyewall (closed globe injury) (Tables 2, 3). The visual acuity of the other 7 patients (36.84%) didn't improve, still remained NLP. Among them, 2 patients underwent evisceration and hydroxyapatite orbital implantation after 8 months. The perioperative factors of poor visual acuity prognosis included delayed intervention; open globe injury; endophthalmitis; severe retinal detachment; large intraocular foreign body (IOFB); macular defect; a wide range of retinal defects and severe proliferative vitreoretinopathy (PVR) (Tables 1,2,3).

It could be seen from the Tables 2, 3 that, for open globe injuries, a posterior globe rupture had a far worse prognosis than an anterior rupture. And the more posterior the wound, the worse the prognosis. In the last seven cases with the ultimate vision of still no light perception, the injury site reached the equator sclera in five patients, their corneoscleral laceration was more than 10mm, or scleral laceration more than 5mm; another two cases of endophthalmitis had the poor prognosis.

Table 3 Clinical data 3 of 19 patients of severely traumatized eyes with no light perception

Patient No.	Surgery	Follow-up surgery	Final VA
1	PPV+SO	SO removal	LP
2	PPV+LE+SO	SO removal	20/1000
3	PPV+LE+SO+IOFB R	SO removal	HM
4	PPV+SO+IOFB R		NLP
5	PPV+LE+SO	SO removal, IOL	20/66
6	PPV+LE+SO+IOFB R	Second PPV+SO	NLP
7	PPV+LE+SO+Buckling		LP
8	PPV+LE+SO+IOFB R	SO removal	FC
9	PPV+SO	Evisceration+HA	NLP
10	PPV+LE+SO		NLP
11	PPV+LE+SO	Second PPV+SO	NLP
12	PPV+LE+SO+IOFB R	SO removal	FC
13	PPV+SO	Evisceration+HA	NLP
14	PPV+LE+SO	SO removal	20/666
15	PPV+SO	SO removal	LP
16	PPV+LE+SO	SO removal, IOL	20/100
17	PPV+LE+SO	Second PPV+SO	NLP
18	PPV+SO+IOFB R	SO removal	20/1000
19	PPV+LE+SO	SO removal	20/500

VA: Visual acuity; PPV: Pars plana vitrectomy; SO: Silicone oil tamponade; LE: Lensectomy; IOFB R: Intraocular foreign body removal; IOL: Intraocular lens implantation; HA: Hydroxyapatite orbital implantation; NLP: No light perception; LP: Light perception; HM: Hand motion; FC: Finger count.

Outcome of Surgical Treatment After the operation, the appearance of the eyeball was good. That was to say, after stitching, the integrity of the wall of the eyeball was restored. Generally seen, the eyeball was complete, no visible leakage, and the sutures could be seen under slit lamp check. Intraocular pressure was at 5-36mmHg (1mmHg=0.133kPa), with an average of 18mmHg. The postoperative IOP of silicone oil filled eyes in 3 patients was a little high

(22-36mmHg) and could be stable after the medication of Timolol eye drops. Complete retina reattachment was achieved in 14 cases (73.68%) postoperatively, among which 12 patients achieved a certain extent visual acuity. Retinal detachment occurred in 3 cases after silicone oil removal. They all underwent vitrectomy and silicone oil tamponade again and achieved retinal reattachment after the surgery. The retinal reattachment could not be achieved in remaining 2 cases because of the severely damaged eye tissues, especially severely damaged uvea and retina, and some almost completely destroyed with no way to repair by surgical treatment, in which lower IOP existed with opaque refractive media, and the fundus could not be observed, the visual acuity remaining no light perception. The patient who underwent scleral buckling also underwent silicone oil tamponade and achieved retinal reattachment. Six patients of IOFB removal also underwent silicone oil tamponade, in which IOFB damaged the retina to different degrees, including retinal holes, bleeding, retinal damage and retinal detachment. Eleven of 19 patients with silicone oil tamponade underwent silicone oil removal in 3 to 18 months postoperatively, among which 1 case had corneal degeneration and 1 case experienced persistent high IOP. Two patients with better prognosis then underwent intraocular lens implantation through the scleral suture fixation. While the other 8 cases were with silicone oil tamponade, but the serious proliferative vitreoretinopathy still occurred and could not be re-operated, the final visual acuity remaining no light perception in 7 cases, 1 case of light perception (Table 3).

DISCUSSION

Ocular trauma is a leading cause of blindness in the United States [4]. Ocular trauma, especially severe ocular trauma, often causes much damage to visual acuity (VA), even to blindness, among which penetrating ocular trauma is more serious. It is well known in the open eye injury that the more posterior the wound, the worse the prognosis [5-8]. In this study, we also observed that, for open eye injury, the more posterior by the site of injury, the worse the prognosis. It could be seen from the corneoscleral laceration and the scleral laceration length, the damage parts all reached the rear of the sclera in five cases with the final vision of no light perception, causing the serious retinal and choroidal injury in the posterior pole. In addition, the prognosis of two cases of endophthalmitis was very poor, showing that the eye infection caused retinal and choroidal extremely serious injury, resulting in poor visual prognosis. This is consistent with the literature [5-8]. Smith *et al* [9] have reported that final visual outcome was 28% with enucleation, "no light perception" (NLP) in 10%, light perception (LP) to 20/200 in 24%, and light perception of 20/200 or better in 38%. In their study, three hundred eighty-four patients with 390 penetrating eye injuries were enrolled. In this study, 19 patients with NLP caused by severe ocular trauma underwent vitrectomy combined with silicone oil tamponade. After the operation, 12 patients (63.16%) achieved varying degrees of vision. Although most patients still had a rather poor visual outcome, our data suggests that NLP after ocular trauma did not always mean permanent vision loss. As long as the integrity of the posterior pole, optic nerve and visual pathway remains intact many injured eyes retain the potential for some visual recovery. The timely reattachment of a traumatically detached retina is a crucial part of this repair process.

The causes for NLP by severe ocular trauma are from many aspects. The refractive media in the majority of cases is highly turbid, in which dense dark brown blood clots obstruct light transmission, this may be the main reason for post-traumatic NLP. The second reason for post-traumatic NLP is the pathological changes after eye injury, including direct tissue damage, defects and circulatory disorders causing a variety of damages of ocular organizational structures, especially optic nerve contusion, commotio retinae, leading to different degrees of visual disturbance or even blindness. As a high refractive media opacity, fundus examination can not be performed through the normal way, only checked with the help of additional tests such as B-ultrasound or CT scan. These examinations are still not effectively reflecting the real damage of the choroid, vitreous and retina, and can only give reference to the actual injury to patients. So the prognosis of these cases can not be specifically judged preoperatively.

In this study, during the operation we found that the reasons for NLP included the following: 1) the high refractive media opacity, mainly the strong dense blood clots in vitreous cavity; 2) the retinal extensive injuries, including retinal defects, tearing, twisting, contracture, holes and folded; 3) a large amount of retinal hemorrhage, often difficult to effectively stop bleeding during surgery, or time-consuming steps to stop bleeding; 4) choroidal damages, often defect, edema, detachment, bleeding; 5) retinal and uveal extensive damages, defect (tissue damage is extremely serious and can not be surgically repaired); 6) endophthalmitis, a large amount of intraocular thick pus especially in vitreous cavity, causing the refractive media opacity, more importantly, the serious vitreous inflammation and retinitis causing severe retinal edema, ischemia, vascular occlusion, nutrition or metabolic disruption, loss of function of photoreceptor cells, resulting in poor visual acuity, or even NLP. From the above reasons, we can see that traumatized eyes with visual acuity of NLP, due to high refractive media opacity, retinal damage resulting in retinal hole, tear, detachment and partial defect, can be treated by vitrectomy mostly, and can obtain some useful VA postoperatively.

In this study, 12 patients (63.16%) achieved VA of LP or better eventually. During the procedures of surgery, it's essential to achieve retinal reattachment[10]. It can be said that the retinal reattachment is a prerequisite for light perception restoration. For retinal reattachment, complete removal of vitreous body, blood turbidity and proliferative fibrous tissue is the key to surgery. We have the following experiences: 1) Broad encircling scleral buckle in the area anterior to the equatorial position can help prevent dialyses retinae and traction retinal detachment caused by the residual vitreous at the base. Pars plana vitrectomy and prophylactic broad encircling scleral buckle, can salvage and prevent subsequent retinal detachment in the severely traumatized eyes [11]. Recurrent retinal detachment caused by fibrous tissue proliferation occurred in 3 eyes of 3 patients postoperatively in our study. 2) The retina must be fully loose, creating adequate conditions for the retinal reattachment. Retinotomy is performed to allow the residual retina, especially posterior pole retina apt to reattachment firmly. For severe ocular trauma, the incomplete retina incarcerated in the wound, formed a distinct funnel-like detachment, and is needed to undergo retinotomy. Or for severe proliferative vitreoretinopathy (PVR), retinal contraction, and the remaining retina not enough to reattachment firmly, retinotomy has to be performed to release and flatten retina for reattachment eventually. Epiretinal membranes and subretinal membranes must be fully stripped. 3) Silicone oil tamponade is relied on in patients for the more reliable retinal reattachment. So indications for silicone oil tamponade should be broadened. For complex retinal detachment (RD) with inferior proliferative vitreoretinopathy (PVR), internal tamponade with high-density silicone oil (HDSO) is even required [12]. 4) It is essential to fully understand the importance of the laser treatment in such cases. Since there is some time lapse as response period after surgery, it is necessary to perform 360° laser photocoagulation along the scleral ridge intraoperatively. If the injury causing most damage to retina and uvea, the retina can not be reattached, the surgical results are poor. In this study, 2 patients were like this, whose surgery could not be completed, and the final VA remained NLP. Even if the retinal reattachment can be achieved, there are possibilities of severe PVR and hence, silicone oil tamponade also injected into the vitreous cavity [12]. For post-traumatic accumulation of blood within the eye and presentation delay causing fibrous proliferation, or endophthalmitis, it is prone to PVR even postoperatively. In this study, 8 cases were like this, the final VA remaining NLP. In summary, posttraumatic severe retinal damages and defects, presentation delay causing severe PVR [13,14], and posttraumatic endophthalmitis[15] are poor predictors of visual outcome.

When will the patients with severe ocular trauma undergo the surgery? It is an important issue. There are numerous unresolved issues and controversies regarding the management of open-globe injuries involving the posterior segment. Timing of vitrectomy surgery has been and will continue to be debated by proponents of early versus delayed intervention[16]. In our hospital, in severe ocular trauma, with CT or MRI diagnosis of no clear avulsion of optic nerve, a fresh wound underwent debridement, and the wound underwent carefully check. The incarceration of uveal and retinal tissues were washed with diluted Gentamicin and pushed back. After coagulation, suture tight scleral tissue, conjunctival tissue, and intravitreal injection of sterilized air or viscoelastic substance and vancomycin + gentamicin or vancomycin + ceftazidime. Due to the eye stress state after the ocular trauma, congestion, easy bleeding in the procedure of surgery, severe postoperative inflammatory reaction, systemic high-dose steroid medication, subconjunctival injection of gentamicin plus dexamethasone or juxtaglobe injection of methylprednisolone 20mg are given in 1st week postoperatively. For ocular trauma patients with refractive media high opacity, no clear retinal detachment, the second phase vitreous surgery will be performed after 2-3 weeks postoperatively. Because the wound of the traumatized eye is always large, the leakage of surgical wound can occur in early time when premature surgery is performed, resulting in inconvenient closed vitrectomy. The dense vitreous hemorrhage begins to resolve in 2 weeks; at the same time, vitreous detachment occurs. This time is proper to perform vitrectomy. In other authers' report [17], they performed vitreoretinal surgery within the first 2 weeks after the blast for the patients with severe ocular trauma of the posterior segment from explosive weapons and obtained stabilization or improvement of the VA for 84% of the cases. Their timing of surgery is consistent with ours. But for a clear retinal, choroidal detachment and defect, vitrectomy should be performed as soon as possible to avoid severe vitreoretinal proliferation and a poor prognosis. For endophthalmitis, intraocular foreign body(IOFB) removal[18], pars plana vitrectomy (PPV) should also be operated as soon as possible to prevent the spread of infection; eye damage increase, PVR and the eye atrophy. Salehi-Had *et al*[19] showed that patients with severe open-globe injury and NLP occasionally recovered LP or better vision. These patients might regain useful vision after vitreoretinal surgery if prompt referral and intervention was attempted within 5 weeks of the initial open-globe injury and if the spontaneous visual recovery occurred within the first week after open-globe repair (OGR).

Postoperative complications of severe ocular trauma patients are more common. These are: 1) retinal damage, a dense blood opacity in the vitreous cavity, often accompanied by

vitreoretinal adhesion, PVR, and the high floating retina when retinal detachment occurred, can easily lead to direct retinal damage intraoperatively; 2) vitreous hemorrhage, although blood clots in the vitreous cavity were removed in the surgery, and intraoperative hemostasis was also obtained, the postoperative recurrence of vitreous hemorrhage could often be observed; 3) retinal detachment, often due to incomplete closure of retinal tears, or multiple holes, or PVR[13] resulting in traction, requiring second retinal reattachment surgery. In this study, there were 3 patients with recurrent retinal detachment, who all underwent retinal reattachment surgery. It was reported that the use of additional 360 degree prophylactic laser retinopexy prior to removal of silicone oil was associated with a higher rate of final retinal reattachment[20]. 4) secondary glaucoma, common in the cases of C3F8 or silicone oil [21] tamponade. Due to expansion of C3F8, or silicone oil blocking aqueous humour outflow, the intraocular pressure (IOP) continued to increase post-operatively. The IOP can be restored to normal levels after symptomatic treatment. But there were also difficulties not easy to deal with in this study. For example, 1 case has been persistently with high intraocular pressure before the silicone oil removal. With regard to the timing of silicone oil removal, some authors demonstrated that the duration of the silicone oil tamponade had no significant effect on the reattachment rate. They recommend not to apply standard criteria for the timing of silicone oil removal, but to decide individually, considering the underlying disease, as well as the previous operations [22]. 5) low intraocular pressure, some patients with persistent hypotony, more common in the patients with a wide range of retinal and uveal defects. These devastating injuries have no effective way to treat, often ending up loss of vision and ocular atrophy.

To sum up, the main reasons of NLP after ocular trauma are severe vitreous hemorrhage opacity, refractive media opacity, retinal detachment, retinal and uveal damages and defects, especially defects of the macula, PVR, endophthalmitis. NLP after ocular trauma in some cases does not mean permanent vision loss. Early intervention of vitrectomy and achieving retinal reattachment of the remaining retina may make the severely traumatized eyes regain the VA of LP or better.

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