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Cryo-compression of sclerotomy sites after transconjunctival sutureless vitrectomy*

Ho Young Lee[1], Sung Hyup Lim[2,3], Il Han Yun[2], Joo Eun Lee[4]
[1]Shinsegae Eye Clinic, Busan, Korea, [2]Department of Ophthalmology, Busan Paik Hospital, Inje University College of Medicine, Busan, Korea, [3]Therapeutics Center for Ocular Neovascular Disease, Busan, Korea, [4]Department of Ophthalmology, Haeundae Paik Hospital, Inje University College of Medicine, Busan, Korea

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Abstract:

Purpose: *Transconjunctival sutureless vitrectomy(TSV) has become more commonly performed, but the incidence of sclerotomy site leakage is becoming an issue. We have developed a new and easy sclerotomy closure technique using cryotherapy, and named it 'cryo-compression'.*

Methods: *After the removal of the cannula, sclerotomy sites' cryotherapy was performed with the setting of one cryospot for each site and ten seconds for each spot. After cryotherapy, firm pressure was maintained for more than 30 seconds. Immediately after compression, when any degree of leakage was detected, a single transconjunctival suture with 8-0 vicryl was placed. Postoperatively, topical steroid and antibiotics eyedrops were administrated.*

Results: *Sixteen patients undergoing 23-gauge vitrectomy with this technique were reviewed retrospectively. The postoperative one- and six-hour intraocular pressures (IOPs) were significantly lower than preoperative IOP, but postoperative one-day and one-week IOPs were not different from preoperative IOP. Incidence of hypotony was 12.5% (N = 2/16 eyes) at only one hour but all eyes recovered. Intraoperative suture at sclerotomy sites was placed in eight of the 48 sclerotomies(16.7%) and suture placement was not required postoperatively. No cases of severe intraocular inflammation or endophthalmitis were indentified.*

Conclusions: *Our short-term results are fairly respectable, so we think that the 'Cryo-compression' technique is helpful to obtain sclerotomy closure in TSV.*

Keywords: *Cryocompression, sclerotomy, transconjunctial sutureless vitrectomy*

Introduction

Since the small-gauge vitrectomy had been introduced by Fujii *et al*.[1] and Eckardt,[2] transconjunctival sutureless vitrectomy (TSV) became the standard vitrectomy technique in many retinal surgeries. Conventional 20-gauge pars plana vitrectomy (PPV) had been shown to have some suture material-related complications, such as postoperative inflammation or prolonged patient discomfort, but TSV has overcome these problems by self-sealing small-diameter sclerotomies.[3]

However, disadvantages such as postoperative hypotony, conjunctival bleb formation are attributed to poor sclera closure. With the advent of TSV, it has been

Correspondence: Ho Young Lee, MD., Shinsegae Eye Clinic, 486-20, Bujeon-dong, Busanjin-gu, Busan, Korea.
E-mail: happytriad@gmail.com

postulated that the risk of choroidal detachment and endophthalmitis may be increased compared with that of conventional 20-gauge PPV.[4-7]

In case of leaking sclerotomies, many surgeons put in a transconjunctival or transscleral suture. Alternative skills to avoid leaking wounds were use of tissue glue,[8] a polyethylene glycol–based hydrogel bandage[9] or transconjunctival plain gut 'tape'.[10] But all of these techniques add cost or are still under investigation. Therefore, we propose another easy surgical technique to obtain sclerotomy closure.

Materials and methods

Patients who received a 23-gauge sutureless vitrectomy during the period between May 2012 and February 2013 were included, but excluded from the study if they had any past history of a PPV. The patients who needed the combined buckling procedure, silicone oil injection, gas injection or phacoemulsification were also excluded from the study. These patients were followed for at least one month after the operation. The potential benefits and possible risks of the technique were explained to the patients, and informed consent was obtained.

We have used technique in all cases with Total Plus 23Ga Vitrectomy Pak® (Alcon Laboratories Inc, Fort Worth, Texas, USA). Three transconjunctival sclerotomies were made parallel to the limbus using a two-step beveled approach. A total vitrectomy was done using a visualizing agent such as triamcinolone with external scleral depressor. At the end of surgery, microcannulas were withdrawn using a forceps, following the angled entry path. And then firm pressure were applied with a cryoprobe onto the sclerotomy sites. Cryostar® (D.O.R.C. International BV, Zuidland, The Netherlands) that we have used had a curved retinal probe with small, hard and round tip(2.5 mm) for conventional retinal reattachment surgery. In case of control group, after microcannula removal, firm pressure was applied with a cotton-tip applicator instead of a cryoprobe.

Sclerotomy sites' cryotherapy was performed with the setting of one cryospot for each site and 10 seconds for each spot. After cryotherapy, firm pressure was maintained for more than 30 seconds (Fig. 1). Immediately after compression, most sclerotomy sites turned concave and no significant leaking signs such as conjunctival bleb were observed (Fig. 2). A few seconds later, concave wounds were *defrosted* and became flat. When any degree of leakage was detected, a single transconjunctival suture with 8-0 vicryl was placed. Postoperatively, topical steroid and antibiotics eyedrops were administrated. To identify early postoperative hypotony(intraocular pressure, IOP ≤ 5 mmHg), we checked IOPs postoperatively. Number of intraoperative or postoperative sclerotomy sutures was collected and any complications related to sclerotomy leakage were noted.

Postoperative IOPs were compared with preoperative IOPs using Mann-Whitney test. P values of < 0.05 were considered statistically significant. Statistical analyses were performed using SPSS for Windows (Ver. 15.0, Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL).

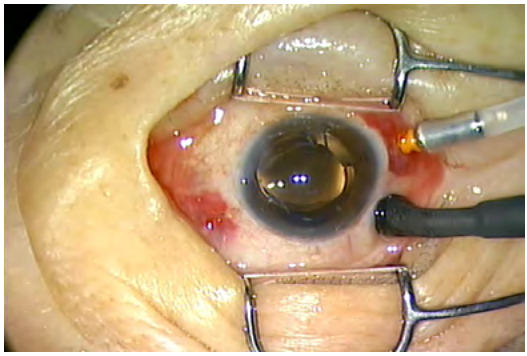

Fig. 1. External photograph of 'Cryo-compression' technique, being performed onto the sclerotomy site after cannula removal.

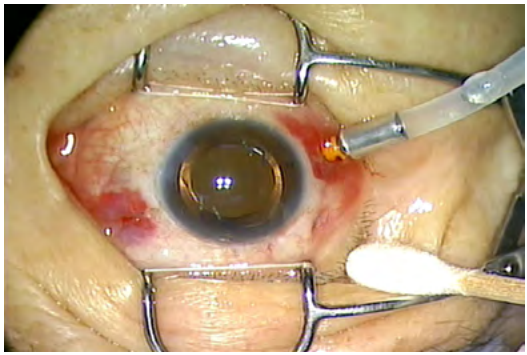

Fig. 2. Immediately after compression, the sclerotomy sites turned concave and no wound leakage was detected.

Results

16 patients undergoing 23-gauge vitrectomy with this technique were reviewed retrospectively, and 15 patients with a cotton-tip applicator were reviewed as a control group. Surgeries were performed by a single surgeon(Ho Young Lee) at a single hospital. The demographics and clinical data of the patients are shown in Table 1.

Intraocular pressures before and after operation are shown in Figure 3. In cryo-compression group, the mean postoperative IOPs at 1 and 6 hours were significantly lower than preoperative IOP. Whereas, in control group, the 1, 6 hour, and 1 day IOPs were significantly lower than preoperative IOP. 1 week and 1 month IOPs were not different from preoperative IOP. So, cryo-compression group eyes were recovered earlier than control group eyes.

Incidences of postoperative hypotony (IOP ≤ 5 mmHg) at 1 and 6 hours, 1 day, 1 week, and 1 month after 23-gauge TSV are illustrated in Figure 4. In cryo-compression group, the incidence of hypotony was 12.5%(N = 2/16 eyes) at only 1 hour and all eyes recovered. But, in control group, the incidence of hypotony was 26.7% at 1 hour (N = 4/15 eyes), 13.3% at 6 hours (N = 2/15 eyes, 6.7% at 1 day (N = 1/15 eyes), and 0% at 1 week and 1 month post-TSV. All eyes with hypotony during the early postoperative period recovered normal IOP at 1 week post-TSV without postoperative suture placement.

The intraoperative and postoperative complications are summarized in Table 2. In cryo-compression group, intraoperative suture at sclerotomy site was placed in 8 of the 48 sclerotomies(16.7%) and suture placement was not required postoperatively. In control group, suture placement was performed in 8 of the 45 scleotomies(17.8%) and no postoperative suture placement was done. Suture placement rate was similar between two groups. In cryo-compression group, one choroidal detachment case was detected but recovered as soon as intraocular pressure was elevated. No cases of severe intraocular inflammation, endophthalmitis or retinal detachment were indentified.

Table 1. Clinical features of cases.

	Cryo-compression group (n = 16)	Control group (n = 15)
Sex (Male : Female)	10 : 6	8 : 7
Age at operation(mean ± SD, year)	55.8 ± 12.05	57.5 ± 17.05
Laterality (OD : OS)	10 : 6	10 : 5
Surgical Indications for PPV		
Vitreous hemorrhage/opacity	6	12
IOL dislocation	7	2
Crystalline lens dislocation	3	1

Table 2. Intraoperative and postoperative complications.

Complications	Cryo-compression group (n = 16)	Control group (n = 15)
Intraoperative suture placement at sclerotomies	8 (8/48, 16.7 %)	8 (8/45, 17.8 %)
Postoperative suture placement at sclerotomies	0	0
Choroidal detachment	1	0
Retinal detachment	0	0
Endophthalmitis	0	0
Vitreous hemorrhage/opacity	0	0
Severe chamber reaction	0	0

Discussion

Making a good beveled incision, such as two-step technique and applying firm pressure onto the seclerotomy sites immediately after cannula removal were key points for tight wound closure in a small-gauge vitrectomy system.[11]

Many retinal surgeons use a cotton-tip applicator to apply firm pressure onto the sclerotomy sites soon after the removal of the cannulas. But a cotton-tip applicator has a little bit soft and large end so it often cannot seal the sclerotomy sites properly. Besides a few strands of cotton may enter the subconjuctival space.

Woo *et al.*[12] recently reported, in a retrospective study including 322 eyes of 292 patients who underwent 23-gauge TSV, that intraoperative suture placement was required for leaking sclerotomies in 36 cases (11.2%) and the incidences of postoperative hypotony were 11.3% at 2 hours, 6.5% at 5 hours, 3.8% at 1 day, and 0% at 1 week. They used a cotton-tip applicator.

Cryotherapy is very popular method to create a chorioretinal adhesion during retinal detachment surgery. During freezing, extracellular and intracellular ice crystal forms, thereby causing mechanical effect and cellular damage. And during thawing, water and electrolytes separate, causing dissolution of cellular membrane. This effect results in the choroidal and retinal scar.[13]

Some retinal surgeons use cryotherapy for other purposes. Yeh *et al.*[14] concluded that cryotherapy of the sclerotomy sites might be a helpful adjunct procedure in diabetic vitrectomy for inhibition of fibrovascular ingrowth, and hence prevention of recurrent vitreous hemorrhage. Their operative technique was a standard 3-port 20-gauge PPV and sclerotomy sites' cryotherapy was performed with the setting of 2 cryospots for each site and 6 seconds for each spot. As their results, there was no significant complication, such as postoperative inflammation reaction. So we decided to apply cryotherapy to seal the sclerotomy sites of TSV. Since the tip of the cryoprobe was harder and smaller than that of the cotton-tip applicator, we thought we could use a cryoprobe instead of a cotton-tip applicator, and finally found out ways to seal the sclerotomy sites with cryotherapy. Moreover only 3 cryospots that we applied were less than their methods.

At first, cryotherapy was performed in the same way that Yeh *et al.*[14] had described, but the setting of cryospot was modified after many trials and errors. In some cases that was applied only cryotherapy shortly without firm pressure, wound leakage was happened several times. So we performed cryotherapy much longer and maintained pressure on the wound sites much harder. After that procedure, we found that small concave-shaped sclerotomy sites meant good surgical wound integrity. That is the reason why we named this technique "cryo-compression" not just cryotherapy.

The technique that we introduce shows several advantages as compared with other methods. Most of all, it can reduce suture-related problems, such as postoperative inflammation, patient discomfort, and delayed visual recovery. In case of leakage after "cryo-compression", placing a single suture is very easy because the wound is compressed. And this technique makes the cost of surgery less than that of cases of suture placement, tissue glue, and a polyethylene glycol–based hydrogel bandage. Moreover, cyrotherapy and cryoprobe are familiar with retinal surgeons, so this technique is very easy to perform.

Our reasons for the sclerotomy sites' cryo-compression were described as below. First, a cryoprobe with a small and hard tip is good for applying firm pressure, so we can use instead of a cotton-tip applicator. Second, freezing just inside and outside the surgical wound by cryotherapy helps to prevent wound leakage. Even though the ice crystal melts into water soon, if firm pressure is applied onto the beveled sclerotomy wound, we expect freezing procedure to fill a small space around the conjunctival and scleral wound. Third, as a delayed effect of cryotherapy, cryo-compression can cause focal scar formation of the pars plana without shrinkage or other damage to the sclera. It is a well-known fact that cryotherapy has little effect on the vitreous and sclera.[15,16]

In our study, intraoperative sclerotomy suture rate was 16.7%(8/48), relatively higher than that reported by Woo *et al.*[12] (11.2%). But the incidence of postoperative hypotony(12.5%, 2/16 eyes at only 1 hour) was lower than their results. Because this study is non-randomized and has small number of subjects, our results can't be directly compared with theirs. Furthermore, there is another limitation that long-term results are lacking. But to our knowledge, this is the first report to describe "cryo-compression" technique for 23-gauge sclerotomy closure in TSV. So we think "cryo-compression" is worth attempting and it can be seen as a useful technique to obtain sclerotmy closure.

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