Ultrasound Biomicroscopy of Conventional and Sutureless (23, 25-Gauge) Sclerotomy Sites after Pars Plana Vitrectomy

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Abstract

Purpose: To compare postoperative anatomical sclerotomy sites of transconjunctival sutureless vitrectomy (TSV) with conventional 20-gauge vitrectomy

Methods: In this prospective, nonrandomized study 30 consecutive patients divided in 2 groups: group I, 15 eyes from 15 patients underwent conventional 20-gauge and group II, 15 eyes from 15 patients underwent TSV (23, 25-gauge) pars plana vitrectomy (PPV). Wound gap, wound healing, vitreous incarceration and fibrovascular ingrowth (FVIG) at the sites of sclerotomy were assessed using ultrasound biomicroscopy (UBM) at week 8, postoperatively.

Results: In group 1 (conventional), healing of infusion cannula, vitrectomy and illuminating sites had occurred in 53.3%, 60% and 66.7% of patients. In group 2 (TSV), healing of infusion cannula, vitrectomy and illuminating sites occurred in 66.7%, 66.7% and 80% of patients. There was no significant difference between the two groups. FVIG was solely observed in diabetic patients in total sclerotomy sites (9 patients, 27 sclerotomy sites in conventional and 8 patients, 24 sites in TSV group). FVIG occurred in 7/27 sites (25.9%) in 20-gauge group and 5/24 sites (20.8%) in TSV group which was not significantly different (P=0.18). Wound gap was not found in any patient of the two groups. The overall comparison of sclerotomy sites (45 sites in each group) showed no significant difference regarding wound healing and vitreous incarceration. No case of ocular hypotony or endophthalmitis was observed at the end of follow-up time.

Conclusion: Based on the UBM images of sclerotomy sites, there were no significant differences in vitreous incarceration, wound healing, wound gap and FVIG between TSV and conventional PPV.

Keywords: 20-gauge, 23, 25-gauge, Sutureless Vitrectomy, Pars Plana Vitrectomy, Ultrasound Biomicroscopy


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Introduction

Pars plana vitrectomy (PPV) has an important role in the management of many of vitreoretinal disorders. Sclerotomy sites in this surgery may lead to postoperative complications including vitreous incarceration, incision gap with leakage and postoperative hypopyon; and in diabetic patients, fibrovascular ingrowth (FVIG) and subsequent vitreous hemorrhage. Evaluation of these sclerotomy sites complications by indirect ophthalmoscope are difficult and can not be documented. Recently, ultrasound biomicroscopy (UBM) has become an important method for studying the structure of sclerotomies in vivo, following healing process and comparing the features of the different sclerotomy structural variations.

There are two approaches for PPV: conventional and transconjunctival sutureless vitrectomy (TSV). Although conventional PPV has been the popular method of vitreoretinal surgery, TSV has many advantages including shorter surgical time, less postoperative inflammation and conjunctival scar, less induced corneal astigmatism, faster postoperative recovery and visual rehabilitation. However, some complications such as increased rate of postoperative endophthalmitis have been reported in this method.

Because of inconsistent results of previous studies and to evaluate postoperative outcomes of TSV, using UBM, we compared conventional PPV and TSV sclerotomy sites with regard to vitreous incarceration, wound healing, wound gap and FVIG.

Methods

This study was a prospective nonrandomized case series. A total of 30 consecutive patients who underwent PPV were included. Exclusion criteria were age less than 7 years, previous vitreoretinal surgery or intraocular silicon injection; and history of endophthalmitis or rhegmatogenous retinal detachment with severe proliferative vitreoretinopathy.

This study followed the tenets of the declaration of Helsinki and approved by the ethics committee of Tehran University of Medical Sciences.

All patients underwent complete eye examinations. Conventional PPV was performed by 2 surgeons who followed the same surgical techniques and all TSV procedures were performed by one surgeon. Alcon 20, 23 and 25-gauge vitrectomy system (Alcon Laboratories Inc, Fort Worth, Texas, USA) was used. For sutureless vitrectomy the technique common to every case was the insertion of micro cannula using a trocar following displacement of the conjunctiva to misalign purposefully the conjunctival and scleral incisions. Transscleral cannulas were placed in the pars plana in the supratemporal, supranasal and infratemporal quadrants. Inferotemporal cannula was the site of infusion and both superior quadrants cannulas were used for intraocular instruments. In eyes with an epiretinal membrane, macular hole and diabetic macular edema, the internal limiting membrane was dissected and removed by use of microforceps. In cases of non-clearing vitreous hemorrhage associated with proliferative diabetic retinopathy or branch retinal vein occlusion, panretinal photocoagulation was performed via an indirect laser system. At the end of each case, both superior quadrant cannulas were temporarily plugged and scleral indentation was applied at 360 degrees to identify any other peripheral retinal pathology. The infusion line was then clumped, and supranasal and supratemporal cannulas removed and the conjunctiva repositioned to cover completely sclerotomy site. Infusion line was then unclamped and sclerotomy site was inspected for fluid leakage.

Conventional (20-gauge) vitrectomy was done through a pars plana approach (20-gauge micro vitreoretinal blade) penetrating the sclera straight and perpendicular to the scleral surface 4 mm from the limbus in phakic and 3.5 mm in pseudophakic patients. Locations of sclerotomies were in supratemporal, supranasal and infratemporal. After vitrectomy, vitreous shave was performed. A 7/0 Vicryl suture was used at the end of operation.

UBM examination was performed postoperatively at week 8. All UBM examinations were performed by one ultrasonographer (S.M) using a 50 MHz transducer (model P40, paradigm medical industries, Inc., Salt Lake City, UT) ultrasound biomicroscope.
For UBM examination, after instillation of anesthetic drops, a polymethylmethacrylate shell was inserted between eyelids to hold a 2.5% methylcellulose bath for the ultrasound probe and examination was performed in supratemporal, supranasal and infratemporal quadrants.

UBM findings were grouped into four major categories according to the criteria in studies of Bhende and Yeh.13,14

1- Well healed
Smooth without an identifiable sclerotomy wound (Figure 1)

2- Gap
Very low reflective echoes on the inner site of the sclerotomy site

3- Vitreous incarceration
A moderate to high reflective echogenic strand converging toward sclerotomy site from and continuous with peripheral vitreous (Figure 2)

4- Fibrovascular ingrowth
High reflective stalk of echoes at scleral wound with high reflective tissue with radial and circumferential extension into the sclerotomy (Figure 3)

Statistical analysis was performed using SPSS version 14 (SPSS Inc., Chicago, IL). Variables of UBM findings such as wound healing, vitreous incarceration and FVIG were analyzed as qualitative variables. T-test and \( \chi^2 \) were used for the quantitative and qualitative data, respectively. P-values of 0.05 or less were considered as statistically significant.
Results

A total of 30 patients (30 eyes) were included in this study. Fifteen patients (10 males) received conventional (20-gauge) PPV (45 sclerotomy sites) and 15 patients (9 males) (45 sclerotomy sites) underwent TSV (23, 25-gauge). In 20-gauge group, the mean age of the patients was 60.4±4 years. Preoperative diagnoses were: diabetic retinopathy (9 patients), macular hole (3 patients), epiretinal membrane (2 patients) and IOL drop (1 patient). There was no significant difference in age of patients between two groups (P=0.1).

In TSV group (4 patients 25-gauge and 11 patients 23-gauge), the mean age of patients was 58.3±3 years. Preoperative diagnoses were as follows: diabetic retinopathy (7 cases), macular hole (3 cases), epiretinal membrane (3 cases), posterior uveitis (1 patient) and vitreous hemorrhage due to CRVO in one patient.

In 20-gauge group, healing of inflow, vitrectomy and illuminating sites were occurred in 53.3%, 60% and 66.7% of patients. In TSV group, healing of inflow, vitrectomy and illuminating sites were occurred in 66.7%, 66.7% and 80% of patients. There were no significant difference between these groups (Table 1).

FVIG was solely assessed in diabetic patients in total sclerotomy sites (9 patients, 27 sclerotomy sites in conventional and 8 patients, 24 sites in TSV group). FVIG was occurred in 7/27 sclerotomies (25.9%) in 20-gauge group and 5/24 sites (20.8%) in TSV group which was no significantly different (P=0.18). Wound gap was not found in all patients of both groups. The overall comparison of sclerotomy sites (45 sites in each group) showed no significant difference regarding healing and vitreous incarceration (Table 2). No case of ocular hypotony or endophthalmitis was observed at the end of follow-up time.

<table>
<thead>
<tr>
<th>Table 1. Comparison of outcomes between patients underpoging conventional 20-gauge and transconjunctival sutureless vitrectomy</th>
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<tr>
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<tr>
<td>20-G (n=15) TSV (n=15) P-value</td>
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<tr>
<td>Healing inflow site</td>
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<td>53.3*</td>
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<td>66.7</td>
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<td>Healing vitrectomy site</td>
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<td>60</td>
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<td>66.7</td>
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<td>Healing illuminating site</td>
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<td>80</td>
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<td>Vitrectomy site vitreous incarceration</td>
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<td>26.7</td>
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<td>20</td>
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<tr>
<td>Inflow site vitreous incarceration</td>
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<td>22.2</td>
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<td>18.6</td>
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<tr>
<td>Illuminating site vitreous incarceration</td>
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<tr>
<td>20</td>
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<tr>
<td>13.3</td>
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<td>*: All data are presented as percentage.</td>
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<td>TSV: Transconjunctival sutureless vitrectomy</td>
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<tr>
<th>Table 2. The overall comparison of healing and vitreous incarceration of sclerotomy sites between patients underpoging conventional 20-gauge and transconjunctival sutureless vitrectomy</th>
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<tr>
<td>20-G (n=45) TSV (n=45) P-value</td>
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<tr>
<td>Healing (n%)</td>
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<tr>
<td>27/60</td>
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<tr>
<td>Vitreous incarceration (n%)</td>
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<tr>
<td>11/ 24.4</td>
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<td>TSV: Transconjunctival sutureless vitrectomy</td>
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Discussion
In this study, no differences between sutureless and conventional 20-gauge sclerotomies were observed related to wound healing, wound gap and vitreous incarceration based-on UBM images.

Consistent with our results, Keshavamurthy et al studied sclerotomy sites in a patient in whom both 20 and 25-gauge sclerotomies had been constructed during PPV and the differences were assessed using UBM. They stated that healing of a 25-gauge sclerotomy is quite rapid, in contrast to conventional sclerotomies, which might take up to 6-8 weeks postoperatively.15

Evaluation of modification in different vitreectomy incisions has been possible with application of UBM. Rizzo et al evaluated natural course of straight and angled incisions. Oblique-parallel insertions were the quickest and most complete sealing since the first day postoperation without complications.16 Gutfleisch et al. examined sclerotomies that were performed using 20-gauge systems and non-stitch 23-G systems, one-step (23/1) and two-step procedures (23/2), as well as one-step 25-gauge systems for PPV with UBM. They performed 23-G non-stitch sclerotomies in an oblique manner perpendicular to the limbus. They found that sclerotomies performed in the 23/2-G PPV technique had better closure than other non-stitch techniques at day 1 after surgery, according to the UBM appearance. However, after 1 month, there were no differences between sutureless sclerotomies regarding wound healing based on UBM appearance and sclerotomy sites could not be detected in most of the eyes.5

FVIG at sclerotomy sites is a well recognized clinicopathologic complication that may cause postoperative intravitreal hemorrhage. Some risk factors associated with development of FVIGs via sclerotomy sites after PPV consist of proliferative diabetic retinopathy, incomplete posterior vitrectomy, larger sclerotomy and incomplete surgical closure of the sclerotomy wound.17 In our study, FVIG was observed in 7 (25.9%) sclerotomy sites of conventional 20-gauge and in 5 sites (20.8%) of TSV. There was no significant difference between the groups.

With regard to vitreous incarceration, our observations showed no significant difference between two groups after surgery. Kwok et al18 in their comparative study of conventional and sutureless pars plana sclerotomies using UBM noted no difference in the amount of vitreous incarceration in two groups. Theelen and associates12 investigated 20-gauge, wedge-shaped, self-sealing pars plana sclerotomy clinically and by means of UBM and compared the outcome with conventionally sutured sclerotomies. The majority of their patients had only low-grade vitreous incarceration with no significant difference between the two groups. However, Gutfleisch and coworkers9 found a high proportion of vitreous incarceration after 25-gauge PPV with straight incisions in comparison to 20-gauge PPV.

Some limitations of this study were the small numbers of patients and that procedures were not performed by a single surgeon although all procedures followed standard techniques. Furthermore, this was not a randomized clinical trial, so we suggest a randomized clinical study with large number of patients.

Conclusion
In summary, according to the UBM images of sclerotomies, there were no significant difference between conventional and transconjunctival sutureless PPV regarding vitreous incarceration, wound gap, wound healing and FVIG.

References