ORIGINAL ARTICLE

Sutureless Vitrectomy: Changing Surgical Trends

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ABSTRACT

Purpose: To assess the safety, efficacy and complications using 23-gauge vitrectomy system.

Method: 34 patients that underwent 23-G transconjunctival sutureless vitrectomy technique were included in the study. All patients were operated by a single surgeon at a single centre. Common indications for surgery were rhegmatogenous retinal detachment, diabetic vitreous hemorrhage with no tractional retinal detachment, diabetic vitreous hemorrhage with tractional retinal detachment and phacoemulsification with vitreous hemorrhage.

Results: Good instrumentation made it possible to apply most of the standard procedure with exception of high molecular weight silicone oil (5000 cst). The average operating time was 48 minutes. Time was saved in beginning (peritomy securing of sclerotomy ports) and end of procedure (suturing the sclera and conjunctival wound). No scleral port required suturing at the end of procedure. Silicone oil (1000cst) was filled for internal tamponade where needed. Scanty leakage of silicone oil was seen in 6 (17.6%) eyes from one of the ports which stopped within 24-48hours causing no ocular complications. Localized conjunctival hemorrhage appeared in 8 (23.5%) eyes from pull of cannulas causing bleed from sclera ports or episcleral vessels. Recurrent (mild) vitreous hemorrhage was seen in 4 eyes (11.7%). Visual acuity improved post-operatively in 18 (52.9%) eyes, unchanged in 12 (35.5%) eyes and decreased in 4 (11.8%) eyes. Post-operative hypotony (IOP 8mmHg or less) occurred in 14 (41.2%) eyes on day 1 which returned to normal range within 24-48 hours without any complications. No other complications like choroidal detachment, endophthalmitis etc were seen in 3 months follow-up.

Conclusion: 23-gauge transconjunctival sutureless vitrectomy is a safe surgical technique. It reduces surgical time and allows faster wound healing, diminished conjunctival scarring, improved patient comfort and decreased post-operative inflammation. It is suitable for a large number of indications.

INTRODUCTION

23-G sutureless vitrectomy which is a modification of 25-G transconjunctival pars plana vitrectomy was first introduced by Eckardt[1] in 2005. This technique allows construction of a self sealing scleral wound with an intact overlying conjunctival covering that makes the incisional ports self-sealing and safe. Peritomy is not required and the vitrectomy instruments are used with ease through the self retaining cannulas. This procedure obviates the need for suturing of sclera at the end of procedure. The vital step is the proper wound construction to ensure postoperative wound stability.

The chief advantage of sutureless sclerotomies resulted in reducing operative time, less risk of per-operative hypotony on removal of instruments, less chances of postoperative inflammation, improved post-operative comfort and a rapid patient recovery.

The main disadvantage with sutureless sclerotomy is hypotony, which is directly related to leaking scleral wound. This usually settles without sequelae, though the eye is at a greater risk of complications like choroidal detachment and choroidal hemorrhage, if low pressure persists. Another possible risk is endophthalmitis as sutureless incisions provide a temporary window of opportunity for pathogens to enter the eye.

A major concern is the cost of procedure. In one large teaching centre, the cost of sutureless micro incision vitrectomy surgery was calculated to be 3.4 times higher than that of sutured 20-G vitrectomy surgery [2].

We conducted this study in our department using 23-G sutureless vitrectomy on patients with vitreoretinal pathologies. We wanted to assess the benefits of this high cost procedure in terms of wound stability, per-operative limitations, patient's response and post-operative findings including complications arising from this procedure.

MATERIALS AND METHODS

The study was conducted in Ophthalmology department of Sir Ganga Ram Hospital, Lahore from June 2010 to March 2011. 34 patients with

various vitreoretinal pathologies were inducted in the study. Data collection included patient's age and gender, complete ocular examination including visual acuity (Snellen's Chart), B scan where retinal details were hindered, indications for vitrectomy, anesthesia required (peribulbar or general), total operating time, difficulties and complications during surgery. Postoperatively, visual acuity, intraocular pressure, slit lamp and fundus examination were performed and recorded on 1st post-op day following subsequently on 7th day, 1 month and 3rd month. Patients were questioned for ocular comfort. Anterior segment photographs and fundus pictures were taken for record keeping.

Inclusion Criteria
Patients requiring primary vitrectomy

Exclusion Criteria
Previously vitrectomized eye, surgery requiring both external and internal tamponade, intraocular foreign body or dropped nucleus and retinal detachment that requires higher molecular weight silicone oil (5000cst) for internal tamponade.

Procedure
34 patients were registered for the procedure. 28 were males and 6 were females. 12 patients had non resolving vitreous hemorrhage, 10 had vitreous hemorrhage with tractional membranes involving macula or nasal to disc. 12 were admitted with rhegmatogenous retinal detachment (2 patients had total RD and 10 had superior RD). Out of these 34, 6 had lenticular changes and phacoemulsification with 23-G PPV was done as combined procedure. In these cases, ports were made before starting phacoemulsification and IOL (5.5 PMMA) was placed on completion of vitrectomy

Table 1:

Indication for surgery	Number of patients
Rhegmatogenous retinal detachment	12
Diabetic vitreous hemorrhage	12
Diabetic vitreous hemorrhage with TRD	10

A total of 12 cases were operated under general anesthesia and 22 were given peribulbar (local) anesthesia consisting of mixture of Bupivicaine and Xylocaine. Surgical consent obtained and procedure explained to the patient. Patients ocular surface, lashes and adjacent skin was prepared with 5% povidone-iodine.

Table 2:

Operated under	Number of patients
General anesthesia	12
Peribulbar anesthesia	22

All vitrectomies were performed by single surgeon in our centre. 23-G transconjunctival sclerotomy ports were made using 1 step technique. Alcon 23-G (Accurus system) trocar and self retaining cannula were used for each procedure. One step incision involves entry with sharp trocar with overlying cannula on it. The conjunctiva was slightly displaced and trocar system inserted 3.5-4mm from limbus. The initial incision was oblique so as to create a valve-like tunnel sclera incision, parallel to limbus. The trocars were removed leaving self retaining cannula in place. The length of self retaining cannula is 4mm, its internal diameter 0.65mm and external diameter is 0.75mm. The 3 ports were made inferotemporal, superotemporal and superonasal quadrants of globe. Vitrectomy carried out using Alcon Accurus vitrectomy system with 23-G cutter (2500 cut/min) and fibro-optic (halogen) light. In cases where internal tamponade was required, silicone oil tamponade (1000cst) was injected through the 23-G superotemporal sclerotomy port.

Instruments used for this surgical procedure included Alcon cutter (2500 cuts/ min), back flush needle, micro end-gripping forceps, membrane pick. Due to unavailability of 23-G endolaser probe, pan-retinal photocoagulation was done post-operative.

Table 3:

Procedure	Number of patients
23-G PPV	8
23-G PPV +Silicone oil (1000cst)	12
23-G PPV+ERM Peel	4
23-G PPV+ERM Peel+ Silicone oil	4
Phaco+23-G PPV+IOL	2
Phaco+23-G PPV+Silicone oil+IOL	

Simple vitrectomy was done in 8 cases, vitrectomy with silicone oil (1000cst) tamponade in 12 cases, vitrectomy with epiretinal membrane peeling in 4 cases, vitrectomy , epiretinal membrane peeling and silicone oil (1000cst) tamponade in 4 cases, phacoemulsification with intraocular lens (PMMA) and vitrectomy in 4 patients and phacoemulsification with intraocular lens combined with vitrectomy and silicone oil (1000cst) tamponade in remaining 2 cases.

On completion of procedure, sclerotomy cannulas were pulled out and wound massaged with cotton bud. No sutures were applied. Subconjunctival injection of steroid-antibiotic combination given and surgical time noted. Post-operatively, topical steroid antibiotic drops were prescribed to reduce inflammation. Initially, frequent instillation of drops (2hrly) for 48 hours, tapering to 6 hourly for a week, then 8 hourly during next week, 12 hourly and finally 1drop in 24 hours (1 week) and the stopped.

Day 1 Post-op, vitrectomized eye was examined. Visual acuity, post operative discomfort/ pain, slit lamp examination of wound site for leakage, conjunctival hemorrhage, inflammation (endophthalmitis), Intraocular pressure, posterior segment examination and photographs were taken for record. Similar examination protocol was carried out on next follow-ups (1week, 1 month and 3rd month).

RESULTS

Out of a total of 34 cases inducted for 23-G transconjunctival sutureless pars plana vitrectomy, the proportion of males was much greater than the females, 28**:**6 (82.4%**:**17.6%). The age ranged between 18-76 years with mean of 56 years. Pre-operative visual acuity ranged between HM to 6/36 with greater proportion of subjects having HM or CF. Likewise, IOP was within normal range in all cases (14-21mmHg)

All patients were operated by single surgeon. Mean surgical time (insertion to removal of 23-G cannulas) was 48 minutes. Longer surgical time in some cases depended on more complex cases (ERM Peeling, silicone oil fill) that were operated using this technique.

22 patients operated under peribulbar anesthesia remained comfortable throughout surgery.

Due to the availability of 23-G instruments, most of the standard procedures such as membrane peeling, aspirating subretinal fluid using soft tipped back flush needle, injecting silicone oil (1000cst) for internal tamponade, combined phaco-vitrectomy were easily done. However, endolaser could not be done due to unavailability of 23-G endolaser probe, PRP or barrier laser was applied post-operative.

23- G single step trocar- cannula insertion through the conjunctivo-scleral site required some amount of pressure. Conjunctiva was displaced slightly and trocar- cannula pushed in. Trocars pulled out and cannulas self secured. The 23- G vitreo-retinal cutter was as rigid as the standard 20- G instrument, thus making it easy to use and rotating the eye during manipulation in the far periphery. Help of intra-vitreous Kenacort was taken to visualize invisible vitreal membranes. The end gripping forceps which was similar in design and utility to 20-G forceps was used to raise the tractional retinal membranes.

Mean surgical time in this series was 48min. Complex cases that needed peeling or silicone oil tamponade took longer time. Silicone oil (1000cst) was used for internal tamponade in cases that had rhegmatogenous detachment with superior breaks and in tractional retinal detachment, when while peeling the epiretinal membranes, small breaks appeared. Due to narrow lumen of cannulas, 5000 cst silicone oil could not be injected into the vitreous cavity.

After completion of vitrectomy, cannulas were removed displacing the conjunctiva slightly and using a cotton tip applicator; the wound site was gently messaged to avoid leakage. In 8 eyes, withdrawal of cannula resulted in localized conjunctival hemorrhage. This cleared on its own within 72-96 hours.

Out of a total of 18 patients in which silicone oil (1000cst) tamponade was needed, 6-cases had scanty leakage of oil on cannula removal. The leakage was scanty requiring no suturing of the sclerotomy port. Eye was padded and examined the next day to assess the leakage.

No procedure required conversion to 20-G vitrectomy.

Day 1:

All patients were comfortable with no ocular pain or lacrimation. 8 cases had mild ocular discomfort. These patients were the ones that had conjunctival bleed at the end of surgery. However it settled with a single systemic dose of Ipubrufen and topical steroid-antibiotic combination.

Visual acuity improved in 18 eyes (52.9 %). In 12 eyes (35.3%), visual acuity remained unchanged from pre-operative vision and remaining 4 eyes (11.8%) showed a decrease in visual acuity. Improvement from hand movement to counting fingers were recorded in 6 patients, HM to HM unchanged in 8 subjects, counting fingers to 6/60 in 4 cases, CF to 6/36 in 2 cases, CF to 6/24 in 4 cases and CF to 6/12 in 2 patients, 6/60 to CF in 2 patients, 6/36 to CF in 2 subjects and finally 6/36 to 6/36 unchanged in 4 cases.

Table 4: Post-operative visual acuity

Visual acuity	Number of patients
Improved	18 (52.9%)
Decreased	4 (11.8%)
Unchanged	12 (35.5%)

On slit- lamp examination, sub-conjunctival hemorrhage (localized to the site of sclerotomy ports) were observed in 8 patients. This resulted in mild ocular discomfort on ocular movement. However, it settled with a single dose of tab ibuprufen.

Sclerotomy sites were well sealed in eyes without silicone oil tamponade. Out of a total of 18 eyes (52.9%) that required internal tamponade with 1000cst silicone oil, 6 eyes (17.6%) showed scanty leakage of silicone oil from one or two sclerotomy sites. As leakage wasn't much, internal tamponade unaffected and the intraocular pressure within normal range, eye was padded and sclerotomies left unsutured for another day. Leakage reduced and stopped within 48 hours.

Intra-ocular pressure was measured using Goldmann tonometer. Hypotony (IOP- 8mmHg or less) was seen in 14 eyes (41.2%). 4 mmHg in 4 eyes, 6 mmHg in 4 eyes, 8 mmHg in 6 eyes. Remaining 20 eyes (58.8 %) had IOP in normal range (10mmHg—4 eyes, 12mmHg—6 eyes, 14mmHg—10 eyes).Fluid (Hartmann's solution) tamponade showed a greater hypotony (4-8mmHg) than with oil tamponade (6-8mmHg).

Slit-lamp examination of all patients was done. Ocular inflammation was well controlled due to topical instillation of antibiotic-steroid combination. Intraocular lens was well placed in eyes that had combined phaco/vitrectomy/IOL implantation (5 eyes).

All pupils were dilated and indirect ophthalmoscopy done. In 4 eyes (11.8%), recurrent vitreous hemorrhage was observed. However it was faint and blurred view of retina (disc, macula) was available. This resulted in reduced visual acuity in these eyes. Intravitreal Bevacizumab 1.25mg/0.05ml was injected which helped in early clearing of hemorrhage.

No other complications like endophthalmitis, retinal detachment, choroidal detachment, raised intraocular pressure occurred.

Anterior and posterior segment photographs were taken for record maintenance.

Day 7

Visual acuity improved further in 16 patients from day 1 post-op (2/60 to 6/60—2pts, HM to CF—4pts, CF to 6/36—4pts, 5/60 to 6/24—2pts, 6/36 to 6/12—2pts, 6/24 to 6/18—2pts.

Intraocular pressure returned to normal range in all patients. Conjunctival hemorrhage cleared in affected eyes and all eyes were comfortable with no ocular discomfort reported. Sclerotomy sites were well sealed with no signs of leakage.

Eyes that showed recurrent vitreous hemorrhage on day 1 improved after intra-vitreal injection of Bevacizumab (Avastin).

Pan-retinal photocoagulation was applied in all operated eyes by one week post-operative. No complications (like uveitis, endophthalmitis, raised intraocular pressure) occurred.

1 Month/ 3 Month

Early lenticular changes were seen in 9 patients. This caused reduced visual acuity (1-2 lines). 3 eyes with combined phaco/PPV/IOL implantation developed some posterior capsular opacification. Rest of the examination results matched the previous ones.

DISCUSSION

Before the advent of sutureless (25- and 23-Gauge) vitrectomy systems, performing vitrectomies with 20-gauge instruments had been the standard of care for many years. However, the scleral incision created during 20-Gauge vitrectomy was large and there was no effort to make a beveled incision, so it had to be sutured for water-tight wound closure [3]. In 1996, Chen [4] described sutureless self-sealing sclerotomy in pars plana vitrectomy. However the technique did not gain much popularity due to complications and ports often required suturing [5]. This led to development of 25-gauge vitrectomy system by Fujii et al [6] that allowed complete sutureless vitrectomy but the instruments were too flexible

and prone to distortion, damage and breakage. Eckardt [1] introduced 23-gauge sutureless vitrectomy system which is similar to the 25-gauge system, but with instrument's functionality and stiffness similar to the traditional 20-gauge system.

12 patients (35.3%) were operated under general anesthesia while majority of patients (64.7%) got operated under local (peribulbar anesthesia). No significant difference in pain level was seen between the two groups. Similar findings are reported by Theocharis IP et al [7] who found no difference in pain levels in their patients getting general or peribulbar anesthesia.

In our study, we made a single step tunnel incision (transconjunctival) which allowed self sealing. The eye had to be stabilized and this required some learning curve but with time we became proficient. Z Tomic et al [8] used the same single step tunnel entry as done in our study. In this way, damage to the conjunctiva was minimized. This will be of clinical significant in those patients requiring glaucoma filtration surgery in the future. Similarly, on removal of cannulas no sutures were applied in their study as well as ours.

No entry site retinal tears occurred in our study group. This compares well with data published by Fine et al [9]. No intraoperative sclerotomy site tears occurred in their (77) patients undergoing 23-gauge vitrectomy.

Leakage of some droplets of silicone oil (1000cst) occurred in 6 eyes (17.6%) of our patients but we did not suture the ports as the leakage was scanty and we wanted to see if it settles on its own. All patients were covered with topical antibiotic-steroid combination medication at end of surgery and post-operatively (2 hourly). This prevented development of endophthalmitis and we were able to see how long it took for the ports to stop leakage. Oil leakage stopped after 24 hours and retinal tamponade was maintained.

In our series, it was possible to apply most of the standard procedures. 5000cst silicone oil could not be injected through the sclerotomy sites due to narrow lumen of cannula. Also limitation would have risen if there was a dropped nucleus but our study group included no such case.

Average surgical time in this series was 48 minutes (35-70 minutes). Longer time was taken in cases where peeling of membranes and air/oil exchange required. However, the operative time (start to end of vitrectomy) was reduced since conjunctival dissection, fixation of infusion line and suturing of sclerotomies and conjunctiva was avoided. In study reported by Tomic Z et al [8], average operating time was longer than our study (60 min, range 35-90 min). This difference is probably due to the larger number of cases in their series (100) as compared to our study (34) and a greater number of cases with complex pathology.

Our study group showed hypotony (IOP 8mmHg or less) on day 1 post-op in 14 (41.2%) eyes. Out of these, 8 eyes had simple vitrectomy (fluid exchange) done and 6 eyes required internal tamponade with 1000cst silicone oil. Greater hypotony was seen in vitrectomized (4-8mmHg) than siliconized eyes (8mmHg). Tomic Z et al [8] also reported a 14% transitory postoperative hypotony on day 1. Total cases in their study were 100. Misra et al [10] too reported hypotony in 4 patients (out of 50) on first postoperative day. This is in contrast to our study where percentage of hypotony was greater. Reason may be the surgeon's learning curve. In similarity with these studies, hypotony recovered and IOP came to normal in our cases within 48-72 hours. None of our cases developed choroidal detachment or required suturing of sclerotomy ports. In Misra et al [10] study, one sclerotomy port (1/50, 0.67%) required suturing.

Cannula withdrawal resulted in minor subconjunctival bleeding in 8 eyes (23.5%) which came mainly from episcleral vessels and in some cases from sclerotomy sites. Vitreous hemorrhage was seen in 4 patients (11.7%) on day 1 post-operative. Visual acuity was affected in these cases. Conjunctiva and vitreal cavity cleared up within a week, so improved the visual acuity. Tomic Z et al [8] also reported subconjunctival hemorrhage in their study, but the number of patients presented with this complaint is not highlighted. Also, transitory pos-toperative vitreous hemorrhage is documented in 1 patient out of total of 100 (1%) which is less than our study group.

Other complications like unintended retinal touch, retinal detachment, choroidal detachment or endophthalmitis did not occur in our cases. Zomic T et al [8] had a 2% retinal touch and 2% retinal detachment seen. This is probably due to greater number of patients (100) with complex vitreoretinal pathologies in their study group than our group. Fine et al [9] documented no complications in their 77 cases except 1 sterile endophthalmitis. Similarly, Kim et al [11] in their 40 eyes series reported no serious complications. Misra et al [10] had no endophthalmitis in their 50 cases series.

Finally postoperative visual acuity improved markedly from 1st postoperative day and further improved in subsequent follow-ups. In similarity to our study, Tewari et al [12] 81 case series focused on visual outcome and documented statistically significant improvement in their patients vision.

CONCLUSION

23-Gauge vitrectomy procedure is safe, minimally invasive and gives good visual and surgical results. It reduces surgical duration and enhances postoperative recovery. The procedure is a “happy medium” because incisions are small enough to self seal but large enough to allow sturdy instruments to enter the eye.

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